ARIZONA ACADEMIC STANDARDS

HIGH SCHOOL

State of Arizona
Arizona Department of Education

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CONTENTS

Additional information about the Arizona Academic Standards including glossaries of terms may be found at http://www.ade.az.gov/standards/contentstandards.asp.

The Arts Standard 2006

High School

ARIZONA ACADEMIC STANDARDS IN THE ARTS
ARTICULATION IN MIDDLE/HIGH SCHOOL

Philosophy and Rationale for the Arts

The arts are essential in education for they provide students with the means to think, feel, and understand the world around them in ways unique and distinct from other academic disciplines. These skills have been recognized as essential to lifelong success both in and out of school by a variety of education and civic leaders, including the National Association of State Boards of Education, the Education Commission of the States, the Arts Education Partnership, and *BusinessWeek*.

Arts Education in Arizona

Arizona has recognized the importance of arts education for its students in a variety of ways, including:

- Requiring music and visual arts be taught in grades K-8
- Creating high quality certifications (endorsements) for teachers in the areas of dance, music, theatre and visual arts
- Requiring a fine arts high school credit for admission to our state's universities
- Adopting Academic Standards in the Arts, with rigorous, sequential guidelines for creating quality arts education for Arizona's students.

Arts Standards Articulation for Middle and High Schools

- The Arts Standards are divided into four discipline areas: **dance**, **music**, **theatre** and **visual arts.**
- The Arts Standards (Dance, Music, Theatre, Visual Arts) are articulated by **skill level**, reflecting the variety of ways in which the arts are taught in Arizona schools. The skill levels are: **Beginning**, **Intermediate**, **Advanced**, **Distinction** (Honors).
- In **Music**, the skill levels are tied to **performing ensembles**, broken down by Band, Choral and Strings/Orchestra. In addition, there are grade level general music standards available for grades 7 and 8.
- Instead of guessing at the skill level of your student artists, the Department encourages you to view the arts standards in their entirety at http://www.ade.az.gov/standards/contentstandards.asp and choose the appropriate skill level for your students. For guidance on appropriate skill level "fit" please call the Arts Education Specialist at 602-364-1534.

Additional Resources for Arts Education

Additional resources on arts education can be accessed at http://www.ade.az.gov/asd/arts/ or by calling the Department's Arts Education Specialist at 602-364-1534.

Approved 6.26.06

Comprehensive Health Education/ Physical Activity Standards 1997

Proficiency and Distinction (Grades 9-12)

Comprehensive Health Rationale

Parents and Guardians

It is understood that parents and guardians are the primary educators in their children's health; therefore, it is important to include the applicable statutes and state Board of Education rule in the comprehensive health education standards. Parents and guardians must be provided opportunities to preview school district policies, curriculum and take-home materials.

The ultimate goal of comprehensive health education is to help young people in Arizona achieve their fullest potential by attaining their highest level of health and wellness as students and adults. Basic to health education is the knowledge about the importance of the interrelationships of physical, behavioral, and social well-being and the prevention of diseases and other health problems. Students should learn to accept responsibility for personal health decisions and practices, work with others to maintain a healthy environment, as well as become informed consumers.

***Rationale for Standard 1**:* Students comprehend concepts related to health promotion and disease prevention.

Comprehension of health promotion strategies and disease prevention concepts enables students to become health literate, self-directed learners, which establishes a foundation for leading healthy and productive lives.

Rationale for Standard 2: Students demonstrate the ability to access accurate health information.

Accessing valid health information and health promoting products and services is important in the prevention, early detection and treatment of most health problems. Applying skills of information analysis, organization, comparison, synthesis and evaluation to health issues provides a foundation for individuals to move toward becoming health literate and responsible, productive citizens.

Rationale for Standard 3: Students demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

Research confirms that many diseases and injuries can be prevented by reducing harmful and risk-taking behaviors. Accepting responsibility and practicing health-enhancing behaviors can contribute to a positive quality of life.

Rationale for Standard 4: Students analyze the influence of culture, media, technology and other factors on health.

Health is influenced by a variety of factors that coexist within society. The ability to analyze, evaluate and interpret the influence of culture, media and technology on health is important in a rapidly changing world. The health literate, responsible and productive

citizen draws upon the contributions of these factors to strengthen individual, family and community health.

Rationale for Standard 5: Students demonstrate the ability to use interpersonal skills to enhance health.

Personal, family and community health are enhanced through effective communication. The ability to organize and to convey information, beliefs, opinions, and feelings (both verbal and nonverbal) are skills that strengthen interactions and can reduce or avoid conflict. When communicating, individuals who are health literate demonstrate care, consideration, and respect for self and others.

Rationale for Standard 6: Students demonstrate the ability to use goal setting and decision-making skills to enhance health.

Decision-making and goal setting are essential lifelong skills needed to implement and sustain health-enhancing behaviors. These skills make it possible for individuals to transfer health knowledge into healthy lifestyles, thus improving the quality of life.

Rationale for Standard 7: Students demonstrate the ability to advocate for personal, family and community health.

Quality of life is dependent on an environment that protects and promotes the health of individuals, families and communities. Responsible citizens who are health literate communicate and advocate for positive health in their communities.

§ 15-102. Parental involvement in the school; definition

A. The governing board, in consultation with parents, teachers and administrators, shall develop and adopt a policy to promote the involvement of parents and guardians of children enrolled in the schools within the school district, including:
   1. A plan for parent participation in the schools which is designed to improve parent and teacher cooperation in such areas as homework, attendance and discipline.
   2. Procedures by which parents may learn about the course of study for their children and review learning materials.
   3. Procedures by which parents who object to any learning material or activity on the basis that it is harmful may withdraw their children from the activity or from the class or program in which the material is used. Objection to a learning material or activity on the basis that it is harmful includes objection to a material or activity because it questions beliefs or practices in sex, morality or religion.

B. The policy adopted by the governing board pursuant to this section may also include the following components:
   1. A plan by which parents will be made aware of the district's parental involvement policy and the provisions of this section, including:
      (a) Rights under the family educational rights and privacy act of 1974 relating to access to children's official records.
      (b) The parent's right to inspect the school district policies and curriculum.
   2. Efforts to encourage the development of parenting skills.

3. The communication to parents of techniques designed to assist the child's learning experience in the home.
4. Efforts to encourage access to community and support services for children and families.
5. The promotion of communication between the school and parents concerning school programs and the academic progress of the parents' children.
6. Identifying opportunities for parents to participate in and support classroom instruction at the school.
7. Efforts to, with appropriate training, support parents as shared decision makers and to encourage membership on school councils.
8. The recognition of the diversity of parents and the development of guidelines that promote widespread parental participation and involvement in the school at various levels.
9. The development of preparation programs and specialized courses for certificated employees and administrators that promote parental involvement.
10. The development of strategies and programmatic structures at schools to encourage and enable parents to participate actively in their children's education.

C. For the purposes of this section, "parent" means the parent or person who has custody of the child.

R7-2-303. Sex Education

A. Instruction in sex education in the public schools of Arizona shall be offered only in conformity with the following requirements.

1. Common schools: Nature of instruction; approval; format.
   a. Supplemental/elective nature of instruction. The common schools of Arizona may provide a specific elective lesson or lessons concerning sex education as a supplement to the health course study.
      i. This supplement may only be taken by the student at the written request of the student's parent or guardian.
      ii. Alternative elective lessons from the state-adopted optional subjects shall be provided for students who do not enroll in elective sex education.
      iii. Elective sex education lessons shall not exceed the equivalent of one class period per day for one-eighth of the school year for grades K-4.
      iv. Elective sex education lessons shall not exceed the equivalent of one class period per day for one-quarter of the school year for grades 5-8.
   b. Local governing board approval. All elective sex education lessons to be offered shall first be approved by the local governing board.
      i. Each local governing board contemplating the offering of elective sex education shall establish an advisory committee with membership representative of district size and the racial and ethnic composition of the community to assist in the development of lessons and advise the local governing board on an ongoing basis.
      ii. The local governing board shall review the total instruction materials for lessons presented for approval.
      iii. The local governing board shall publicize and hold at least two public hearings for the purpose of receiving public input at least one week prior

to the local governing board meeting at which the elective sex education lessons will be considered for approval.

iv. The local governing board shall maintain for viewing by the public the total instructional materials to be used in approved elective sex education lessons within the district.

c. Format of instruction.

i. Lessons shall be taught to boys and girls separately.

ii. Lessons shall be ungraded, require no homework, and any evaluation administered for the purpose of self-analysis shall not be retained or recorded by the school or the teacher in any form.

iii. Lessons shall not include tests, psychological inventories, surveys, or examinations containing any questions about the student's or his parents' personal beliefs or practices in sex, family life, morality, values or religion.

2. High Schools: Course offering; approval; format.
   a. A course in sex education may be provided in the high schools of Arizona.
   b. The local governing board shall review the total instructional materials and approve all lessons in the course of study to be offered in sex education.
   c. Lessons shall not include tests, psychological inventories, surveys, or examinations containing any questions about the student's or his parents' personal beliefs or practices in sex, family life, morality, values or religion.
   d. Local governing boards shall maintain for viewing by the public the total instructional materials to be used in all sex education courses to be offered in high schools within the district.
3. Content of instruction: Common schools and high schools.
   a. All sex education materials and instruction shall be age appropriate, recognize the needs of exceptional students, meet the needs of the district, recognize local community standards and sensitivities, shall not include the teaching of abnormal, deviate, or unusual sexual acts and practices, and shall include the following:
      i. Emphasis upon the power of individuals to control their own personal behavior. Pupils shall be encouraged to base their actions on reasoning, self-discipline, sense of responsibility, self-control and ethical considerations such as respect for self and others; and
      ii. Instruction on how to say "no" to unwanted sexual advances and to resist negative peer pressure. Pupils shall be taught that it is wrong to take advantage of, or to exploit, another person.
   b. All sex education materials and instruction which discuss sexual intercourse shall:
      i. Stress that pupils should abstain from sexual intercourse until they are mature adults;
      ii. Emphasize that abstinence from sexual intercourse is the only method for avoiding pregnancy that is 100 percent effective;
      iii. Stress that sexually transmitted diseases have severe consequences and constitute a serious and widespread public health problem;

iv. Include a discussion of the possible emotional and psychological consequences of preadolescent and adolescent sexual intercourse and the consequences of preadolescent and adolescent pregnancy;
v. Promote honor and respect for monogamous heterosexual marriage; and
vi. Advise pupils of Arizona law pertaining to the financial responsibilities of parenting, and legal liabilities related to sexual intercourse with a minor.

B. Certification of compliance. All districts offering a local governing board-approved sex education course of lesson shall certify, under the notarized signature of both the president of the local governing board and the chief administrator of the school district, compliance with this rule except as specified in paragraph (C). Acknowledgment of receipt of the compliance certification from the state Board of Education is required as a prerequisite to the initiation of instruction. Certification of compliance shall be in a format and with such particulars as shall be specified by the Department of Education.
C. All districts offering state Board approved sex education lessons or courses prior to the effective date of this rule shall comply with this rule on or before June 30, 1990.

§ 15-716. Instruction on acquired immune deficiency syndrome; department assistance

A. Each common, high and unified school district may provide instruction to kindergarten programs through the twelfth grade on acquired immune deficiency syndrome and the human immunodeficiency virus.
B. Each district is free to develop its own course of study for each grade. At a minimum, instruction shall:
   1. Be appropriate to the grade level in which it is offered.
   2. Be medically accurate.
   3. Promote abstinence.
   4. Discourage drug abuse.
   5. Dispel myths regarding transmission of the human immunodeficiency virus.
C. No district shall include in its course of study instruction which:
   1. Promotes a homosexual life-style.
   2. Portrays homosexuality as a positive alternative life-style.
   3. Suggests that some methods of sex are safe methods of homosexual sex.
D. At the request of a school district, the department of health services or the department of education shall review instruction materials to determine their medical accuracy.
E. At the request of a school district, the department of education shall provide the following assistance:
   1. A suggested course of study.
   2. Teacher training
   3. A list of available films and other teaching aids.
F. At the request of a parent, a pupil shall be excused from instruction on the acquired immune deficiency syndrome and the human immunodeficiency virus as provided in subsection A of this section. The school district shall notify all parents of their ability to withdraw their child from the instruction.

ADDENDUM

A Brief Description of Ten Major Content Areas in Comprehensive School Health Education

1. **Community Health** includes topics such as individual responsibility; healthful school, home and community environments; community health resources and facilities; official and nonofficial health agencies; health service careers; pollution control; community involvement; current issues; and trends in medical care.

2. **Consumer Health** addresses health care resources i.e., knowing what is available and how to be an educated consumer.

3. **Environmental Health** addresses individual and community responsibility, pollution, effects of environment on health, environmental protection agencies, population density, world health, waste disposal, sanitation, laws and career choices.

4. **Family Life Education** covers information about family dynamics, building relationships, child abuse, choices about relationships, family planning, parenting skills, sex education, and sexually transmitted diseases such as HIV infection and AIDS.

5. **Injury Prevention and Safety** includes learning about first aid and emergency health care and addresses the prevention of unintentional injuries. (Many schools include violence prevention and homicide as health issues within this content area.)

6. **Mental and Emotional Health** includes building self-esteem, effectively coping with stress, and communication skills, among others.

7. **Nutrition** addresses a balanced diet, food preparation, reading and understanding food labels, differences in nutritional needs for pregnant women, and more.

8. **Personal Health** includes physical fitness and lifetime activities, cardiovascular health, sleep, rest, relaxation, recreation, growth and development, oral health, vision and hearing, body systems and their functions, aging, personal wellness plans, and positive health habits and choices.

9. **Prevention and Control of Disease** addresses heart disease, stroke, diabetes, cancer, HIV/AIDS and others.

10. **Substance Use and Abuse** refers to the use and misuse of tobacco, alcohol, and other drugs and often includes topics such as positive decision-making, individual responsibility, substances beneficial to humankind, the classification of substances and their effects on the body, and the formation of habits and their influence.

The ten major content areas in this addendum are provided to assist local school districts in developing sequential curricula. It will be left to the discretion of the local district to determine the emphasis of each of the content areas. The Comprehensive Health Education and Physical Activity Standards are the required competency indicators, while the addendum is a tool to be used by school districts as a cross-reference.

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 1

Students comprehend concepts related to health promotion and disease prevention.

PROFICIENCY (Grades 9-12)

- **1CH-P1. Explain how behavior impacts health maintenance and disease prevention (e.g., ability to prevent homicide, suicide, accident and illness)**

  PO 1. Identify the positive and negative choices for a balanced, healthy lifestyle (e.g., poor eating habits vs. good eating habits)
  PO 2. Identify personal stress management techniques
  PO 3. Formulate methods of prevention for each of the identified causes of death among teens
  PO 4. Identify teen death statistics

- **1CH-P2. Explain the interrelationships among the mental, emotional, psychological and physical realities that occur throughout the life cycle**

  PO 1. Identify the different stages of the human life cycle (conception, prenatal, infant, toddler, preschool, school)
  PO 2. Identify the characteristics and developmental needs related to each stage of the life cycle
  PO 3. Relate the principles of healthy living to each stage of the life cycle

- **1CH-P3. Explain the impact of personal health behaviors on the functioning of body systems and describe how to delay onset and reduce risks of potential health problems**

  PO 1. Identify personal health behaviors that promote and/or detract from the functioning of body systems
  PO 2. Predict the impact of personal health behaviors that promote and or detract from the functioning of body systems (to include sleep, nutrition, exercise, sexual and substance abuse)
  PO 3. Construct a personalized continuum of health behaviors that range from more healthy to less healthy and defend rationale
  PO 4. Determine strategies to reduce health risk for more healthy behavior

- **1CH-P4. Explain how the family, peers and community influence the health of individuals**

  PO 1. Describe how problem solving skills relate to the influence that family, peers and the community have on a person's health
  PO 2. Develop a plan of how the family, peers and the community influence a person's attitudes, beliefs and feelings about health

PO 3. Rank order from most to least influential group (family, peers, community), that impacts a person's health

- **1CH-P5. Explain how environmental health influences the community and the functions of local, state and federal resources in addressing health issues**

  PO 1. Summarize major environmental health concerns
  PO 2. List the roles and functions of agencies that address areas of environmental concern

- **1CH-P6. Identify the physiological effects of drug usage**

  PO 1. Describe major physiological effects of different classes of drugs such as the following: depressants, stimulants, hallucinogens, and inhalants
  PO 2. Cite effects of drug usage on the unborn child at various stages of development
  PO 3. List specific communicable diseases which may be transmitted by substance abuse behaviors

- **1CH-P7. Describe the relationship among an individual's abuse of substances and the impact on self, the family system, the economy and society as a whole**

  PO 1. Identify the effect of substance abuse on the individual
  PO 2. Describe the relationship between family members in a substance-abusing household
  PO 3. Describe the economic impact of substance abuse on worker productivity and national health care cost
  PO 4. Explain the relationship between substance abuse and its impact on society related to violence, to include rape and domestic violence, crime and vehicular accidents

- **1CH-P8. Identify the location and function of the reproductive organs, the fertility cycle, and the process of conception, and emphasize factors that contribute to the birth of a healthy child**

  PO 1. Describe male and female reproductive organs and understand the location and basic function of each (to include menstrual cycle)
  PO 2. Describe the association of conception to the fertility cycle
  PO 3. Describe the economic impact of substance abuse on worker productivity and national health care cost
  PO 4. Describe the major factors in family planning (e.g., personal goal setting, number of children desired, importance of timing of pregnancy, identification of available resources and family education)

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **1CH-P9. Describe proper food selection, preparation, and handling for self and others, taking into consideration that nutrient needs vary according to age, development, activity level and body type**

  PO 1. Illustrate the process of human digestion
  - a) Describe how nutrients are released, absorbed, utilized and excreted by the body
  - b) Classify dietary nutrients as to their function in producing energy, in growth or in the maintenance/repair of body tissue

  PO 2. Predict how excesses or deficiencies of nutrients impact on health and disease
  - a) Correlate the relationship between food consumption patterns and dietary-related health problems (e.g., diabetes, obesity, some cancers, osteoporosis, anemia, dental caries, cardiovascular disease)
  - b) Identify the proper food/nutrient adjustments required due to physical exertion, sports/fitness training, etc.

  PO 3. Identify the most common errors made which result in food borne infections (person to food, equipment to food, and food to food)

  PO 4. Identify those behaviors which are characteristically associated with anorexia and bulimia
  - a) Identify the psychosocial factors that lead to eating disorders
  - b) Identify the harmful effects of eating disorders
  - c) Critique the differences between a fad diet and a well-balanced diet

  PO 5. Describe the influence of advertising, peer pressure and food fads on proper diet, food selection and eating habits

- **1CH-P10. Explain the association of personal risk factors of chronic and communicable diseases, risk reduction and disease prevention components**

  PO 1. Define and provide examples of acute, chronic, communicable, noncommunicable, degenerative, metabolic, hereditary and congenital diseases

  PO 2. Describe how race, culture and hereditary factors impact disease susceptibility
  - a) List environmental influences that affect disease susceptibility
  - b) Describe the impact of fitness, diet, rest and other lifestyle issues related to disease

  PO 3. Evaluate disease prevention and control practices (e.g., immunization, pollution control and smoking cessation)
  - a) Identify methods of early recognition of health problems
  - b) Identify their responsibility as active participants in treatment and rehabilitation

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

DISTINCTION (Honors)

- **1CH-D1. Form hypotheses regarding the influence of physical, mental, social and environmental health on the growth and development of members of select populations**

  PO 1. Describe the effectiveness of current prevention programs related to members of select populations (e.g., tobacco-use cessation, abstinence-only curriculum)

- **1CH-D2. Describe the nutritional status and needs of the members of a population by examining the age, gender, physical activity, eating patterns, diet, pregnancy, substance use and disease associated with that population**

  PO 1. Create a food plan for a specific population taking into consideration age, gender, physical activity, eating patterns, health condition (pregnancy, substance use, disease)

- **1CH-D3. Describe the impact of personal histories, health care choices and the aging process on the health and wellness of individuals**

  PO 1. Critique the personal histories of individuals, from adolescence through late life, in relation to the health choices they made and the impact on their health status

- **1CH-D4. Explain conclusions drawn from current worldwide health issues**

  PO 1. Form a hypothesis related to current worldwide issues which is grounded in a search on the topic (e.g., HIV, poverty, substance abuse)

- **1CH-D5. Identify the problems of malnutrition in relation to population distribution, economics, food consumption and politics**

  PO 1. Design a program to address reduction in malnutrition among a target population, keeping in mind the population distribution, economics, food consumption and politics

- **1CH-D6. Explain ways in which American families accommodate and care for their elderly**

  PO 1. Identify effective and ineffective ways that American families accommodate and care for their elderly

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **1CH-D7. Explain how public health policies, safety-related legislation, and government regulations influence health promotion and disease prevention**

  PO 1. Describe agreements related to the relationship between publications, safety-related legislation and government regulations concerning their influence on health promotion and disease prevention

- **1CH-D8. Explain how the prevention and control of health problems are influenced by research and medical advances**

  PO 1. Review NIH (National Institute of Health), CDC (Centers for Disease Control) or WHO (World Health Organization) research on a specific health issue and explain how the publication of the research changed public policy (e.g., HIV/AIDS, Breast Cancer, TB, Hepatitis B)

STANDARD 2
Students demonstrate the ability to access accurate health information.

PROFICIENCY (Grades 9-12)

- **2CH-P1. Explain the effectiveness of health information from home, school and community**

  PO 1. Compile documents that are sources of health given in the home, at the school and from community health agencies
  PO 2. Evaluate each document for its age appropriateness, content and its ability to influence health behavior

- **2CH-P2. Evaluate factors (e.g., peer pressure, media) that influence personal selection of health products and services)**

  PO 1. Rank personal and social factors (e.g., peer pressure, family, media, culture, economics) that influence selection of health products and services for their level of influence

- **2CH-P3. Describe situations requiring professional health services and the cost and accessibility of health care services**

  PO 1. Select a health situation requiring professional health services
  PO 2. Compare the cost and accessibility of those services through multiple service providers (no private insurance, private insurance, indigent care and those that don't qualify for indigent care [KidCARE]) e.g., broken arm, pregnancy, leukemia, pneumonia, hernia, wound needing stitches

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **2CH-P4. Demonstrate how to access appropriate organizations (e.g., paramedics, law enforcement and physicians) useful in reducing threatening situations**

  PO 1. Same as concept

- **2CH-P5. Identify the licensing and certification standards for health professions**

  PO 1. Review local, state and federal regulations, and create a chart that reflects the licensing and certification standards for specific health professionals (e.g., physical therapist, nurse, nurse assistant, physician, dietitian, dentist, dental hygienist, X-ray technician, phlebotomist)

- **2CH-P6. Explain the role of local, state, federal and international agencies in providing health services and protecting and informing consumers**

  PO 1. Describe local, state, federal and international agency involvement in providing health services and protecting and informing consumers (use a specific service or health issue)

DISTINCTION (Honors)

- **2CH-D1. Describe the effectiveness, accessibility and inclusiveness of a health program in supporting individual and public health**

  PO 1. Critique a public health program in relation to its accessibility, effectiveness, and inclusiveness for individuals as well as the public (e.g., STD's, campaigns to address risk behavior, violence intervention)

- **2CH-D2. Describe health promotion and disease prevention efforts in developing measures to reduce risks and protect against the spread of disease**

  PO 1. Compare multi-state programs on their effectiveness in reducing and preventing the spread of disease (e.g., immunizations)
  PO 2. Evaluate the contributing factors that account for the differences in effectiveness of public health programs

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **2CH-D3. Identify the changing trends in the health care delivery system and individual rights and responsibilities within the health care system**

  PO 1. Track the health care delivery system over the past 20 years and the changing trends related to individual rights and responsibilities for a specific health issue (e.g., formation of managed care systems vs. private health insurance vs. indigent health care system)

STANDARD 3

Students demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

PROFICIENCY (Grades 9-12)

- **3CH-P1. Describe the role of individual responsibility for health-enhancement and wellness**

  PO 1. Describe the role of individual responsibility for the individual's physical, social, spiritual and psychological growth and development (e.g., adequate nutrition, recreation and fitness, eating disorders, sexual involvement, and alcohol, tobacco and other drug use)

- **3CH-P2. Conduct a personal health assessment to determine strategies for health enhancement, risk reduction and stress management**

  PO 1. Conduct a personal health assessment
  PO 2. Establish personal goals related to personal health assessment (include strengths and weaknesses identified in the areas of health enhancement, risk-taking and stress)

- **3CH-P3. Explain the short-term and long-term consequences of responsible and risky/harmful behaviors (e.g., responsible: exercise, sleep, nutrition; risky: the use of tobacco, alcohol and other drugs)**

  PO 1. Identify the decision-making process
  PO 2. Identify the short-term and long-term consequences of responsible and risky/harmful behaviors
  PO 3. Design a flow chart that distinguishes on a continuum most responsible vs. most risky/harmful behaviors (e.g., exercise, sleep, nutrition, use of tobacco, alcohol, and other drugs, sexual involvement)

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **3CH-P4. Develop injury prevention and management strategies to improve and maintain personal, family and community health**

  PO 1. Describe responsible and safe behavior (personal, family and community) such as driving, sports, recreation, interpersonal relationships
  PO 2. Construct self-protection techniques to use in various personal, family, social/community environments

- **3CH-P5. Perform advanced first aid procedures**

  PO 1. Demonstrate basic first aid procedures for unconsciousness, shock, fractures, burns, cuts, choking, poisoning, etc.
  PO 2. Demonstrate correct CPR procedures

- **3CH-P6. Explain how to survive in adverse environmental situations**

  PO 1. Develop a plan for surviving in adverse environmental situations (e.g., extreme weather conditions)

DISTINCTION (Honors)

- **3CH-D1. Conduct a personal health assessment to determine strategies for health- enhancement, risk reduction and stress management**

  PO 1. Design a personal health assessment tool
  PO 2. Develop strategies for personal health enhancement, risk reduction and stress management

- **3CH-D2. Describe consequences of responsible and risky/harmful behaviors throughout the life cycle**

  PO 1. Identify the short-term and long-term consequences of responsible and risky/harmful behaviors during pregnancy, infancy, childhood, adolescence, adulthood and for the elderly

- **3CH-D3. Apply injury prevention and management strategies to improve and maintain personal, family and community health**

  PO 1. Create a presentation to teach injury prevention and management strategies to improve or maintain either personal, family and/or community health

COMPREHENSIVE HEALTH STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 4
Students analyze the influence of culture, media, technology and other factors on health.

PROFICIENCY (Grades 9-12)

- **4CH-P1. Explain how cultural diversity enriches and challenges health behaviors**

  PO 1. Identify the benefits and challenges that different cultures provide in relation to health behaviors through development of a written project (e.g., table, graph, artistic interpretation)

- **4CH-P2. Describe the impact of media and technology on personal, family and community health**

  PO 1. Produce a presentation that compares media and technology modalities (e.g., television, movies, advertisements, Internet, music, MTV) in terms of their influence on personal, family and community health

DISTINCTION (Honors)

- **4CH-D1. Use primary and secondary source information and government regulations to assess the impact of the production, promotion and distribution of products and services on consumer health**

  PO 1. Contact government agencies to obtain information
  PO 2. Compile documents from health agencies to create an assessment of an agency's impact on production, promotion and distribution of products and services on consumer health (e.g., exercise equipment, fitness centers, safety features on automobiles)

STANDARD 5
Students demonstrate the ability to use interpersonal skills to enhance health.

PROFICIENCY (Grades 9-12)

- **5CH-P1. Select ways to communicate care, consideration and respect of self and others to enhance health**

  PO 1. Demonstrate the ability to:
    a) send clear and direct messages, verbally and nonverbally
    b) listen to others, receiving and understanding their communication
    c) ask for clarification when needed
    d) respond verbally and nonverbally
  PO 2. Demonstrate effective techniques, including refusal skills, for handling conflict and solving problems

PO 3. Demonstrate effective techniques for resisting negative peer pressure, while maintaining positive interpersonal relationships

- **5CH-P2. Identify the causes of conflict among youth and adults in school and community, and demonstrate refusal, negotiation and collaboration skills to manage the conflict**

  PO 1. Explain conflict and its root causes
  PO 2. Explain effective conflict resolution techniques
  PO 3. Participate in role plays that demonstrate refusal, negotiation, mediation and collaboration skills to resolve conflict

DISTINCTION (Honors)

- **5CH-D1. Describe the social, economic and physical characteristics that influence family structures and interpersonal relations**

  PO 1. Explain the factors that influence family structures and interpersonal relations
  PO 2. Conduct a study of an actual (or fictitious from literature or media) family to assess the social, economic and physical characteristics that have influenced this family structure and its interpersonal relations

- **5CH-D2. Identify the causes of conflict in schools, families and communities; model strategies for solving interpersonal conflicts through refusal, negotiation and collaboration skills to avoid potentially harmful situations**

  PO 1. Construct a presentation that models effective refusal, negotiation, mediation and collaboration skills to resolve conflict
  PO 2. Present role plays, demonstrations or other means of effective conflict resolution

STANDARD 6
Students demonstrate the ability to use goal setting and decision-making skills to enhance health.

PROFICIENCY (Grades 9-12)

- **6CH-P1. Demonstrate the ability to utilize various strategies when making decisions related to health needs and risks of young adults**

  PO 1. Demonstrate at least one effective strategy for reducing the probability of involvement in a risk behavior

- **6CH-P2. Describe health issues that require collaborative decision-making**

PO 1. Prepare a discussion analyzing health issues that require a collaborative decision (e.g., communicable disease, violence, environmental issues, sexual involvement)

- **6CH-P3. Explain immediate and long-term impact of health decisions on the individual**

  PO 1. Demonstrate the impact (immediate and long-term) of health decisions on the individual (e.g., use of tobacco, alcohol and other drugs, sexual behavior, nutrition, exercise, sleep)

- **6CH-P4. Develop an effective plan for achieving and maintaining personal health goals for lifelong health-enhancement and wellness which recognizes the importance of goal setting and time management skills**

  PO 1. Construct a health and wellness personal activities log for at least one week
  PO 2. Construct a long-term plan for improving personal health and wellness that will include the goal setting procedures used and time management skills needed to accomplish this plan

DISTINCTION (Honors)

- **6CH-D1. Describe immediate and long-term impact of health decisions on the individual, family and community**

  PO 1. Interview an individual who has made healthy vs. unhealthy life choices and describe how their choices have impacted them individually, within their family and in the community (e.g., use tobacco or not, violence and incarceration or not, obesity or not, Type A vs. Type B personalities)

- **6CH-D2. Formulate an effective plan for lifelong health enhancement and wellness**

  PO 1. Develop a strategic plan of personal, lifelong health and wellness

STANDARD 7

Students demonstrate the ability to advocate for personal, family and community health.

PROFICIENCY (Grades 9-12)

- **7CH-P1. Describe the effectiveness of communication methods for accurately expressing health information and ideas**

  PO 1. Select a variety of communication modalities/methods (e.g., visual, verbal, written) for those most effective at presenting health information and ideas

- **7CH-P2. Research and present information about health issues**

PO 1. Present information about health issues (e.g., nutrition, eating disorders, exercise, athletic needs, the environment, disease control, human sexuality, substance abuse, mental health, stress management)

- **7CH-P3. Utilize strategies to overcome barriers when communicating information about health issues**

  PO 1. Develop a presentation to a select group involved in unhealthy behavior that would encourage the choice of health-enhancing behavior (e.g., cessation information to smokers, conflict resolution)

- **7CH-P4. Demonstrate the ability to influence and support others in making positive health choices**

  PO 1. Participate in a peer mediation, peer education, peer leadership, or peer counseling program, or create one on your campus
  PO 2. Participate in a school or community services learning activity

- **7CH-P5. Demonstrate the ability to work cooperatively when advocating for healthy communities**

  PO 1. Participate as a volunteer for a school/community health promotion program

DISTINCTION (Honors)

- **7CH-D1. Demonstrate the ability to adapt health messages and communication techniques to the characteristics of a particular audience**

  PO 1. Create age-appropriate presentations that promote healthy behavior (e.g., tobacco use prevention presentations to sixth grade classes; dating violence prevention to ninth graders; diabetes management for senior citizens)

Physical Activity Standards Rationale

A wealth of information has been accumulated to point to the importance of physical activity in promoting health and wellness. Evidence also indicates that habits (lifestyles) established in youth are likely to influence adult lifestyles and associated health and wellness. Physical activity, a primary risk factor for many chronic health conditions, is an integral part of comprehensive school health education but also must be promoted as an important educational goal. Meeting physical activity standards includes both promotion of physical activity among youth and promotion of lifelong physical activity that will enhance workplace skills, fitness and wellness associated with quality of life. Achieving lifetime physical activity standards results in learning real life skills. Higher order skills include decision-making and problem solving required to become informed, lifetime physical activity consumers.

Rationale for Standard 1: Students demonstrate proficiency and the achievement of higher order cognitive skills necessary to enhance motor skills.

Movement competence implies the development of sufficient ability to enjoy participation in physical activities and re-establish a foundation to facilitate continued motor skill acquisition and increased ability to engage in developmentally appropriate daily physical activities. In addition to achieving competence in a few movement forms, which increases the likelihood of lifetime activity participation, the students apply concepts from exercise science disciplines that will help them achieve independence in developing movement competence in new movement forms. The focus is on movement forms appropriate for lifetime activity involvement and the establishment of personal competence.

Rationale for Standard 2: Students comprehend basic physical activity principles and concepts that enable them to make decisions, solve problems and become self-directed lifelong learners who are informed physical activity consumers.

Accessing accurate physical activity information, products and services is important to become informed, responsible physical activity consumers.

Rationale for Standard 3: Students exhibit a physically active lifestyle.

The intent of this standard is to establish patterns of regular participation in meaningful physical activity. This standard connects what is taught in school with students' choices for physical activity outside of school. Students are more likely to participate in physical activities if they have had opportunities to develop interests that are personally meaningful to them.

Rationale for Standard 4: Students achieve and maintain a health-enhancing level of physical fitness.

The intent of this standard is for the student to achieve a health-enhancing level of physical fitness. Students should be encouraged to develop personal fitness levels above those necessary for health-enhancement, based on unique personal needs and interests and necessary for many work situations and active leisure participation. Health-related fitness components include cardio-respiratory endurance, muscular strength and endurance, flexibility, and body composition. Expectations for students' fitness levels should be established on a personal basis, taking into account variation in entry levels, rather than setting a single standard for all children at a given grade level.

Rationale for Standard 5: Students develop self-initiated behaviors that promote effective personal and social interactions in physical activity settings.

The intent of this standard is achievement of self-initiated behaviors that promote personal and group success in activity settings. Behaviors such as safe practices, adherence to rules and procedures, etiquette, cooperation and teamwork, ethical behavior in sports, and positive social interaction are necessary for all students to develop effective communication skills.

Rationale for Standard 6: Students demonstrate understanding and respect for differences among people in physical activity settings.

The intent of this standard is to develop respect for similarities and differences through positive interaction among participants in physical activity. Similarities and differences include characteristics of culture, ethnicity, motor performance, disabilities, physical characteristics (e.g., strength, size, shape), gender, race and socioeconomic status.

Rationale for Standard 7: Students develop behavioral skills (self-management skills) essential to maintaining a physically active lifestyle.

The intent of this standard is for students to develop an awareness of the intrinsic benefits of participation in lifelong physical activity. Physical activity can provide opportunities for enjoyment, physical fitness and personal challenge.

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 1

Students demonstrate proficiency and the achievement of higher order cognitive skills necessary to enhance motor skills.

PROFICIENCY (Grades 9-12)

- **1PA-P1. Demonstrate competency in at least three different types of movement forms (e.g., aquatics, team sports, individual and dual sports, outdoor pursuits, self-defense, gymnastics, dance)**

  PO 1. Demonstrate competency (basic skills, strategies and rules) in an increasing number of more complex versions of at least three different movement forms

- **1PA-P2. Use specialized knowledge to develop movement competence/proficiency**

  PO 1. Demonstrate improved skills by applying the critical elements to competent performance

- **1PA-P3. Identify and apply critical elements to enable the development of movement competence/proficiency**

  PO 1. Identify the critical elements of a skill
  PO 2. Demonstrate and apply the biomechanical concepts and principles to the skills

- **1PA-P4. Identify and apply characteristics of highly skilled performance to enable the development of movement competence/proficiency**

  PO 1. Identify strengths and weaknesses of highly skilled performances
  PO 2. Identify skills needed to improve performance

- **1PA-P5. Apply discipline-specific information to individual performance**

  PO 1. Same as concept

DISTINCTION (Honors)

- **1PA-D1. Demonstrate proficiency in at least three movement forms (e.g., aquatics, team sports, individual and dual sports, outdoor pursuits, self-defense, gymnastics, dance)**

  PO 1. Demonstrate proficiency (basic skills, strategies and rules) in at least three different movement forms

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **1PA-D2. Explain pertinent scientifically-based information regarding movement performance**

  PO 1. Demonstrate improved skills by applying the critical elements to proficient performance
  PO 2. Research highly skilled performers or performances and critique the research

- **1PA-D3. Apply advanced movement-specific information in the development of movement proficiency**

  PO 1. Use coaching information (self, peer, teacher, video) to improve performance

- **1PA-D4. Use discipline-specific knowledge to enable the independent learning of movement skills**

  PO 1. Design a plan for self-improvement of a specific movement skill

STANDARD 2

Students comprehend basic physical activity principles and concepts that enable them to make decisions, solve problems and to become self-directed lifelong learners who are informed physical activity consumers.

PROFICIENCY (Grades 9-12)

- **2PA-P1. Explain the difference between facts and myths (e.g., the validity of marketing claims promoting fitness products and services) related to physical activity**

  PO 1. Identify various products and their marketing claims
  PO 2. Explain value of consumer items

- **2PA-P2. Identify consumer issues related to selection, purchase, care and maintenance of personal fitness equipment**

  PO 1. Identify personal needs
  PO 2. Identify similarities and differences among products
  PO 3. Identify use
  PO 4. Explain cost quality

- **2PA-P3. Identify appropriate individual requirements for physical activity prescription concerning the mode, intensity, duration, frequency and progression**

  PO 1. Explain principles of training
  PO 2. Apply principles of training

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **2PA-P4. Demonstrate ability to self-assess each area of health-related physical fitness and interpret test scores**

  PO 1. Match fitness components and tests
  PO 2. Administer self-tests
  PO 3. Explain results
  PO 4. Prescribe needs and identify strengths

- **2PA-P5. Identify different sports and activities and their contributions to specific health-related physical fitness components**

  PO 1. Explain the value of various sports/activities on fitness components

- **2PA-P6. Demonstrate a knowledge of physiological changes that result from physical activity participation**

  PO 1. Identify positive physical changes that affect the heart, circulatory, respiratory and other systems as a result of active participation in sports

- **2PA-P7. Identify safety principles associated with physical fitness development**

  PO 1. Same as concept

- **2PA-P8. Design a personal fitness program that 1) will lead to, or maintain, an acceptable level of health-related fitness and 2) is based on an understanding of training principles, individual skill levels and availability of resources**

  PO 1. Write program goals
  PO 2. Design a program
  PO 3. Follow the program
  PO 4. Monitor and adjust
  PO 5. Complete the program
  PO 6. Design a personal fitness program
  PO 7. Participate regularly in a personal fitness program
  PO 8. Complete a personal fitness program

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

DISTINCTION (Honors)

- **2PA-D1. Explain how each part of health-related physical fitness contributes to lifelong health and wellness**

  PO 1. Same as concept

- **2PA-D2. Design a personal fitness program that will 1) lead to, or maintain, an acceptable level of health-related fitness and 2) is based on an understanding of training principles, individual skill levels and availability of resources**

  PO 1. Write program goals
  PO 2. Design a program
  PO 3. Follow the program
  PO 4. Monitor and adjust
  PO 5. Complete the program
  PO 6. Design a personal fitness program
  PO 7. Participate regularly in a personal fitness program
  PO 8. Complete a personal fitness program

- **2PA-D3. Identify sound nutritional practices and stress management skills associated with physical activity and fitness**

  PO 1. Same as concept

STANDARD 3

Students exhibit a physically active lifestyle.

PROFICIENCY (Grades 9-12)

- **3PA-P1. Participate regularly in health-enhancing and personally rewarding physical activity**

  PO 1. Complete a program in cardio-respiratory fitness
  PO 2. Complete a developmental program in muscular strength and muscular endurance
  PO 3. Complete a flexibility program

- **3PA-P2. Select physical activities from a variety of movement forms based on personal interest, meaning and fulfillment**

  PO 1. Complete a program in cardio-respiratory fitness
  PO 2. Complete a developmental program in muscular strength and muscular endurance
  PO 3. Complete a flexibility program

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **3PA-P3. Develop a personal physical activity program meeting individual needs**

  PO 1. Design a program
  PO 2. Follow the program
  PO 3. Monitor and adjust the program

DISTINCTION (Honors)

- **3PA-D1. Participate regularly in health-enhancing and personally challenging physical activity**

  PO 1. Complete a semester or season in a chosen extracurricular sport or activity

- **3PA-D2. Participate in aquatics, self-defense, gymnastics, games, sports, dance, outdoor pursuits and other physical activities that contribute to the attainment of personal goals and the maintenance of wellness**

  PO 1. Same as concept

- **3PA-D3. Explain how activity participation patterns will change throughout life and have some strategies to deal with those changes**

  PO 1. Develop a plan for lifelong activity

STANDARD 4

Students achieve and maintain a health-enhancing level of physical fitness.

PROFICIENCY (Grades 9-12)

- **4PA-P1. Accomplish the health-related physical fitness standards as designed by Fitnessgram**

  PO 1. Identify a personal level of fitness on:
  (a) cardio-respiratory performance
  (b) muscular strength
  (c) muscular endurance
  (d) flexibility
  (e) body composition

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **4PA-P2. Use principles of training for the purpose of modifying levels of health fitness**

  PO 1. Identify the results of the Fitnessgram
  PO 2. Apply the information to develop personal fitness goals/plans

- **4PA-P3. Design a personal health-related fitness program based on an accurately assessed fitness profile**

  PO 1. Design and participate in a personal fitness program incorporating the FITT principle

- **4PA-P4. Identify safe and risky exercises and demonstrate safe exercise alternatives**

  PO 1. Describe unsafe practices and the appropriate safe alternative
  PO 2. Devise a plan to reduce risk and possible injury

DISTINCTION (Honors)

- **4PA-D1. Accomplish the health-related fitness standards as designed by Fitnessgram**

  PO 1. Explain the results of the Fitnessgram
  PO 2. Apply the information to develop personal fitness goals/plans
  PO 3. Monitor Fitnessgram results and adjust the personal fitness plan as necessary for continuous improvement

- **4PA-D2. Demonstrate the skill, knowledge and desire to monitor and adjust levels of fitness to meet personal goals**

  PO 1. Same as concept

- **4PA-D3. Design a personal health-related fitness program based on an accurately assessed fitness profile**

  PO 1. Design a personal fitness program
  PO 2. Participate regularly in a personal fitness program
  PO 3. Complete a personal fitness program and re-evaluate using the Fitnessgram

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 5
Students develop self-initiated behaviors that promote effective personal and social interactions in physical activity settings.

PROFICIENCY (Grades 9-12)

- **5PA-P1. Apply safe practices, rules, procedures and etiquette in all physical activity settings**

  PO 1. Follow safety rules
  PO 2. Behave appropriately
  PO 3. Show respect and consideration for oneself and others

- **5PA-P2. Act independently of peer pressure**

  PO 1. Same as concept

- **5PA-P3. Resolve conflict in appropriate ways**

  PO 1. Identify and discuss conflict in physical education and sports
  PO 2. Construct a conflict resolution plan
  PO 3. Demonstrate conflict resolution skills

DISTINCTION (Honors)

- **5PA-D1. Initiate independent and responsible personal behavior in physical activity settings**

  PO 1. Demonstrate exemplary standards of behavior

- **5PA-D2. Take a leadership role and follow through, as appropriate, in order to accomplish group goals**

  PO 1. Demonstrate leadership skills
  PO 2. Apply leadership skills

- **5PA-D3. Explain a safe environment for self and others in physical activity settings**

  PO 1. Identify and recognize unsafe conditions and behaviors

- **5PA-D4. Identify potentially dangerous outcomes and consequences of participation in physical activities**

  PO 1. Discuss the level of risk in various sports and activities

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 6

Students demonstrate understanding and respect for differences among people in physical activity settings.

PROFICIENCY (Grades 9-12)

- **6PA-P1. Explain the value of sport and physical activity in understanding multiculturalism**

  PO 1. Identify sports and activities that appeal to people of different genders, race, ethnic and religious backgrounds

- **6PA-P2. Invite others with differences to join in personally enjoyable physical activity**

  PO 1. Team up with people of diverse backgrounds
  PO 2. Complete an activity with a diverse team

DISTINCTION (Honors)

- **6PA-D1. Explain the role of physical activity in a diverse society**

  PO 1. Explain how sports and physical activities can remove boundaries and improve understanding between people

- **6PA-D2. Develop strategies for including persons from diverse backgrounds and abilities in physical activities**

  PO 1. Design a sports or fitness activity for a specific individual or group from a different ethnic, racial or ability background
  PO 2. Instruct a sport or activity to a diverse group or person

STANDARD 7

Students develop behavioral skills (self-management skills) essential to maintaining a physically active lifestyle.

PROFICIENCY (Grades 9-12)

- **7PA-P1. Demonstrate knowledge of goal setting and the ability to apply this knowledge to personal physical fitness and activity goals**

  PO 1. List goal setting steps
  PO 2. Apply goal setting strategies to a personal fitness plan

PHYSICAL ACTIVITY STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **7PA-P2. Identify attitudes associated with regular participation in physical activity and/or fitness development activities**

  PO 1. List the rewards of regular participation
  PO 2. Identify obstacles to regular participation
  PO 3. Explain the importance of motivation, prioritizing, dedication and self-discipline in fitness development

- **7PA-P3. Organize time management skills associated with regular physical activity participation**

  PO 1. Complete and document regular physical activity outside of class at least 3 times per week

- **7PA-D1. Describe common barriers to regular activity participation and methods of overcoming these barriers**

  PO 1. Create a diary recording one's own workouts and their feelings about them
  PO 2. Evaluate the diary

DISTINCTION (Honors)

- **7PA-D2. Explain how an understanding of self-efficacy and self-esteem is related to physical activity and the ability to use self-management skills necessary for developing both**

  PO 1. Describe the mental benefits of participation in lifelong fitness and sports
  PO 2. Describe one's own feelings having accomplished personal fitness goals or failed to reach such goals
  PO 3. Organize a fitness program into a busy lifestyle (time management)
  PO 4. Create rewards for achieving personal goals

Foreign and Native Language Standards 1997

Proficiency and Distinction (Grades 9-12)

Foreign and Native Language* Standards Rationale

Today's students prepare for the tomorrow in which they will need to function in varied contexts. The constant shrinking of the globe will expand their experience beyond that of previous generations to include contacts with other languages and cultures, both in their private lives and in their work. Languages are increasingly demanded in a wide range of professions. To succeed, students will need new tools, many of which are available primarily, if not solely, through the study of other languages. They include:

- ***the ability to communicate well for varied purposes*.** In other languages, as well as in English, effective communication requires an understanding of both the target language and culture under study and one's own, which implies the ability to interact confidently within many arenas, including the workplace and communities where the language is spoken.

- ***a solid foundation in basic subject matter and skills*.** All core subjects must contribute to this end, in an integrated fashion, to aid students in realizing the connections among the parts of their education. Basic subject matter includes the development of verbal reasoning, and listening skills and knowledge of the great achievements of human cultures, e.g., artistic, literary, scientific. The study of another language has been shown to enhance student performance in other academic fields. Learnings from other fields can also be reinforced in the foreign language classroom.

- ***an understanding and appreciation of the diversity of languages and cultures, including one's own*.** These tools aid students to function as responsible, informed, and confident citizens and enhance their personal development. They allow the finding of one's own place in the wider world.

Introduction to the Foreign Language Standards

The foreign language standards state what students need to know about languages and cultures, including their own; what students need to be able to do; and how this knowledge and these abilities relate to the subject matter of other core areas. The standards are stated clearly and in measurable terms:

- what students need to **know** in order to function successfully as they enter a new millennium that promises major changes in communications and contacts with other languages and cultures;

- what students need to be able to **do**. Knowing about a language and its culture(s), while essential, is not sufficient; students will develop skills for functioning effectively in varied contexts; and

- the integration of foreign languages into the rest of the curriculum so that the connections are clear and so that learning in all areas is facilitated, including the development of a deeper understanding of one's own language and culture. The five strands under which the standards are organized–Communication, Culture, Connections, Comparisons and Communities–are meant to be interwoven among themselves as well, rather than taught as separate entities. Meeting the standards for each one will contribute to reaching the standards of the others.

These standards for foreign language study are highly challenging for all students. They assume an extended sequence of learning throughout the students' school career, thus reflecting the likely nature of schools in the future. Meeting these standards will require the study of grammar–the forms and structures of the language–as well as effective learning strategies. Students will also need to use technologies that will bring the language and the culture to them in new ways and enhance their opportunities to learn.

In these standards we refer to "the target language," which may stand for "world language," "foreign language," "second language," or "heritage language" (i.e., the language that is the predominant language in the home).

Descriptions of Language Abilities for Each Level

Readiness

Students use basic vocabulary related to people, places, things and actions close to their own lives. They express themselves in phrases, short sentences and memorized material. Their language is characterized by an emerging control of the most common basic grammatical forms and structures. Because comprehension of oral and written language normally exceeds production, students are able to comprehend simple descriptions, narratives, and authentic materials such as advertisements, on topics studied in class. Pronunciation and fluency are such that students often might not be understood by native speakers. They are able to write accurately what they can say.

Foundations

Students speak and write extemporaneously using short sentences and sentence strings in present tense on topics within their experience with the language. They can describe, ask and answer questions; engage in simple conversations; and carry out simple realistic functions such as ordering a meal, buying something, or introducing themselves or others to a group. Since their knowledge of the forms and structures of the language has grown rapidly but their practice has been limited, their speech is likely to contain numerous linguistic errors. Students are comprehensible to sympathetic listeners who have experience with non-native speakers of their language. Their written language still mirrors their oral language, although they may be able to express more ideas more accurately in writing, given time to reflect, review and revise.

Essentials

Students speak with somewhat longer utterances and begin to display an ability to connect phrases and sentences to show relations between ideas expressed. Although patterns of errors are still common, students now speak and write extemporaneously in past, present and future time, using vocabulary related to their own lives and interests. Accent and intonation are generally accurate, although pauses and false starts may be common, as students give simple instructions and directions, make comparisons, solve problems together, and engage in conversations on a range of topics including leisure activities, professions and current events. In written work, students' spelling and punctuation are mostly accurate; and they organize their ideas well.

Proficiency

Students use paragraph-length connected discourse to narrate, describe, and discuss ideas and opinions. On topics of interest to them and within their experience, they show few patterns of linguistic errors, they are generally comprehensible to native speakers of the language, and their vocabulary is sufficient to avoid awkward pauses. They are able to circumvent linguistic gaps or lapses by "finding another way to say it." Given time to reflect and revise, they are able to express their ideas completely and interestingly in writing, with generally accurate grammar, vocabulary, spelling, accents and punctuation. They comprehend most authentic expository and fictional material produced for contemporary native speakers.

Distinction

Students show almost no patterns of linguistic errors and are able to carry out almost any task that they can execute in English, albeit with less fluency and control or breadth of vocabulary and grammar. They can argue a point effectively and extemporaneously, explaining their point of view in detail. In writing, their ideas are well organized and clearly, completely, and interestingly presented, with accurate use of the language's writing system. They can comprehend any non-technical material produced for the general public of native speakers in the standard language.

FOREIGN AND NATIVE LANGUAGE STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 1: COMMUNICATION

Students understand and interpret written and spoken communication on a variety of topics in the target language.

PROFICIENCY (Grades 9-12)

- **1FL-P1. Comprehend the main ideas and significant details in both oral presentations and written text**
- **1FL-P2. Comprehend authentic newspapers and magazine articles**
- **1FL-P3. Identify characteristics of a variety of literary genres including poetry**
- **1FL-P4. Identify and comprehend cultural nuances, including humor, in written and spoken language**
- **1FL-P5. Analyze and determine the significance of the principal themes and characteristics of a major literary text**
- **1FL-P6. Analyze the styles of two or more authors within one genre**

DISTINCTION (Honors)

Note: This level description applies to each of the three standards for the Communication Strand

- **1FL-D1. Discuss ideas, events or texts successfully with native speakers in conversation or as a presentation to a group**
- **1FL-D2. Debate, argue and negotiate on a variety of issues**
- **1FL-D3. Write analyses of literary works, noting stylistic conventions and cultural nuances**
- **1FL-D4. Conduct a comparative analysis of two or more authentic written or recorded works in the target language**

FOREIGN AND NATIVE LANGUAGE STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 2: COMMUNICATION

Students engage in oral and written exchanges which include providing and obtaining information, expressing feelings and preferences, and exchanging ideas and opinions in the target language.

PROFICIENCY (Grades 9-12)

- **2FL-P1. Express and support opinions on a variety of topics, concepts and ideas**
- **2FL-P2. Use complex sentences with connective expressions and idioms in oral and written communication**
- **2FL-P3. Compare and contrast ideas, people, places and things**
- **2FL-P4. Narrate anecdotes and original stories**

DISTINCTION (Honors)

(See Standard 1 [Communication])

STANDARD 3: COMMUNICATION

Students present information and ideas in the target language on a variety of topics to listeners and readers.

PROFICIENCY (Grades 9-12)

- **3FL-P1. Present persuasive arguments effectively on a range of topics**
- **3FL-P2. Present a research project orally or publish it in writing or in a video**
- **3FL-P3. Present a humorous story, anecdote or joke**

DISTINCTION (Honors)

(See Standard 1 [Communication])

FOREIGN AND NATIVE LANGUAGE STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 4: CULTURE

Students know "what to do when" and "what to say while doing it" in the culture and use this knowledge to interact appropriately. They also understand the relationships between cultural perspectives, products and practices within cultures.

PROFICIENCY (Grades 9-12)

- **4FL-P1. Explain how the target language and its culture add to the richness of our cultural diversity**
- **4FL-P2. Use formal and informal language appropriately in a variety of settings**
- **4FL-P3. Identify, analyze and discuss various patterns of behavior or interactions typical of the culture studied**
- **4FL-P4. Investigate and explain the function of products of the culture (e.g., institutions, crafts, laws, music) and their relationship to cultural perspectives**
- **4FL-P5. Identify the target language's literary masterpieces and their authors**

DISTINCTION (Honors)

- **4FL-D1. Identify, discuss and analyze products of the culture (e.g., social, economic and political institutions) and the relationships between these institutions and the perspectives of the culture**
- **4FL-D2. Experience, discuss and analyze expressive products of the culture including selections from various literary genres and the visual arts**
- **4FL-D3. Recognize the similarities and differences in literary style among well-known authors within the target language from one or more historical periods**

FOREIGN AND NATIVE LANGUAGE STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 5: CONNECTIONS

Students use the target language and authentic sources to reinforce and/or learn other content from the other subject areas.

PROFICIENCY (Grades 9-12)

- **5FL-P1. Discuss topics from other school subjects or the workplace in the target language including political and historical concepts, world-wide health issues and environmental concerns**
- **5FL-P2. Acquire information from a variety of sources written in the target language about a topic being studied in other subjects**
- **5FL-P3. Use a variety of authentic sources in the target language to prepare reports for other content subject areas**

DISTINCTION (Honors)

- **5FL-D1. Study successfully one or more content areas in the target language**

STANDARD 6: COMPARISONS

Students develop insights into their own language and their own culture through the study of the target language.

PROFICIENCY (Grades 9-12)

- **6FL-P1. Compare and contrast various elements of the target language, such as tie or tense, with parallel linguistic elements in English**
- **6FL-P2. Use idiomatic expressions in appropriate contexts**
- **6FL-P3. Compare and contrast the treatment of current issues in both the target culture and the student's culture by drawing on authentic texts**

DISTINCTION (Honors)

- **6FL-D1. Provide an in-depth analysis of another culture's perception of the United States within the world arena**
- **6FL-D2. Compare and contrast the use of English and the target language and culture to carry out specific communicative purposes (e.g., motivating others, telling a story, conducting business)**

FOREIGN AND NATIVE LANGUAGE STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 7: COMMUNITIES

Students use the target language within and beyond the school setting.

PROFICIENCY (Grades 9-12)

- **7FL-P1. Research topics of personal, global or community interest, using resources produced for native speakers**
- **7FL-P2. Interview speakers of the target language on historical or current topics of cultural or professional interest**
- **7FL-P3. Serve as a guide or informal interpreter for visitors from other countries**
- **7FL-P4. Perform a short play in the target language for parents, visitors or a community group**

DISTINCTION (Honors)

- **7FL-D1. Translate written materials for a local business, bank, school, etc.**
- **7FL-D2. Publish an original article or story**
- **7FL-D3. Serve as interpreter to assist native speakers who require help, such as the elderly or disabled**
- **7FL-D4. Tutor students from other countries who need help with school subjects in their native language while they are learning English**
- **7FL-D5. Co-host a cultural festival in conjunction with the community**

Reading Standard Articulated by Grade Level 2003

High School

Reading Standard Articulated by Grade Level

INTRODUCTION

Reading is a complex skill that involves learning language and using it effectively in the active process of constructing meaning embedded in text. It requires students to fluently decode the words on a page, understand the vocabulary of the writer, and use strategies to build comprehension of the text. It is a vital form of communication in the 21st century and a critical skill for students of this "information age" as they learn to synthesize a vast array of texts.

The Reading Standard Articulated by Grade Level will provide a clear delineation of what students need to know and be able to do at each grade level. This allows teachers to better plan instructional goals for students at any grade.

BACKGROUND

The state Board of Education adopted the Arizona Academic Standards in 1996 to define what Arizona's students need to know and be able to do by the end of twelfth grade. Developed by committees comprised of educators, parents, students, and business and community leaders, these standards were written in grade-level clusters with benchmarks at grades 3, 5, 8, and high school.

RATIONALE

Requirements in the *No Child Left Behind Act of 2001* (NCLB) and the standard practice of conducting periodic review of the state academic standards prompted the decision by the Arizona Department of Education to refine and articulate the academic standards for mathematics and reading by grade level. This refinement and articulation project was started in July 2002, and was completed in March 2003.

METHODOLOGY

Work teams for reading consisted of a representative sample of educators from around the state designed to include large and small schools, rural and urban schools, and ethnic diversity. National reading consultants, university professors, and test company consultants advised the teams. The goal was to articulate, or align, the current academic standards by grade level (K-12).

The Reading Articulation Teams utilized information from the National Council of Teachers of English and the findings of the National Reading Panel, which promote quality instruction, based on current, pedagogical, and researched practices.

The articulation process included a restructuring of the Arizona Academic Content Standards to better facilitate the alignment of performance objectives by grade level, while maintaining the content integrity of the existing standards. Over a period of

months, the articulation team and smaller sub-committees of the teams refined the documents. Reasonableness, usefulness, and appropriateness were the guidelines for the articulation process.

External reviews by nationally recognized consultants brought a broad perspective to the articulation process. Internal reviews by university and local experts provided additional validation.

Another important step in the project was the request for public comment. In December 2002, drafts of the Standards Articulated by Grade Level, along with a survey to gather feedback, were posted on the Arizona Department of Education website. This provided the public with easy access to the documents, and the survey allowed reviewers a means for submitting comments. The public and all educators had the opportunity to submit comments and suggestions, either electronically or in writing, until the survey closing date of January 31, 2003. In January, six public hearings were held throughout the state, offering further opportunities for public input.

After all the public comments were collected and organized by topic, the articulated teams met one last time to determine what modifications to the standards documents would be appropriate, based on this information. All public comments were given equal consideration.

The completion of the standards articulation process was followed by the development of rationales, glossaries, and crosswalks. These additional documents were designed to assist educators with the transition from the 1996 standards to the Reading Standard Articulated by Grade Level.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 9

Strand 1: Reading Process

Reading Process consists of the five critical components of reading, which are Phonemic Awareness, Phonics, Fluency, Vocabulary and Comprehension of connected text. These elements support each other and are woven together to build a solid foundation of linguistic understanding for the reader.

Concept 1: Print Concepts
Demonstrate understanding of print concepts.

(Grades K-3)

Concept 2: Phonemic Awareness
Identify and manipulate the sounds of speech.

(Grades K-2)

Concept 3: Phonics
Decode words, using knowledge of phonics, syllabication, and word parts.

(Grades K-3)

Concept 4: Vocabulary
Acquire and use new vocabulary in relevant contexts.

PO 1. Determine the meaning of vocabulary, using linguistic roots and affixes (e.g., Latin, Greek, Anglo-Saxon).

PO 2. Infer word meanings from context (e.g., definition, example, restatement, comparison/contrast, cause/effect).

PO 3. Distinguish between the denotative and connotative meanings of words.

PO 4. Identify the meaning of metaphors based on common literary allusions.

PO 5. Identify the meanings, pronunciations, syllabication, synonyms, antonyms, parts of speech, and correct spellings by using resources such as general and specialized dictionaries, thesauri, glossaries, and CD-ROM and the Internet when available.

Concept 5: Fluency
Read fluently.

PO 1. Read from a variety of genres with accuracy, automaticity (*immediate recognition*)*, and prosody (expression).*

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 9

Concept 6: Comprehension Strategies
Employ strategies to comprehend text.

PO 1. Predict text content using prior knowledge and text features (e.g., illustrations, titles, topic sentences, key words).

PO 2. Generate clarifying questions in order to comprehend text.

PO 3. Use graphic organizers in order to clarify the meaning of the text.

PO 4. Connect information and events in text to experience and to related text and sources.

PO 5. Apply knowledge of organizational structures (e.g., chronological order, sequence-time order, cause and effect relationships, logical order, by classification, problem-solution) of text to aid comprehension.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 9

Strand 2: Comprehending Literary Text

Comprehending Literary Text identifies the comprehension strategies that are specific in the study of a variety of literature.

Concept 1: Elements of Literature
Identify, analyze, and apply knowledge of the structures and elements of literature.

PO 1. Describe the author's use of literary elements:
- theme (moral, lesson, meaning, message, view or comment on life),
- point of view (e.g., first vs. third, limited vs. omniscient),
- characterization (qualities, motives, actions, thoughts, dialogue, development, interactions),
- setting (time of day or year, historical period, place, situation), and
- plot (exposition, conflict, rising action, climax, falling action, and resolution).

PO 2. Explain different elements of figurative language, including simile, metaphor, personification, hyperbole, symbolism, allusion, and imagery in a literary selection.

PO 3. Compare (and contrast) works within a literary genre that deal with similar themes (e.g., compare short stories, novels, short stories, poems).

PO 4. Compare interactions among major characters and minor characters in literary text with emphasis upon how the plot is revealed through action of the dialog.

Concept 2: Historical and Cultural Aspects of Literature
Recognize and apply knowledge of the historical and cultural aspects of American, British, and world literature.

PO 1. Describe the historical and cultural aspects found in cross-cultural works of literature.

PO 2. Compare (and contrast) classic works of literature that deal with similar topics and problems (e.g., individual and society, meaning of friendship, freedom, responsibility).

PO 3. Recognize ways that forms of literature (including poetry, novel and/or short story) present similar themes differently across genres.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 9

Strand 3: Comprehending Informational Text

Comprehending Informational Text delineates specific and unique skills that are required to understand the wide array of informational text that is a part of our day-to-day experiences.

Concept 1: Expository Text

Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.

PO 1. Compare (and contrast) original text to a summary for accuracy of the main ideas, inclusion of critical details, and the extent to which it conveys the underlying meaning of the original text.

PO 2. Distinguish facts from opinions in expository selections such as editorials, newspaper articles, essays, reviews, and critiques, providing supporting evidence from the text.

PO 3. Locate specific information by using organizational features (e.g., table of contents, headings, captions, bold print, italics, glossaries, indices, key/guide words, topic sentences, concluding sentences, end notes, footnotes, bibliographic references) in expository text. (Connected to Research Strand in Writing)

PO 4. Organize information from both primary and secondary sources by taking notes, outlining ideas, paraphrasing information; and by making charts, conceptual maps, learning logs, and/or timelines. (Connected to Research Strand in Writing)

PO 5. Interpret graphic sources of information (e.g., charts, maps, diagrams, illustrations, tables, timelines, graphs) to support ideas. (Connected to Research Strand in Writing)

PO 6. Use knowledge of modes of expository writing (e.g., chronological order, comparison and contrast, cause and effect relationships, logical order, classification schemes, sequence-time order, problem-solution, analogy, definition, narrative) to interpret text.

PO 7. Explain how one excerpt relates and contributes to the reading selection (e.g., sentence to paragraph, paragraph to selection).

PO 8. Support conclusions drawn from ideas and concepts in expository text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 9

Concept 2: Functional Text
Identify, analyze, and apply knowledge of the purpose, structures, clarity, and relevancy of functional text.

PO 1. Synthesize information from multiple sources (e.g., texts, maps, illustrations, workplace documents, schematic diagrams) to solve a problem.

PO 2. Synthesize information from multiple sources (e.g., texts, maps, illustrations, workplace documents, schematic diagrams) to draw conclusions.

PO 3. Identify the objective(s) of functional text (e.g., warranties, product information, technical manuals, consumer publications, workplace documents).

Concept 3: Persuasive Text
Explain basic elements of argument in text and their relationship to the author's purpose and use of persuasive strategies.

PO 1. Identify the central argument and its elements (e.g., argument by cause and effect, analogy, authority, emotion, logic) in persuasive text.

PO 2. Evaluate the appropriateness of an author's word choice for an intended audience.

PO 3. Identify unsupported inferences or fallacious reasoning (e.g., circular reasoning, false causality, over-generalization, over-simplification, self-contradiction) in the arguments advanced in persuasive text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Strand 1: Reading Process

Reading Process consists of the five critical components of reading, which are Phonemic Awareness, Phonics, Fluency, Vocabulary and Comprehension of connected text. These elements support each other and are woven together to build a solid foundation of linguistic understanding for the reader

.

Concept 1: Print Concepts
Demonstrate understanding of print concepts.

(Grades K-3)

Concept 2: Phonemic Awareness
Identify and manipulate the sounds of speech.

(Grades K-2)

Concept 3: Phonics
Decode words, using knowledge of phonics, syllabication, and word parts.

(Grades K-3)

Concept 4: Vocabulary
Acquire and use new vocabulary in relevant contexts.

PO 1. Determine the meaning of vocabulary, using linguistic roots and affixes (e.g., Latin, Greek, Anglo-Saxon).

PO 2. Infer word meanings from context (e.g., definition, example, restatement, comparison/contrast, cause/effect).

PO 3. Determine how the meaning of the text is affected by the writer's word choice (e.g., literal vs. figurative language, idioms, adages).

PO 4. Identify the meaning of metaphors based on common literary allusions.

PO 5. Determine the meanings, pronunciations, contextually appropriate synonyms and antonyms, replacement words and phrases, etymologies, and correct spellings of words by using resources such as general and specialized dictionaries, thesauri, glossaries, and CD-ROM and the Internet when available.

Concept 5: Fluency
Read fluently.

PO 1. Read from a variety of genres with accuracy, automaticity (immediate recognition), and prosody (expression).

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Concept 6: Comprehension Strategies

Employ strategies to comprehend text.

PO 1. Predict text content using prior knowledge and text features (e.g., illustrations, titles, topic sentences, key words).

PO 2. Generate clarifying questions in order to comprehend text.

PO 3. Use graphic organizers in order to clarify the meaning of the text.

PO 4. Connect information and events in text to experience and to related text and sources.

PO 5. Apply knowledge of organizational structures (e.g., chronological order, sequence-time order, cause and effect relationships, logical order, by classification, problem-solution) of text to aid comprehension.

Strand 2: Comprehending Literary Text

Comprehending Literary Text identifies the comprehension strategies that are specific in the study of a variety of literature.

Concept 1: Elements of Literature

Identify, analyze, and apply knowledge of the structures and elements of literature.

PO 1. Analyze the author's use of literary elements:

- theme (moral, lesson, meaning, message, view or comment on life),
- point of view (e.g., first vs. third, limited vs. omniscient),
- characterization (qualities, motives, actions, thoughts, dialogue, development, interactions),
- setting (time of day or year, historical period, place, situation), and
- plot (exposition, major and minor conflicts, rising action, climax, falling action, and resolution).

PO 2. Analyze the author's use of figurative language, including simile, metaphor, personification, hyperbole, symbolism, allusion, and imagery in a literary selection.

PO 3. Compare (and contrast) the illustration of the same theme in two different literary genres, using their structural features as the basis for the comparison (e.g., novel and play, poem, short story).

PO 4. Identify how an author's choice of words and imagery sets the tone and advances the work's theme.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Concept 2: Historical and Cultural Aspects of Literature
Recognize and apply knowledge of the historical and cultural aspects of American, British, and world literature.

PO 1. Describe the historical and cultural aspects found in cross-cultural works of literature.

PO 2. Compare (and contrast) classic works of literature that deal with similar topics and problems (e.g., individual and society, meaning of friendship, freedom, responsibility).

PO 3. Recognize ways that forms of literature (including poetry, novel and/or short story) present similar themes differently across genres.

Strand 3: Comprehending Informational Text

Comprehending Informational Text delineates specific and unique skills that are required to understand the wide array of informational text that is a part of our day-to-day experiences.

Concept 1: Expository Text
Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.

PO 1. Compare (and contrast) original text to a summary for accuracy of the main ideas, inclusion of critical details, and the extent to which it conveys the underlying meaning of the original text.

PO 2. Distinguish supported inferences from unsupported inferences in expository selections such as editorials, newspaper articles, essays, reviews, and critiques.

PO 3. Locate specific information by using organizational features (e.g., table of contents, headings, captions, bold print, italics, glossaries, indices, key/guide words, topic sentences, concluding sentences, end notes, footnotes, bibliographic references) in expository text. (Connected to Research Strand in Writing)

PO 4. Organize information from both primary and secondary sources by taking notes, outlining ideas, paraphrasing information; and by making charts, conceptual maps, learning logs and/or timelines for a research document or other assigned tasks. (Connected to Research Strand in Writing)

PO 5. Interpret graphic sources of information (e.g., charts, maps, diagrams, illustrations, tables, timelines, graphs) to support ideas. (Connected to Research Strand in Writing)

PO 6. Use knowledge of modes of expository writing (e.g., chronological order, comparison and contrast, cause and effect relationships, logical order, classification schemes, sequence-time order, problem-solution, analogy, definition, narrative) to interpret text.

PO 7. Make relevant inferences by synthesizing concepts and ideas from a single reading selection.

PO 8. Support conclusions drawn from ideas and concepts in expository text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Concept 2: Functional Text

Identify, analyze, and apply knowledge of the purpose, structures, clarity, and relevancy of functional text.

PO 1. Synthesize information from multiple sources (e.g., texts, maps, illustrations, workplace documents, schematic diagrams) to solve a problem.

PO 2. Synthesize information from multiple sources (e.g., texts, maps, illustrations, workplace documents, schematic diagrams) to draw conclusions.

PO 3. Analyze the effectiveness of functional text (e.g., warranties, product information, technical manuals, consumer publications, workplace documents) to achieve its stated purpose(s).

Concept 3: Persuasive Text

Explain basic elements of argument in text and their relationship to the author's purpose and use of persuasive strategies.

PO 1. Describe the central argument and its elements (e.g., argument by cause and effect, analogy, authority, emotion, logic) in persuasive text.

PO 2. Describe how persuasive techniques (e.g., repetition, sentence variety, understatement, overstatement) contribute to the power of persuasive text.

PO 3. Identify unsupported inferences or fallacious reasoning (e.g., circular reasoning, false causality, over-generalization, over-simplification, self-contradiction) in the arguments advanced in persuasive text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Strand 1: Reading Process

Reading Process consists of the five critical components of reading, which are Phonemic Awareness, Phonics, Fluency, Vocabulary and Comprehension of connected text. These elements support each other and are woven together to build a solid foundation of linguistic understanding for the reader.

Concept 1: Print Concepts
Demonstrate understanding of print concepts.

(Grades K-3)

Concept 2: Phonemic Awareness
Identify and manipulate the sounds of speech.

(Grades K-2)

Concept 3: Phonics
Decode words, using knowledge of phonics, syllabication, and word parts.

(Grades K-3)

Concept 4: Vocabulary
Acquire and use new vocabulary in relevant contexts.

PO 1. Draw inferences about meaning of new vocabulary, based on knowledge of linguistic roots and affixes (e.g., Latin, Greek, Anglo-Saxon).

PO 2. Identify the meaning of metaphors based on literary allusions and conceits.

Concept 5: Fluency
Read fluently.

PO 1. Read from a variety of genres with accuracy, automaticity (*immediate recognition*)*, and prosody (expression).*

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 6: Comprehension Strategies
Employ strategies to comprehend text.

PO 1. Predict text content using prior knowledge and text features (e.g., illustrations, titles, topic sentences, key words).

PO 2. Generate clarifying questions in order to comprehend text.

PO 3. Use graphic organizers in order to clarify the meaning of the text.

PO 4. Connect information and events in text to experience and to related text and sources.

PO 5. Apply knowledge of organizational structures (e.g., chronological order, sequence-time order, cause and effect relationships, logical order, classification schemes, problem-solution) of text to aid comprehension.

Strand 2: Comprehending Literary Text

Comprehending Literary Text identifies the comprehension strategies that are specific in the study of a variety of literature
.

Concept 1: Elements of Literature
Identify, analyze, and apply knowledge of the structures and elements of literature.

PO 1. Evaluate the author's use of literary elements:
- theme (moral, lesson, meaning, message, view or comment on life),
- point of view (e.g., first vs. third, limited vs. omniscient),
- characterization (qualities, motives, actions, thoughts, dialogue, development, interactions),
- setting (time of day or year, historical period, place, situation), and
- plot (exposition, major and minor conflicts, rising action, climax, falling action, and resolution).

PO 2. Interpret figurative language, including, personification, hyperbole, symbolism, allusion, imagery, extended metaphor/conceit, and allegory with emphasis upon how the writer uses language to evoke readers' emotions.

PO 3. Analyze the way in which the theme or meaning of a selection represents a view or comment on life, providing textual evidence for the identified theme

PO 4. Explain the writer's use of irony, contradictions, paradoxes, incongruities, and ambiguities in a literary selection.

PO 5. Analyze an author's development of time and sequence through the use of complex literary devices such as foreshadowing and flashbacks.

PO 6. Explain how meaning is enhanced through various features of poetry, including sound (e.g., rhythm, repetition, alliteration, consonance, assonance), structure (e.g., meter, rhyme scheme), and graphic elements (e.g., line length, punctuation, word position).

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 2: Historical and Cultural Aspects of Literature
Recognize and apply knowledge of the historical and cultural aspects of American, British, and world literature.

PO 1. Describe the historical and cultural aspects found in cross-cultural works of literature.

PO 2. Relate literary works to the traditions, themes, and issues of their eras.

PO 3. Analyze culturally or historically significant literary works of American literature that reflect our major literary periods and traditions.

Strand 3: Comprehending Informational Text

Comprehending Informational Text delineates specific and unique skills that are required to understand the wide array of informational text that is a part of our day-to-day experiences.

Concept 1: Expository Text
Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.

PO 1. Critique the consistency and clarity of the text's purposes.

PO 2. Distinguish among different kinds of evidence used to support conclusions (e.g., logical, empirical, anecdotal).

PO 3. Make relevant inferences by synthesizing concepts and ideas from a single reading selection.

PO 4. Compare (and contrast) readings on the same topic, by explaining how authors reach the same or different conclusions based upon differences in evidence, reasoning, assumptions, purposes, beliefs, or biases.

Concept 2: Functional Text
Identify, analyze, and apply knowledge of the purpose, structures, clarity, and relevancy of functional text.

PO 1. Analyze the structures of functional text (e.g., their format, graphics and headers) to determine how authors use these features to achieve their purposes.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 3: Persuasive Text
Explain basic elements of argument in text and their relationship to the author's purpose and use of persuasive strategies.

PO 1. Analyze the power, validity, and truthfulness of the arguments advanced in persuasive text.

PO 2. Evaluate the arguments an author uses in a document to refute opposing arguments and address reader concerns.

PO 3. Identify unsupported inferences or fallacious reasoning in arguments advanced in persuasive text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Strand 1: Reading Process

Reading Process consists of the five critical components of reading, which are Phonemic Awareness, Phonics, Fluency, Vocabulary and Comprehension of connected text. These elements support each other and are woven together to build a solid foundation of linguistic understanding for the reader

.

Concept 1: Print Concepts

Demonstrate understanding of print concepts.

(Grades K-3)

Concept 2: Phonemic Awareness

Identify and manipulate the sounds of speech.

(Grades K-3)

Concept 3: Phonics

Decode words, using knowledge of phonics, syllabication, and word parts.

(Grades K-3)

Concept 4: Vocabulary

Acquire and use new vocabulary in relevant contexts.

PO 1. Draw inferences about meaning of new vocabulary, based on knowledge of linguistic roots and affixes (e.g., Latin, Greek, Anglo-Saxon).

PO 2. Identify the meaning of metaphors based on literary allusions and conceits.

Concept 5: Fluency

Read fluently.

PO 1. Read from a variety of genres with accuracy, automaticity (immediate recognition), and prosody (expression).

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 6: Comprehension Strategies
Employ strategies to comprehend text.

PO 1. Predict text content using prior knowledge and text features (e.g., illustrations, titles, topic sentences, key words).

PO 2. Generate clarifying questions in order to comprehend text.

PO 3. Use graphic organizers in order to clarify the meaning of the text.

PO 4. Connect information and events in text to experience and to related text and sources.

PO 5. Apply knowledge of organizational structures (e.g., chronological order, sequence-time order, cause and effect relationships, logical order, classification schemes, problem-solution) of text to aid comprehension.

Strand 2: Comprehending Literary Text

Comprehending Literary Text identifies the comprehension strategies that are specific in the study of a variety of literature.

Concept 1: Elements of Literature
Identify, analyze, and apply knowledge of the structures and elements of literature.

PO 1. Evaluate the author's use of literary elements:
- *theme (moral, lesson, meaning, message, view or comment on life),*
- *point of view (e.g., first vs. third, limited vs. omniscient),*
- *characterization (qualities, motives, actions, thoughts, dialogue, development, interactions),*
- *setting (time of day or year, historical period, place, situation), and*
- *plot (exposition, major and minor conflicts, rising action, climax, falling action, and resolution).*

PO 2. Interpret figurative language, including, personification, hyperbole, symbolism, allusion, imagery, extended metaphor/conceit, and allegory with emphasis upon how the writer uses language to evoke readers' emotions.

PO 3. Analyze a writer's word choice and imagery as a means to appeal to the reader's senses and to set the tone, providing evidence from the text to support the analysis.

PO 4. Compare (and contrast) literary texts that express a universal theme, providing textual evidence (e.g., examples, details, quotations) as support for the identified theme.

PO 5. Analyze characteristics of sub genres (e.g., satire, parody, allegory) that overlap or cut across the lines of genre classifications such as poetry, novel, drama, short story, essay or editorial.

PO 6. Describe the function of dialogue, scene design, soliloquies, asides, and/or character foils in dramatic literature.

PO 7. Explain how meaning is enhanced through various features of poetry, including sound (e.g., rhythm, repetition, alliteration, consonance, assonance), structure (e.g., meter, rhyme scheme), graphic elements (e.g., line length, punctuation, word position).

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 2: Historical and Cultural Aspects of Literature
Recognize and apply knowledge of the historical and cultural aspects of American, British, and world literature.

PO 1. *Describe the historical and cultural aspects found in cross-cultural works of literature.*

PO 2. Relate literary works and their authors to the seminal ideas of their eras.

PO 3. Analyze culturally or historically significant literary works of British and world literature that reflect the major literary periods and traditions.

Strand 3: Comprehending Informational Text

Comprehending Informational Text delineates specific and unique skills that are required to understand the wide array of informational text that is a part of our day-to-day experiences
.

Concept 1: Expository Text
Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.

PO 1. Critique the effectiveness of the organizational pattern (e.g., logic, focus, consistency, coherence, visual appeal) of expository text.

PO 2. Determine the accuracy and truthfulness of one source of information by examining evidence offered in the material itself and by referencing and comparing the evidence with information available from multiple sources.

PO 3. Evaluate the evidence used to support the author's perspective contained within both primary and secondary sources. (Connected to Research Strand in Writing)

PO 4. Compare (and contrast) readings on the same topic, by explaining how authors reach the same or different conclusions based upon differences in evidence, reasoning, assumptions, purposes, beliefs, biases, and argument.

PO 5. Identify an author's implicit and stated assumptions about a subject, based upon evidence in the selection.

Concept 2: Functional Text
Identify, analyze, and apply knowledge of the purpose, structures, clarity, and relevancy of functional text.

PO 1. Analyze how the patterns of organization, hierarchic structures, repetition of key ideas, syntax, and word choice influence the clarity and understandability of functional text.

PO 2. Evaluate the logic within functional text.

READING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 3: Persuasive Text

Explain basic elements of argument in text and their relationship to the author's purpose and use of persuasive strategies.

PO 1. Evaluate the merit of an argument, action, or policy by citing evidence offered in the material itself and by comparing the evidence with information available in other sources.

PO 2. Evaluate the effectiveness of an author's use of rhetorical devices in a persuasive argument.

PO 3. Identify unsupported inferences or fallacious reasoning in arguments advanced in persuasive text.

PO 4. Evaluate persuasive sources for adherence to ethics.

Writing Standard Articulated by Grade Level 2004

High School

Writing Standard Articulated by Grade Level

INTRODUCTION

The purpose of the Writing Standard Articulated by Grade Level is to equip students with the skills and knowledge needed to participate in society as literate citizens. The ability to communicate effectively in writing will be essential to their success in their communities and careers. Students may realize personal fulfillment and enjoyment as they learn to become proficient writers and continue as writers throughout their lives.

Writing is a complex skill that involves learning language and using it effectively to convey meaning through text. This standard recognizes that students' abilities in writing develop from their earliest stages with phonetic spelling; to limited understanding of a certain genre; to the ability to produce conventional, coherent, unified documents. Their ideas are expressed in various forms, such as notes, lists, letters, journal writing, stories, web postings, instant messaging, essays, and reports. Effective writing may be evaluated by examining the use of ideas, organization, voice, word choice, sentence fluency, and conventions.

The Writing Standard Articulated by Grade Level will provide a clear delineation of what students need to know and be able to do at each grade level. This allows teachers to better plan instructional goals for students at any grade.

BACKGROUND

The state Board of Education adopted the Arizona Academic Standards in 1996 to define what Arizona's students need to know and be able to do by the end of twelfth grade. Developed by committees comprised of educators, parents, students, and business and community leaders, these standards were written in grade-level clusters with benchmarks at grades 3, 5, 8, and high school.

RATIONALE

Requirements in the No Child Left Behind Act of 2001 (NCLB) and the standard practice of conducting periodic review of the state academic standards prompted the decision by the Arizona Department of Education to refine and articulate the academic standards for mathematics, reading, writing, and science by grade level. This refinement and articulation project was started in December 2003, and was completed in June 2004.

METHODOLOGY

Writing Standard refinement began in January 2004, expanding the standard to include performance objectives for all grade levels, kindergarten through twelfth grade. The writing articulation teams consisted of educators from around the state, representing large and small schools, rural and urban schools, and ethnic diversity. National consultants, university professors, and Arizona Department of Education staff advised the teams. The goal was to articulate and align the current academic standards by grade level (K-12).

The Writing Articulation Committee utilized resources and information from current, effective classroom practices, from other states' standards, and from the National Council of Teachers of English, which promotes quality literacy instruction.

The articulation process included a restructuring of the Arizona Academic Content Writing Standards to better facilitate the alignment of performance objectives by grade level, while maintaining the content integrity.

Over a period of months, the articulation team and smaller subcommittees of the teams refined the documents. Reasonableness, usefulness, and appropriateness were the guidelines for the articulation process.

External reviews by nationally recognized consultants brought a broad perspective to the articulation process. Internal reviews by university and local experts provided additional validation.

Another important step in the project was the request for public comment. In May 2004, a draft of the Writing Standard Articulated by Grade Level, along with a survey to gather feedback, was posted on the Arizona Department of Education website. This provided the public with easy access to the documents, and the survey allowed reviewers a means for submitting comments. The public and all educators had the opportunity to submit comments and suggestions, either electronically or in writing, until the public review closing date of May 27, 2004. In May, three public hearings were held throughout the state, offering further opportunities for public input.

Based on public comment and online survey results, the articulation team met to determine necessary modifications to the standard. All public comments were given equal consideration.

Included in the standard articulation process the development of a rationale, glossary, and a crosswalk (correlation between the 1996 Writing Standard and revised, articulated standard). These additional documents were designed to assist educators with the transition from the 1996 Writing Standards to the 2004 Writing Standard Articulated by Grade Level.

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Strand 1: Writing Process

Research has established the major steps of the writing process. These steps are identified in the five concepts of this strand, each supported with specific performance objectives. While all steps are needed and used by effective writers as they compose text, different skills may be emphasized in individual assignments. These steps may be used recursively as a piece moves toward completion. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress

.

Concept 1: Prewriting Prewriting includes using strategies to generate, plan, and organize ideas for specific purposes.
*PO 1. Generate ideas through a variety of activities (e.g., brainstorming, notes and logs, **graphic organizers**, record of writing ideas and discussion, printed material or other sources).*
PO 2. Determine the purpose (e.g., to entertain, to inform, to communicate, to persuade, to explain) of an intended writing piece.
PO 3. Determine the intended audience of a writing piece.
*PO 4. Establish a **controlling idea** appropriate to the type of writing.*
*PO 5. Use organizational strategies (e.g., outline, chart, table, graph, **Venn Diagram**, **web**, **story map**, **plot pyramid**) to plan writing.*
PO 6. Maintain a record (e.g., lists, journal, folder, notebook) of writing ideas.
*PO 7. Use **time management strategies**, when appropriate, to produce a writing product within a set time period.*

Concept 2: Drafting Drafting incorporates prewriting activities to create a first draft containing necessary elements for a specific purpose.
*PO 1. Use a **prewriting plan** to develop the main idea(s) with supporting details.*
PO 2. Sequence ideas into a cohesive, meaningful order.

Italics denote a repetition of a performance objective (learned in an earlier grade) that is to be applied to grade level content or at a higher level of complexity.
The bulleted items within a performance objective indicate specific content to be taught.

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Concept 3: Revising Revising includes evaluating and refining the rough draft for clarity and effectiveness. (Ask: Does this draft say what you want it to say?)
PO 1. Evaluate the draft for use of ideas and content, organization, voice, word choice, and sentence fluency. (See Strand 2)
PO 2. Add details to the draft to more effectively accomplish the purpose.
PO 3. Delete irrelevant and/or redundant information from the draft to more effectively accomplish the purpose.
PO 4. Rearrange words, sentences, and paragraphs in the draft in order to clarify the meaning or to enhance the writing style.
*PO 5. Add **transitional words** and phrases to the draft in order to clarify meaning or enhance the writing style.*
*PO 6. Use a variety of sentence structures (i.e., **simple**, **compound**, **complex)** to improve sentence fluency in the draft.*
*PO 7. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to refine the draft.*
PO 8. Use resources and reference materials (e.g., thesaurus, dictionary) to select more effective and precise language.

Concept 4: Editing Editing includes proofreading and correcting the draft for conventions.
PO 1. Identify punctuation, spelling, and grammar and usage errors in the draft. (See Strand 2)
PO 2. Use resources (e.g., dictionary, word lists, spelling/grammar checkers) to correct conventions.
*PO 3. Apply **proofreading marks** to indicate errors in conventions.*
*PO 4. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to edit the draft.*

Concept 5: Publishing Publishing includes formatting and presenting a final product for the intended audience.
PO 1. Prepare writing that follows a format appropriate for the purpose (e.g., for display, sharing with others, submitting to a publication).
PO 2. Include such techniques as principles of design (e.g., margins, tabs, spacing, columns) and graphics (e.g., drawings, charts, graphs), when applicable, to enhance the final product.
PO 3. Write legibly.

Italics denote a repetition of a performance objective (learned in an earlier grade) that is to be applied to grade level content or at a higher level of complexity.
The bulleted items within a performance objective indicate specific content to be taught.

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Strand 2: Writing Elements

This strand focuses on the elements of effective writing. Good writing instruction incorporates multiple performance objectives into an integrated experience of learning for the student. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress. The order of the concepts and performance objectives is not intended to indicate a progression or hierarchy for writing instruction. Instructional activities may focus on just one concept or many.

Concept 1: Ideas and Content Writing is clear and focused, holding the reader's attention throughout. Main ideas stand out and are developed by strong support and rich details. Purpose is accomplished.
PO 1. Maintain a clear, narrow focus to support the topic.
PO 2. Write with an identifiable purpose and for a specific audience.
PO 3. Provide sufficient, relevant, and carefully selected details for support.
PO 4. Demonstrate a thorough, balanced explanation of the topic.
PO 5. Include ideas and details that show original perspective and insights.

Concept 2: Organization Organization addresses the structure of the writing and integrates the central meaning and patterns that hold the piece together.
*PO 1. Use a structure that fits the type of writing (e.g., letter format, **narrative**, play, essay).*
PO 2. Include a strong beginning or introduction that draws in the reader.
PO 3. Place details appropriately to support the main idea.
PO 4. Use effective transitions among all elements (sentences, paragraphs, and ideas).
PO 5. Employ a variety of paragraphing strategies (e.g., topical, chronological, spatial) appropriate to application and purpose.
*PO 6. Create an ending that provides a sense of **resolution** or closure.*

Concept 3: Voice Voice will vary according to the type of piece, but should be appropriately formal or casual, distant or personal, depending on the audience and purpose.
PO 1. Show awareness of the audience through word choice, style, and an appropriate connection with, or distance from, the audience.
PO 2. Convey a sense of identity through originality, sincerity, liveliness, or humor appropriate to topic and type of writing.
*PO 3. Choose appropriate voice (e.g., formal, informal, **academic discourse)** for the application.*
PO 4. Use engaging and expressive language that shows a commitment to the topic.
PO 5. Use language appropriate to purpose, topic, and audience.

Italics denote a repetition of a performance objective (learned in an earlier grade) that is to be applied to grade level content or at a higher level of complexity.
The bulleted items within a performance objective indicate specific content to be taught.

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Concept 4: Word Choice Word choice reflects the writer's use of specific words and phrases to convey the intended message and employs a variety of words that are functional and appropriate to the audience and purpose.
PO 1. Use accurate, specific, powerful words and phrases that effectively convey the intended message.
PO 2. Use vocabulary that is original, varied, and natural.
PO 3. Use words that evoke clear images.
PO 4. Use **literal** and **figurative language** intentionally when appropriate. (See R09-S2C1-02, R10-S2C1-02, R11-S2C1-02, R12-S2C1-02)
PO 5. Use **clichés** only when appropriate to purpose.

Concept 5: Sentence Fluency Fluency addresses the rhythm and flow of language. Sentences are strong and varied in structure and length.
PO 1. Use a variety of sentence structures (**simple**, **compound**, **complex**, **and compound-complex**) and lengths to reinforce relationships among ideas and to enhance the flow of the writing.
PO 2. Show extensive variation in sentence beginnings, lengths, and patterns to enhance the flow of the writing.
PO 3. Demonstrate a flow that is natural and powerful when read aloud.

Italics denote a repetition of a performance objective (learned in an earlier grade) that is to be applied to grade level content or at a higher level of complexity.
The bulleted items within a performance objective indicate specific content to be taught.

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Concept 6: Conventions
Conventions addresses the mechanics of writing, including capitalization, punctuation, spelling, grammar and usage, and paragraph breaks.

PO 1. Use capitals correctly for:

a. ***proper nouns:***
- *holidays*
- *place/regional names*
- *languages*
- *historical events*
- *organizations*
- *academic courses (e.g., algebra/Algebra I)*
- *product names*

b. *words used as names (e.g., Grandpa, Aunt Lyn)*
c. *literary titles (book, story, poem, play, song)*
d. *titles*
e. *abbreviations*
f. ***proper adjectives*** *(e.g., German shepherd, Chinese restaurant)*

PO 2. Use commas to correctly punctuate:

a. items in a series
b. greetings and closings of letters
c. introductory words, phrases and clauses
d. ***direct address***
e. ***interrupters***
f. ***compound sentences***
g. ***appositives***
h. ***dialogue***

PO 3. Use quotation marks to punctuate:

a. ***dialogue***
b. *titles*
c. *exact words from sources*

PO 4. Use underlining or italics to correctly identify titles and vessels (e.g., ships, spacecrafts, planes, trains).

PO 5. Use colons to punctuate business letter salutations and sentences introducing lists.

PO 6. Use semicolons to punctuate **compound** and **compound-complex sentences** when appropriate.

PO 7. Use apostrophes to punctuate:

a. contractions
b. singular possessives
c. plural possessives

PO 8. Use hyphens, dashes, parentheses, ellipses, and brackets correctly.

PO 9. Spell words correctly.

PO 10. Use paragraph breaks to reinforce the organizational structure, including **dialogue**.

PO 11. Demonstrate control of grammar and usage in writing:

a. parts of speech
b. verb forms and tenses
c. subject/verb agreement
d. pronoun/antecedent agreement
e. parallel structure
f. comparative and superlative degrees of adjectives
g. modifier placement
h. **homonyms**

PO 12. Use appropriate format, according to type of writing, to cite sources (e.g., Chicago, APA, MLA, UPI, any other recognized **style manual**).

Italics denote a repetition of a performance objective (learned in an earlier grade) that is to be applied to grade level content or at a higher level of complexity.
The bulleted items within a performance objective indicate specific content to be taught.

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Strand 3: Writing Applications

Writing skills particular to the applications listed here may be taught across the curriculum, although some applications may lend themselves more readily to specific content areas. It is imperative that students write in all content areas in order to increase their communication skills, and ultimately to improve their understanding of content area concepts. When appropriate, other content standards are referenced to show interdisciplinary connections.

Concept 1: Expressive

Expressive writing includes **personal narratives**, stories, poetry, songs, and dramatic pieces. Writing may be based on real or imagined events.

PO 1. Write a **personal narrative** that:

a. describes a sequence of events, focusing on one incident experienced by the author
b. sets scenes and incidents in specific times and places
c. describes with specific details the sights, sounds and smells of the scenes
d. uses **figurative language** (e.g., **simile**, **metaphor**, **personification**)

Example: Write an autobiographical account of a time when you had to make an important decision.

Concept 2: Expository

Expository writing includes non-fiction writing that describes, explains, informs, or summarizes ideas and content. The writing supports a **thesis** based on research, observation, and/or experience.

PO 1. Write an explanatory, multi-paragraph essay that:

a. includes background information to establish the **thesis** (**hypothesis**, essential question), as appropriate
b. states a t**hesis** (**hypothesis**, essential question) with a narrow focus
c. includes **evidence** in support of a **thesis** (**hypothesis**, essential question) in the form of details, facts, examples, or reasons
d. communicates information and ideas from **primary** and/or **secondary sources** accurately and coherently, as appropriate
e. attributes sources of information as appropriate
f. includes a topic sentence for each body paragraph
g. includes relevant factors and variables that need to be considered
h. includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate
i. includes an effective conclusion

Example: Write a report of a science experiment that was conducted in class, describing both the process and the scientific conclusions.

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Concept 3: Functional
Functional writing provides specific directions or information related to real-world tasks. This includes letters, memos, schedules, directories, signs, manuals, forms, recipes, and technical pieces for specific content areas.

PO 1. Write a business letter that:
- a. presents information purposefully and succinctly to meet the needs of the intended audience
- b. follows a conventional business letter format (block, modified block, email)

Example: Write a letter of complaint expressing a consumer problem you've experienced.

PO 2. Address an envelope for correspondence that includes:
- a. *an appropriate return address*
- b. *an appropriate recipient address*

Concept 4: Persuasive
Persuasive writing is used for the purpose of influencing the reader. The author presents an issue and expresses an opinion in order to convince an audience to agree with the opinion or to take a particular action.

PO 1. Write a persuasive composition (e.g., business letter, essay) that:
- a. states a position or claim
- b. presents detailed **evidence**, examples, and reasoning to support effective arguments and emotional appeals
- c. attributes sources of information when appropriate
- d. structures ideas
- e. addresses the reader's concerns

Example: Write a letter to the principal to persuade him/her to support your views on some educational policy (e.g., open campus, cheating, year-round school, scheduling)

(See R09-S3C3)

Concept 5: Literary Response
Literary response is the writer's reaction to a literary selection. The response includes the writer's interpretation, analysis, opinion, and/or feelings about the piece of literature and selected elements within it.

PO 1. Write a literary analysis that:
- a. describes the author's use of **literary elements** (i.e., **theme**, **point of view**, **characterization**, **setting**, **plot**)
- b. explains different elements of **figurative language**, (i.e., **simile**, **metaphor**, **personification**, **hyperbole**, **symbolism**, **allusion**, **and imagery**) in a literary selection
- c. compares works within a literary **genre** that deal with similar **themes** (e.g., compare two short stories or two poems)

Example: Write an essay about different characters in "The Necklace" by Guy de Maupassant explaining how each serves to move forward the plot.

(See R09-S2C1)

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Concept 6: Research
Research writing is a process in which the writer identifies a topic or question to be answered. The writer locates and evaluates information about the topic or question, and then organizes, summarizes, and synthesizes the information into a finished product.

PO 1. Write an essay that:

a. incorporates **evidence** in support of a **thesis**/claim
b. integrates information from two or more pieces of research information
c. integrates direct quotes
d. cites sources

Example: Write an essay about water conservation in the desert.

(See R09-S3C1-03 -04, -05; R10-S3C1-03 -04, -05)

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
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Strand 1: Writing Process

Research has established the major steps of the writing process. These steps are identified in the five concepts of this strand, each supported with specific performance objectives. While all steps are needed and used by effective writers as they compose text, different skills may be emphasized in individual assignments. These steps may be used recursively as a piece moves toward completion. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress.

Concept 1: Prewriting Prewriting includes using strategies to generate, plan, and organize ideas for specific purposes.
PO 1. Generate ideas through a variety of activities (e.g., brainstorming, notes and logs, ***graphic organizers****, record of writing ideas and discussion, printed material or other sources).*
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PO 3. Determine the intended audience of a writing piece.
PO 4. Establish a ***controlling idea*** *appropriate to the type of writing.*
PO 5. Use organizational strategies (e.g., outline, chart, table, graph, ***Venn Diagram, web, story map, plot pyramid****) to plan writing.*
PO 6. Maintain a record (e.g., lists, journal, folder, notebook) of writing ideas.
PO 7. Use ***time management strategies****, when appropriate, to produce a writing product within a set time period.*

Concept 2: Drafting Drafting incorporates prewriting activities to create a first draft containing necessary elements for a specific purpose.
PO 1. Use a ***prewriting plan*** *to develop the main idea(s) with supporting details.*
PO 2. Sequence ideas into a cohesive, meaningful order.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
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Concept 3: Revising Revising includes evaluating and refining the rough draft for clarity and effectiveness. (Ask: Does this draft say what you want it to say?)
PO 1. Evaluate the draft for use of ideas and content, organization, voice, word choice, and sentence fluency. (See Strand 2)
PO 2. Add details to the draft to more effectively accomplish the purpose.
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*PO 6. Use a variety of sentence structures (i.e., **simple**, **compound**, **complex)** to improve sentence fluency in the draft.*
*PO 7. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to refine the draft.*
PO 8. Use resources and reference materials (e.g., thesaurus, dictionary) to select more effective and precise language.

Concept 4: Editing Editing includes proofreading and correcting the draft for conventions.
PO 1. *Identify punctuation, spelling, and grammar and usage errors in the draft.* (See Strand 2)
PO 2. Use resources (e.g., dictionary, word lists, spelling/grammar checkers) to correct conventions.
*PO 3. Apply **proofreading marks** to indicate errors in conventions.*
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Concept 5: Publishing Publishing involves formatting and presenting a final product for the intended audience.
PO 1. Prepare writing that follows a format appropriate for the purpose (e.g., for display, sharing with others, submitting to a publication).
PO 2. Include such techniques as principles of design (e.g., margins, tabs, spacing, columns) and graphics (e.g., drawings, charts, graphs), when applicable, to enhance the final product.
PO 3. Write legibly.

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
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Strand 2: Writing Components

This strand focuses on the elements of effective writing. Good writing instruction incorporates multiple performance objectives into an integrated experience of learning for the student. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress. The order of the concepts and performance objectives is not intended to indicate a progression or hierarchy for writing instruction. Instructional activities may focus on just one concept or many.

Concept 1: Ideas and Content Writing is clear and focused, holding the reader's attention throughout. Main ideas stand out and are developed by strong support and rich details. Purpose is accomplished.
PO 1. Maintain a clear, narrow focus to support the topic.
PO 2. Write with an identifiable purpose and for a specific audience.
PO 3. Provide sufficient, relevant, and carefully selected details for support.
PO 4. Demonstrate a thorough, balanced explanation of the topic.
PO 5. Include ideas and details that show original perspective and insights.

Concept 2: Organization Organization addresses the structure of the writing and integrates the central meaning and patterns that hold the piece together.
*PO 1. Use a structure that fits the type of writing (e.g., letter format, **narrative**, play, essay).*
PO 2. Include a strong beginning or introduction that draws in the reader.
PO 3. Place details appropriately to support the main idea.
PO 4. Use effective transitions among all elements (sentences, paragraphs, and ideas).
PO 5. Employ a variety of paragraphing strategies (e.g., topical, chronological, spatial) appropriate to application and purpose.
*PO 6. Create an ending that provides a sense of **resolution** or closure.*

Concept 3: Voice Voice will vary according to the type of piece, but should be appropriately formal or casual, distant or personal, depending on the audience and purpose.
PO 1. Show awareness of the audience through word choice, style, and an appropriate connection with, or distance from, the audience.
PO 2. Convey a sense of identity through originality, sincerity, liveliness, or humor appropriate to topic and type of writing.
*PO 3. Choose appropriate voice (e.g., formal, informal, **academic discourse)** for the application.*
PO 4. Use engaging and expressive language that shows a commitment to the topic.
PO 5. Use language appropriate to purpose, topic, and audience.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
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Concept 4: Word Choice Word choice reflects the writer's use of specific words and phrases to convey the intended message and employs a variety of words that are functional and appropriate to the audience and purpose.
PO 1. Use accurate, specific, powerful words and phrases that effectively convey the intended message.
PO 2. Use vocabulary that is original, varied, and natural.
PO 3. Use words that evoke clear images.
PO 4. Use **literal** and **figurative language** intentionally when appropriate. (See R09-S2C1-02, R10-S2C1-02, R11-S2C1-02, R12-S2C1-02)
PO 5. Use **clichés** only when appropriate to purpose.

Concept 5: Sentence Fluency Fluency addresses the rhythm and flow of language. Sentences are strong and varied in structure and length.
PO 1. Use a variety of sentence structures (**simple**, **compound**, **complex**, **and compound-complex**) and lengths to reinforce relationships among ideas and to enhance the flow of the writing.
PO 2. Show extensive variation in sentence beginnings, lengths, and patterns to enhance the flow of the writing.
PO 3. Demonstrate a flow that is natural and powerful when read aloud.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

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Concept 6: Conventions
Conventions addresses the mechanics of writing, including capitalization, punctuation, spelling, grammar and usage, and paragraph breaks.

PO 1. Use capitals correctly for:

a. ***proper nouns:***
- *holidays*
- *place/regional names*
- *languages*
- *historical events*
- *organizations*
- *academic courses (e.g., algebra/Algebra I)*
- *product names*

b. words used as names (e.g., Grandpa, Aunt Lyn)
c. literary titles (book, story, poem, play, song)
d. titles
e. abbreviations
f. ***proper adjectives*** *(e.g., German shepherd, Chinese restaurant)*

PO 2. Use commas to correctly punctuate:

a. items in a series
b. greetings and closings of letters
c. introductory words, phrases and clauses
d. direct address
e. interrupters
f. compound sentences
g. appositives
h. dialogue

PO 3. Use quotation marks to punctuate:

a. dialogue
b. titles
c. exact words from sources

PO 4. Use underlining or italics to correctly identify titles and vessels (e.g., ships, spacecrafts, planes, trains).

PO 5. Use colons to punctuate business letter salutations and sentences introducing lists.

PO 6. Use semicolons to punctuate **compound** and **compound-complex sentences** when appropriate.

PO 7. Use apostrophes to punctuate:

a. contractions
b. singular possessives
c. plural possessives

PO 8. Use hyphens, dashes, parentheses, ellipses, and brackets correctly.

PO 9. Spell words correctly.

PO 10. Use paragraph breaks to reinforce the organizational structure, including **dialogue**.

PO 11. Demonstrate control of grammar and usage in writing:

a. parts of speech
b. verb forms and tenses
c. subject/verb agreement
d. pronoun/antecedent agreement
e. parallel structure
f. comparative and superlative degrees of adjectives
g. modifier placement
h. homonyms

PO 12. Use appropriate format, according to type of writing, to cite sources (e.g., Chicago, APA, MLA, UPI, any other recognized **style manual**).

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Strand 3: Writing Applications

Writing skills particular to the applications listed here may be taught across the curriculum, although some applications may lend themselves more readily to specific content areas. It is imperative that students write in all content areas in order to increase their communication skills, and ultimately to improve their understanding of content area concepts. When appropriate, other content standards are referenced to show interdisciplinary connections.

Concept 1: Expressive

Expressive writing includes **personal narratives**, stories, poetry, songs, and dramatic pieces. Writing may be based on real or imagined events.

PO 1. Write a **reflective personal narrative** that:

a. describes a sequence of events, communicating the significance of the events to the audience
b. sets scenes and incidents in specific times and places
c. describes with specific details the sights, sounds, and smells of the scenes
d. describes with specific details the actions, movements, gestures, and feelings of the characters
e. uses **interior monologue**
f. uses **figurative language** (e.g., **simile**, **metaphor**, **personification**)

Example: Select a quotation that is particularly meaningful. Explain the significance of the quotation.

Concept 2: Expository

Expository writing includes non-fiction writing that describes, explains, or summarizes ideas and content. The writing supports a **thesis** based on research, observation, and/or experience.

PO 1. Write an explanatory, multi-paragraph essay that:

a. *includes background information to establish the **thesis** (**hypothesis**, essential question), as appropriate*
b. *states a t**hesis** (**hypothesis**, essential question) with a narrow focus*
c. *includes **evidence** in support of a **thesis** (**hypothesis**, essential question) in the form of details, facts, examples, or reasons*
d. *communicates information and ideas from **primary** and/or **secondary sources** accurately and coherently, as appropriate*
e. *attributes sources of information, as appropriate*
f. *includes a topic sentence for each body paragraph*
g. *includes relevant factors and variables that need to be considered*
h. *includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate*
i. *includes an effective conclusion*

Example: Discuss three reasons why the bombing of Hiroshima was a controversial act.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Concept 3: Functional
Functional writing provides specific directions or information related to real-world tasks. This includes letters, memos, schedules, directories, signs, manuals, forms, recipes, and technical pieces for specific content areas.

PO 1. Write a business letter and/or memo that:
- a. presents information purposefully and succinctly to meet the needs of the intended audience
- b. follows a conventional format (block, modified block, memo, email)

Example: Write a letter requesting an informational interview with a person in a career area that interests you.

PO 2. Address an envelope for correspondence that includes:
- a. *an appropriate return address*
- b. *an appropriate recipient address*

Concept 4: Persuasive
Persuasive writing is used for the purpose of influencing the reader. The author presents an issue and expresses an opinion in order to convince an audience to agree with the opinion or to take a particular action.

PO 1. Write a persuasive composition (e.g., business letter, essay, letter to the editor) that:
- a. *states a position or claim*
- b. *presents detailed **evidence**, examples, and reasoning to support effective arguments and emotional appeals*
- c. *attributes sources of information when appropriate*
- d. *structures ideas*
- e. *addresses the reader's concerns*

Example: Write a letter to a television network to persuade the network to keep a program on the air despite low ratings.

(See R10-S3C3)

Concept 5: Literary Response
Literary response is the writer's reaction to a literary selection. The response includes the writer's interpretation, analysis, opinion, and/or feelings about the piece of literature and selected elements within it.

PO 1. Write a literary analysis that:
- a. analyzes the author's use of **literary elements** (i.e., **theme**, **point of view**, **characterization**, **setting**, **plot**)
- b. analyzes different elements of **figurative language** (i.e., **simile**, **metaphor**, **personification**, **hyperbole**, **symbolism**, **allusion**, **and imagery**) in a literary selection
- c. compares the illustration of the same **theme** in two different literary **genres**, using their structural features as the basis for the comparison (e.g., novel and play, poem and short story)
- d. identifies how an author's choice of words and i**magery** sets the **tone** and advances the work's **theme**

Example: Write an essay explaining Gwendolyn Brook's use of word choice in "We Real Cool" to communicate its theme.

(See R10-S2C1)

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 10

Concept 6: Research
Research writing is a process in which the writer identifies a topic or question to be answered. The writer locates and evaluates information about the topic or question, and then organizes, summarizes, and synthesizes the information into a finished product.

PO 1. Write a research report that:

a. incorporates **evidence** in support of a **thesis** or claim
b. integrates information from two or more pieces of primary and/or secondary research information
c. makes distinctions between the relative value and significance of specific data, facts, and ideas
d. integrates direct quotes
e. uses **internal citations**
f. includes a works cited, bibliography, or reference page

Example: Write a report on the Globe Theatre explaining its significance in the development of Shakespeare's works.

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Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Strand 1: Writing Process

Research has established the major steps of the writing process. These steps are identified in the five concepts of this strand, each supported with specific performance objectives. While all steps are needed and used by effective writers as they compose text, different skills may be emphasized in individual assignments. These steps may be used recursively as a piece moves toward completion. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress.

Concept 1: Prewriting Prewriting includes using strategies to generate, plan, and organize ideas for specific purposes.
PO 1. Generate ideas through a variety of activities (e.g., brainstorming, notes and logs, ***graphic organizers****, record of writing ideas and discussion, printed material or other sources).*
PO 2. Determine the purpose (e.g., to entertain, to inform, to communicate, to persuade, to explain) of an intended writing piece.
PO 3. Determine the intended audience of a writing piece.
PO 4. Establish a ***controlling idea*** *appropriate to the type of writing.*
PO 5. Use organizational strategies (e.g., outline, chart, table, graph, ***Venn Diagram, web, story map, plot pyramid****) to plan writing.*
PO 6. Maintain a record (e.g., lists, journals, folders, notebooks) of writing ideas.
PO 7. Use ***time management strategies****, when appropriate, to produce a writing product within a set time period.*

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 2: Drafting Drafting incorporates prewriting activities to create a first draft containing necessary elements for a specific purpose.
*PO 1. Use a **prewriting plan** to develop the **main idea**(s) with supporting details.*
PO 2. Sequence ideas into a cohesive, meaningful order.

Concept 3: Revising Revising includes evaluating and refining the rough draft for clarity and effectiveness. (Ask: Does this draft say what you want it to say?)
PO 1. Evaluate the draft for use of ideas and content, organization, voice, word choice, and sentence fluency. (See Strand 2)
PO 2. Add details to the draft to more effectively accomplish the purpose.
PO 3. Delete irrelevant and/or redundant information from the draft to more effectively accomplish the purpose.
PO 4. Rearrange words, sentences, and paragraphs in the draft in order to clarify the meaning or to enhance the writing style.
*PO 5. Add **transitional words** and phrases to the draft in order to clarify meaning or enhance the writing style.*
*PO 6. Use a variety of sentence structures (i.e., **simple**, **compound, complex)** to improve sentence fluency in the draft.*
*PO 7. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to refine the draft.*
PO 8. Use resources and reference materials (e.g., thesaurus, dictionary) to select more effective and precise language.

Concept 4: Editing Editing includes proofreading and correcting the draft for conventions.
PO 1. Identify punctuation, spelling, and grammar and usage errors in the draft. (See Strand 2)
PO 2. Use resources (e.g., dictionary, word lists, spelling/grammar checkers) to correct conventions.
*PO 3. Apply **proofreading marks** to indicate errors in conventions.*
*PO 4. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to edit the draft.*

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 5: Publishing Publishing involves formatting and presenting a final product for the intended audience.
PO 1. Prepare writing that follows a format appropriate for the purpose (e.g., for display, sharing with others, submitting to a publication).
PO 2. Include such techniques as principles of design (e.g., margins, tabs, spacing, columns) and graphics (e.g., drawings, charts, graphs), when applicable, to enhance the final product.
PO 3. Write legibly.

Strand 2: Writing Components

This strand focuses on the elements of effective writing. Good writing instruction incorporates multiple performance objectives into an integrated experience of learning for the student. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress. The order of the concepts and performance objectives is not intended to indicate a progression or hierarchy for writing instruction. Instructional activities may focus on just one concept or many.

Concept 1: Ideas and Content Writing is clear and focused, holding the reader's attention throughout. Main ideas stand out and are developed by strong support and rich details. Purpose is accomplished.
PO 1. Maintain a clear, narrow focus to support the topic.
PO 2. Write with an identifiable purpose and for a specific audience.
PO 3. Provide sufficient, relevant, and carefully selected details for support.
PO 4. Demonstrate a thorough, balanced explanation of the topic.
PO 5. Include ideas and details that show original perspective and insights.

Concept 2: Organization Organization addresses the structure of the writing and integrates the central meaning and patterns that hold the piece together.
*PO 1. Use a structure that fits the type of writing (e.g., letter format, **narrative**, play, essay).*
PO 2. Include a strong beginning or introduction that draws in the reader.
*PO 3. Place details appropriately to support the **main idea**.*
PO 4. Use effective transitions among all elements (sentences, paragraphs, and ideas).
PO 5. Employ a variety of paragraphing strategies (e.g., topical, chronological, spatial) appropriate to application and purpose.
*PO 6. Create an ending that provides a sense of **resolution** or closure*

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 3: Voice *Voice will vary according to the type of writing, but should be appropriately formal or casual, distant or personal, depending on the audience and purpose.*
PO 1. Show awareness of the audience through word choice, style, and an appropriate connection with, or distance from, the audience.
PO 2. Convey a sense of identity through originality, sincerity, liveliness, or humor appropriate to topic and type of writing.
*PO 3. Choose appropriate voice (e.g., formal, informal, **academic discourse)** for the application.*
PO 4. Use engaging and expressive language that shows a commitment to the topic.
PO 5. Use language appropriate to purpose, topic, and audience.

Concept 4: Word Choice Word choice reflects the writer's use of specific words and phrases to convey the intended message and employs a variety of words that are functional and appropriate to the audience and purpose.
PO 1. Use accurate, specific, powerful words and phrases that effectively convey the intended message.
PO 2. Use vocabulary that is original, varied, and natural.
PO 3. Use words that evoke clear images.
PO 4. Use **literal** and **figurative language** intentionally when appropriate. (See R09-S2C1-02, R10-S2C1-02, R11-S2C1-02, R12-S2C1-02)
PO 5. Use **clichés** only when appropriate to purpose.

Concept 5: Sentence Fluency Fluency addresses the rhythm and flow of language. Sentences are strong and varied in structure and length.
PO 1. Use a variety of sentence structures (**simple, compound, complex,** and **compound-complex**) and lengths to reinforce relationships among ideas and to enhance the flow of the writing.
PO 2. Show extensive variation in sentence beginnings, lengths, and patterns to enhance the flow of the writing.
PO 3. Demonstrate a flow that is natural and powerful when read aloud.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 6: Conventions
Conventions addresses the mechanics of writing, including capitalization, punctuation, spelling, grammar and usage, and paragraph breaks.

PO 1. Use capitals correctly for:

a. proper nouns:
- *holidays*
- *place/regional names*
- *languages*
- *historical events*
- *organizations*
- *academic courses (e.g., algebra/Algebra I)*
- *product names*

b. words used as names (e.g., Grandpa, Aunt Lyn)
c. literary titles (book, story, poem, play, song)
d. titles
e. abbreviations
f. ***proper adjectives*** *(e.g., German shepherd, Chinese restaurant)*

PO 2. Use commas to correctly punctuate:
a. items in a series
b. greetings and closings of letters
c. introductory words, phrases and clauses
d. ***direct address***
e. interrupters
f. compound sentences
g. appositives
h. dialogue

PO 3. Use quotation marks to punctuate:
a. ***dialogue***
b. titles
c. exact words from sources

PO 4. Use underlining or italics to correctly identify titles and vessels (e.g., ships, spacecrafts, planes, trains).

PO 5. Use colons to punctuate business letter salutations and sentences introducing lists.

PO 6. Use semicolons to punctuate **compound** and **compound-complex sentences** when appropriate.

PO 7. Use apostrophes to punctuate:
a. contractions
b. singular possessives
c. plural possessives

PO 8. Use hyphens, dashes, parentheses, ellipses, and brackets correctly.

PO 9. Spell words correctly.

PO 10. Use paragraph breaks to reinforce the organizational structure, including dialogue.

PO 11. Demonstrate control of grammar and usage in writing:
a. parts of speech
b. verb forms and tenses
c. subject/verb agreement
d. pronoun/antecedent agreement
e. parallel structure
f. comparative and superlative degrees of adjectives
g. modifier placement
h. **homonyms**

PO 12. Use appropriate format, according to type of writing, to cite sources (e.g., Chicago, APA, MLA, UPI, any other recognized **style manual**).

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Strand 3: Writing Applications

Writing skills particular to the applications listed here may be taught across the curriculum, although some applications may lend themselves more readily to specific content areas. It is imperative that students write in all content areas in order to increase their communication skills, and ultimately to improve their understanding of content area concepts. When appropriate, other content standards are referenced to show interdisciplinary connections.

Concept 1: Expressive
Expressive writing includes **personal narratives**, stories, poetry, songs, and dramatic pieces. Writing may be based on real or imagined events.

PO 1. Write in a variety of expressive forms (e.g. poetry, short story, and/or drama) that:

a. use voice and style appropriate to audience and purpose
b. organize ideas in writing to ensure coherence, logical progression, and support
c. employ literary devices (e.g., **irony**, **conceit**, **foreshadowing**, **symbolism**) to enhance style and voice

Example: Write a contemporary version of "The Raven" by Edgar Allan Poe.

Concept 2: Expository
Expository writing includes non-fiction writing that describes, explains, or summarizes ideas and content. The writing supports a **thesis** based on research, observation, and/or experience.

PO 1. Write a multi-paragraph essay (e.g., compare/contrast, cause/effect, process) that:

a. *includes background information to establish the **thesis** (**hypothesis**, essential question), as appropriate*
b. *states a t**hesis** (**hypothesis**, essential question) with a narrow focus*
c. *includes evidence in support of a **thesis** (**hypothesis**, essential question) in the form of details, facts, examples, or reasons*
d. *communicates information and ideas from **primary** and/or **secondary sources** accurately and coherently, as appropriate*
e. *attributes sources of information, as appropriate*
f. *includes a topic sentence for each body paragraph*
g. *includes relevant factors and variables that need to be considered*
h. *includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate*
i. *includes an effective conclusion*

Example: Compose an essay on Alexis de Tocqueville's 1830s observations on American political and social life. Examine other historical documents to determine how accurate the de Tocqueville's analysis was, and how his views of society reflect the United States today.

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 3: Functional

Functional writing provides specific directions or information related to real-world tasks. This includes letters, memos, schedules, directories, signs, manuals, forms, recipes, and technical pieces for specific content areas.

PO 1. Write a work-related document (e.g., application, minutes, memo, cover letter, letter of application, speaker introduction, letter of recommendation, technical manual) that:

a. presents information purposefully and succinctly to meet the needs of the intended audience
b. follows a conventional format

Example: Complete a job application form for a part-time job and attach a memorandum outlining the particular skills you have that fit the job description.
(See R11-S3C2)

Concept 4: Persuasive

Persuasive writing is used for the purpose of influencing the reader. The author presents an issue and expresses an opinion in order to convince an audience to agree with the opinion or to take a particular action.

PO 1. Write a persuasive composition (e.g. speech, editorial, letter to the editor, public service announcement) that:

a. states a position or claim
b. presents detailed **evidence**, examples, and reasoning to support effective arguments and emotional appeals
c. attributes sources of information when appropriate
d. structures ideas
e. acknowledges and refutes opposing arguments

Example: Write a letter to the editor about a community issue (e.g., teen curfew laws, racial profiling, affirmative action). (See R11-S3C3)

Concept 5: Literary Response

Literary response is the writer's reaction to a literary selection. The response includes the writer's interpretation, analysis, opinion, and/or feelings about the piece of literature.

PO 1. Write a literary analysis that:

a. evaluates the author's use of **literary elements** (i.e., **theme**, **point of view**, **characterization**, **setting**, **plot**)
b. interprets different elements of **figurative language** (i.e., **simile**, **metaphor**, **personification**, **hyperbole**, **symbolism**, **allusion**, **and imagery**, **extended metaphor/conceit)** with emphasis on how the author's use of language evokes readers' emotions
c. analyzes the way in which the **theme**, or meaning of a selection, represents a view or comment on life, providing textual evidence for the identified theme
d. explains the writer's use of **irony**, **contradictions, paradoxes**, **incongruities**, **and ambiguities** in a literary selection
e. analyzes an author's development of time and sequence through the use of complex **literary devices** such as **foreshadowing** and **flashbacks**
f. explains how meaning is enhanced through various features of poetry, including sound (e.g., **rhythm**, **repetition, alliteration, consonance**, **assonance**), structure (e.g., **meter, rhyme scheme**), and graphic elements (e.g., line length, punctuation, word position)

Example: Write an essay about F. Scott Fitzgerald's use of symbolism in *The Great Gatsby*.

(See R11-S2C1)

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 11

Concept 6: Research

Research writing is a process in which the writer identifies a topic or question to be answered. The writer locates and evaluates information about the topic or question, and then organizes, summarizes, and synthesizes the information into a finished product.

PO 1. Write a research product that:

a. incorporates **evidence** in support of a **thesis** or claim
b. integrates information and ideas from multiple **primary** and **secondary sources**
c. makes distinctions between the relative value and significance of specific data, facts, and ideas
d. includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate
e. integrates direct quotes
f. uses **internal citations**
g. includes a works cited, bibliography, or reference page

Example: Choose a post-secondary institution and research its relevance to your future goals.

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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Strand 1: Writing Process

Research has established the major steps of the writing process. These steps are identified in the five concepts of this strand, each supported with specific performance objectives. While all steps are needed and used by effective writers as they compose text, different skills may be emphasized in individual assignments. These steps may be used recursively as a piece moves toward completion. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress.

Concept 1: Prewriting Prewriting includes using strategies to generate, plan, and organize ideas for specific purposes.
PO 1. *Generate ideas through a variety of activities (e.g., brainstorming, notes and logs, **graphic organizers**, record of writing ideas and discussion, printed material or other sources).*
PO 2. Determine the purpose (e.g., to entertain, to inform, to communicate, to persuade, to explain) of an intended writing piece.
PO 3. Determine the intended audience of a writing piece.
*PO 4. Establish a **controlling idea** appropriate to the type of writing.*
*PO 5. Use organizational strategies (e.g., outline, chart, table, graph, **Venn Diagram, web, story map, plot pyramid**) to plan writing.*
PO 6. Maintain a record (e.g., list, journal, folder, notebook) of writing ideas.
*PO 7. Use **time management strategies**, when appropriate, to produce a writing product within a set time period.*

Concept 2: Drafting Drafting incorporates prewriting activities to create a first draft containing necessary elements for a specific purpose.
*PO 1. Use a **prewriting plan** to develop the main idea(s) with supporting details.*
PO 2. Sequence ideas into a cohesive, meaningful order.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 3: Revising Revising includes evaluating and refining the rough draft for clarity and effectiveness. (Ask: Does this draft say what you want it to say?)
PO 1. Evaluate the draft for use of ideas and content, organization, voice, word choice, and sentence fluency. (See Strand 2)
PO 2. Add details to the draft to more effectively accomplish the purpose.
PO 3. Delete irrelevant and/or redundant information from the draft to more effectively accomplish the purpose.
PO 4. Rearrange words, sentences, and paragraphs in the draft in order to clarify the meaning or to enhance the writing style.
*PO 5. Add **transitional words** and phrases to the draft in order to clarify meaning or enhance the writing style.*
*PO 6. Use a variety of sentence structures (i.e., **simple**, **compound**, **complex)** to improve sentence fluency in the draft.*
*PO 7. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to refine the draft.*
PO 8. Use resources and reference materials (e.g., thesaurus, dictionary) to select more effective and precise language.

Concept 4: Editing Editing includes proofreading and correcting the draft for conventions.
PO 1. Identify punctuation, spelling, and grammar and usage errors in the draft. (See Strand 2)
PO 2. Use resources (e.g., dictionary, word lists, spelling/grammar checkers) to correct conventions.
*PO 3. Apply **proofreading marks** to indicate errors in conventions.*
*PO 4. Apply appropriate tools or strategies (e.g., **peer review**, checklists, **rubrics**) to edit the draft.*

Concept 5: Publishing Publishing involves formatting and presenting a final product for the intended audience.
PO 1. Prepare writing that follows a format appropriate for the purpose (e.g., for display, sharing with others, submitting to a publication).
PO 2. Include such techniques as principles of design (e.g., margins, tabs, spacing, columns) and graphics (e.g., drawings, charts, graphs), when applicable, to enhance the final product.
PO 3. Write legibly.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Strand 2: Writing Elements

This strand focuses on the elements of effective writing. Good writing instruction incorporates multiple performance objectives into an integrated experience of learning for the student. Throughout the process, students should reflect on their own writing skills, set goals, and evaluate their own progress. The order of the concepts and performance objectives is not intended to indicate a progression or hierarchy for writing instruction. Instructional activities may focus on just one concept or many.

Concept 1: Ideas and Content Writing is clear and focused, holding the reader's attention throughout. Main ideas stand out and are developed by strong support and rich details. Purpose is accomplished.
PO 1. Maintain a clear, narrow focus to support the topic.
PO 2. Write with an identifiable purpose and for a specific audience.
PO 3. Provide sufficient, relevant, and carefully selected details for support.
PO 4. Demonstrate a thorough, balanced explanation of the topic.
PO 5. Include ideas and details that show original perspective and insights.

Concept 2: Organization Organization addresses the structure of the writing and integrates the central meaning and patterns that hold the piece together.
*PO 1. Use a structure that fits the type of writing (e.g., letter format, **narrative**, play, essay).*
PO 2. Include a strong beginning or introduction that draws in the reader.
*PO 3. Place details appropriately to support the **main** idea.*
PO 4. Use effective transitions among all elements (sentences, paragraphs, and ideas).
PO 5. Employ a variety of paragraphing strategies (e.g., topical, chronological, spatial) appropriate to application and purpose.
*PO 6. Create an ending that provides a sense of **resolution** or closure.*

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 3: Voice Voice will vary according to the type of piece, but should be appropriately formal or casual, distant or personal, depending on the audience and purpose.
PO 1. Show awareness of the audience through word choice, style, and an appropriate connection with, or distance from, the audience.
PO 2. Convey a sense of identity through originality, sincerity, liveliness, or humor appropriate to topic and type of writing.
*PO 3. Choose appropriate voice (e.g., formal, informal, **academic discourse)** for the application.*
PO 4. Use engaging and expressive language that shows a commitment to the topic.
PO 5. Use language appropriate to purpose, topic, and audience.

Concept 4: Word Choice Word choice reflects the writer's use of specific words and phrases to convey the intended message and employs a variety of words that are functional and appropriate to the audience and purpose.
PO 1. Use accurate, specific, powerful words and phrases that effectively convey the intended message.
PO 2. Use vocabulary that is original, varied, and natural.
PO 3. Use words that evoke clear images.
PO 4. Use **literal** and **figurative language** intentionally when appropriate. (See R09-S2C1-02, R10-S2C1-02, R11-S2C1-02, R12-S2C1-02)
PO 5. Use **clichés** only when appropriate to purpose.

Concept 5: Sentence Fluency Fluency addresses the rhythm and flow of language. Sentences are strong and varied in structure and length.
PO 1. Use a variety of sentence structures (**simple**, **compound**, **complex**, **and compound-complex**) and lengths to reinforce relationships among ideas and to enhance the flow of the writing.
PO 2. Show extensive variation in sentence beginnings, lengths, and patterns to enhance the flow of the writing.
PO 3. Demonstrate a flow that is natural and powerful when read aloud.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 6: Conventions
Conventions addresses the mechanics of writing, including capitalization, punctuation, spelling, grammar and usage, and paragraph breaks.

PO 1. Use capitals correctly for:

a. proper nouns:
- *holidays*
- *place/regional names*
- *languages*
- *historical events*
- *organizations*
- *academic courses (e.g., algebra/Algebra I)*
- *product names*

b. words used as names (e.g., Grandpa, Aunt Lyn)
c. literary titles (book, story, poem, play, song)
d. titles
e. abbreviations
f. ***proper adjectives*** *(e.g., German shepherd, Chinese restaurant)*

PO 2. Use commas to correctly punctuate:

a. items in a series
b. greetings and closings of letters
c. introductory words, phrases and clauses
d. ***direct address***
e. interrupters
f. compound sentences
g. appositives
h. dialogue

PO 3. Use quotation marks to punctuate:

a. ***dialogue***
b. titles
c. exact words from sources

PO 4. Use underlining or italics to correctly identify titles and vessels (e.g., ships, spacecrafts, planes, trains).

PO 5. Use colons to punctuate business letter salutations and sentences introducing lists.

PO 6. Use semicolons to punctuate **compound** and **compound-complex sentences** when appropriate.

PO 7. Use apostrophes to punctuate:

a. contractions
b. singular possessives
c. plural possessives

PO 8. Use hyphens, dashes, parentheses, ellipses, and brackets correctly.

PO 9. Spell words correctly.

PO 10. Use paragraph breaks to reinforce the organizational structure, including dialogue.

PO 11. Demonstrate control of grammar and usage in writing:

a. parts of speech
b. verb forms and tenses
c. subject/verb agreement
d. pronoun/antecedent agreement
e. parallel structure
f. comparative and superlative degrees of adjectives
g. modifier placement
h. **homonyms**

PO 12. Use appropriate format, according to type of writing, to cite sources (e.g., Chicago, APA, MLA, UPI, any other recognized **style manual**).

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Strand 3: Writing Applications

Writing skills particular to the applications listed here may be taught across the curriculum, although some applications may lend themselves more readily to specific content areas. It is imperative that students write in all content areas in order to increase their communication skills, and ultimately to improve their understanding of content area concepts. When appropriate, other content standards are referenced to show interdisciplinary connections.

Concept 1: Expressive

Expressive writing includes **personal narratives**, stories, poetry, songs, and dramatic pieces. Writing may be based on real or imagined events.

*PO 1. Write in a variety of expressive forms (e.g., poetry, fiction, autobiography, **narrative**, and/or drama) that:*

a. *use voice and style appropriate to audience and purpose*
b. *organize ideas in writing to ensure coherence, logical progression, and support*
c. *employ literary devices (e.g., **irony**, **conceit**, **flashback, foreshadowing**, **symbolism**, **allusion**) to enhance style and voice*

Example: After reading from Geoffrey Chaucer's *The Canterbury Tales*, write your own version of a traveler's tale.

Concept 2: Expository

Expository writing includes non-fiction writing that describes, explains, or summarizes ideas and content. The writing supports a **thesis** based on research, observation, and/or experience.

PO 1. Write a multi-paragraph essay (e.g., analysis, deduction/induction, problem/solution, extended definition) that:

a. *includes background information to set up the **thesis** (**hypothesis**, essential question), as appropriate*
b. *states a **thesis** (**hypothesis**, essential question) with a narrow focus*
c. *includes evidence in support of a **thesis** (**hypothesis**, essential question) in the form of details, facts, examples, or reasons*
d. *communicates information and ideas from **primary** and/or **secondary sources** accurately and coherently, as appropriate*
e. *attributes sources of information as appropriate*
f. *includes a topic sentence for each body paragraph*
g. *includes relevant factors and variables that need to be considered*
h. *includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate*
i. *includes an effective conclusion*

Example: Compose an essay explaining how your school's service learning program has identified and addressed a community problem.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 3: Functional

Functional writing provides specific directions or information related to real-world tasks. This includes letters, memos, schedules, directories, signs, manuals, forms, recipes, and technical pieces for specific content areas.

PO 1. Write a work-related document (e.g., resume, application essay) that:

a. *presents information purposefully and succinctly to meet the needs of the intended audience*
b. *follows a conventional format*

Example: Write a resume outlining job experience, extra-curricular activities and other skills, formatted for the intended audience.
(See R12-S3C2)

Concept 4: Persuasive

Persuasive writing is used for the purpose of influencing the reader. The author presents an issue and expresses an opinion in order to convince an audience to agree with the opinion or to take a particular action.

PO 1. Write a persuasive composition (e.g. speech, editorial, letter to the editor, public service announcement) that:

a. *states a position or claim*
b. *presents detailed **evidence**, examples, and reasoning to support effective arguments and emotional appeals*
c. *attributes sources of information when appropriate*
d. *structures ideas*
e. acknowledges and refutes opposing arguments

Example: Write a public service announcement persuading citizens to vote.
(See R12-S3C3)

Concept 5: Literary Response

Literary response is the writer's reaction to a literary selection. The response includes the writer's interpretation, analysis, opinion, and/or feelings about the piece of literature.

PO 1. Write literary analyses that:

a. *evaluates the author's use of **literary elements** (i.e., **theme, point of view, characterization**, **setting**, **plot**)*
b. *interprets **figurative language** (i.e., **personification**, **hyperbole**, **symbolism**, **allusion**, **imagery**, **extended metaphor/conceit**, **and allegory**) with emphasis upon how the writer uses language to evoke readers' emotions*
c. *explains how meaning is enhanced through various features of poetry, including sound (e.g., **rhythm**, **repetition**, **alliteration**, **consonance**, **assonance**), structure (e.g., **meter**, **rhyme scheme**), graphic elements (e.g., line length, punctuation, word position)*
d. analyzes a writer's word choice and **imagery** as a means to appeal to the reader's senses and to set the tone, providing evidence from the text to support the analysis,
e. describes the function of dialogue, scene design, **soliloquies**, **asides**, and/or **character foils** in dramatic literature
f. compares literary texts that express a universal theme, providing textual evidence (e.g., examples, details, quotations) as support for the identified **theme**
g. analyzes characteristics of subgenres (e.g., **satire**, **parody**, **allegory**) that overlap or cut across the lines of genre classifications such as poetry, novel, drama, short story, essay or editorial

Example: Write an essay comparing and contrasting the realities of war as presented in "Dulce Et Decorum Est " by Wilfred Owen and *All Quiet on the Western Front* by Erich Maria Remarque.

(See R12-S2C1)

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
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Words shown in bold print are referenced in the glossary.

WRITING STANDARD ARTICULATED BY GRADE LEVEL
GRADE 12

Concept 6: Research
Research writing is a process in which the writer identifies a topic or question to be answered. The writer locates and evaluates information about the topic or question, and then organizes, summarizes, and synthesizes the information into a finished product.

PO 1. Write a research product that:

a. *incorporates evidence in support of a* ***thesis*** *or claim*
b. *integrates information and ideas from multiple* ***primary*** *and* ***secondary sources***
c. *makes distinctions between the relative value and significance of specific data, facts, and ideas*
d. *includes visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate*
e. *integrates direct quotes*
f. *uses* ***internal citations***
g. *includes a works cited, bibliography, or reference page*

Example: Write a research report about inventions that were first mentioned in science fiction novels or movies and later became a scientific reality.

Italics denotes a repetition of a performance objective (learned in an earlier grade) that is to be applied to more complex writing.
The bulleted (lettered) items within a performance objective indicate specific content to be taught.
Words shown in bold print are referenced in the glossary.

Language Arts Standards 1996

Standard 3: Listening and Speaking
Standard 4: Viewing and Presenting

Proficiency and Distinction (Grades 9-12)

Language Arts Standards Rationale

A Vision for Arizona's Students

Arizona's students must be able to communicate effectively in their schools and communities. The communication skills of reading, writing, listening, speaking, viewing and presenting form the core of language and literacy. The ultimate purpose of the following language arts standards is to ensure that all students be offered the opportunities, the encouragement and the vision to develop the language skills they need to pursue lifelong goals, including finding personal enrichment and participating as informed members of society. The language art standards presented in this document are organized into four areas:

- Reading
- Writing
- Listening and Speaking
- Viewing and Presenting

Reading, writing, listening and speaking are commonly recognized as language skills. Visual communication skills have long been applied in language arts classrooms through the use of media and visual resources. However, with the increase in the availability and variety of media, students are faced with numerous demands for interpreting and creating visual messages. In this document, viewing (interpreting visual messages) and presenting (creating visual messages) are the two aspects of visual communication. Resources available for teaching visual communication range from charts, graphs and photographs to the most sophisticated electronic media.

The interdependency of reading, writing, listening, speaking, viewing and presenting requires that language arts skills be integrated in two ways:

- Within language art
- Across other content areas

Students use language skills to understand academic subject matter and to enrich their lives. They develop literacy at different rates and in a variety of ways. Consequently, interdependent language arts skills and processes should be taught in a variety of learning situations.

Assessment of language arts skills and processes should be comprehensive, authentic and performance based. Multiple assessment methods should be used to evaluate a student's knowledge base and the application of reading, writing, listening, speaking, viewing and presenting. Assessment tasks should reflect those experiences encountered in the home, community and workplace. Issues concerning assessment of specific populations pose complex questions with no simple solutions. As programs and assessments are developed, these issues must be resolved to enable all students to meet the standards.

In conclusion, the standards in the language arts framework form the core of every student's ability to function effectively in society. Students will need a wide repertoire of communication strategies and skills to succeed as learners, citizens, workers and fulfilled individuals in the 21st century.

LANGUAGE ARTS STANDARD
STRAND 3 – LISTENING AND SPEAKING AND
STRAND 4 – VIEWING AND PRESENTING
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 3: LISTENING AND SPEAKING

Students effectively listen and speak in situations that serve different purposes and involve a variety of audiences.

PROFICIENCY (Grades 9-12)

- **LS-P1. Deliver a polished speech that is organized and well suited to the audience and that uses resource materials to clarify and defend positions**
- **LS-P2. Deliver an impromptu speech that is organized, addresses a particular subject and is tailored to the audience**
- **LS-P3. Deliver oral interpretations of literary or original works**
- **LS-P4. Conduct an interview, taking appropriate notes and summarizing the information learned**
- **LS-P5. Evaluate the effectiveness of informal and formal presentations that use illustrations, statistics, comparisons and analogies**

DISTINCTION (Honors)

- **LS-D1. Use clear and concise language when presenting analytical responses to literature, conveying technical information, and explaining complex concepts and procedures**
- **LS-D2. Deliver creative and dramatic interpretations of literary or original works**
- **LS-D3. Communicate information expressively, informatively and analytically through a variety of media to audiences inside or outside of school**
- **LS-D4. Evaluate and improve personal communication skills**

LANGUAGE ARTS STANDARD
STRAND 3 – LISTENING AND SPEAKING AND
STRAND 4 – VIEWING AND PRESENTING
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 4: VIEWING AND PRESENTING
Students use a variety of visual media and resources to gather, evaluate and synthesize information and to communicate with others.

PROFICIENCY (Grades 9-12)

- **VP-P1. Analyze and evaluate visual media for language, subject matter and visual techniques used to influence attitudes, decision making and cultural perceptions**

- **VP-P2. Plan, organize, develop, produce and evaluate an effective multimedia presentation, using tools such as charts, photographs, maps, tables, posters, transparencies, slides and electronic media**

- **VP-P3. Analyze and evaluate the impact of visual media on the intended audience**

DISTINCTION (Honors)

- **VP-D1. Conduct research to evaluate the impact of language, subject matter and visual techniques used by the media**

- **VP-D2. Expand abilities in developing multimedia presentations**

- **VP-D3. Research ethnical issues related to the laws, rules and regulations for the use of media**

Mathematics Standard

Articulated by Grade Level 2008

High School (Grades 9 and 10)

College Work Readiness (Grades 11 and 12)

Mathematics Standard Articulated by Grade Level

The Arizona Mathematics Standard Articulated by Grade Level describes a connected body of mathematical understandings and competencies that provide a foundation for all students. This standard is coherent, focused on important mathematics, and well articulated across the grades. Concepts and skills that are critical to the understanding of important processes and relationships are emphasized.

The need to understand and use a variety of mathematical strategies in multiple contextual situations has never been greater. Utilization of mathematics continues to increase in all aspects of everyday life, as a part of cultural heritage, in the workplace, and in scientific and technical communities. Today's changing world will offer enhanced opportunities and options for those who thoroughly understand mathematics.

Communication, problem solving, reasoning and proof, connections, and representation are the process standards as described in the *Principles and Standards for School Mathematics* from the National Council of Teachers of Mathematics (NCTM). These process standards are interwoven within each of the content strands of the Arizona Mathematics Standard and are explicitly connected to the teaching of specific performance objectives in the grade level documents. The process standards emphasize ways to acquire and apply the content knowledge.
Mathematics education should enable students to fulfill personal ambitions and career goals in an informational age. In the NCTM *Principles and Standards* document it asks us to "*Imagine a classroom, a school, or a school district where all students have access to high-quality, engaging mathematics instruction. There are ambitious expectations for all, with accommodations for those who need it".*[1] The Arizona Mathematics Standard Articulated by Grade Level is intended to facilitate this vision.

BACKGROUND

The State Board of Education adopted the Mathematics Standard Articulated by Grade Level in 2003 to define what Arizona students need to know and be able to do at each grade level through the end of tenth grade. Developed by a committee comprised of a diverse group of educators, this standard was written in response to the requirements of *No Child Left Behind Act of 2001* (NCLB).

RATIONALE

In 2007 the State Board of Education began the process for increasing the high school graduation requirement in mathematics from two to four years. This requirement was approved in December 2007 effective with the graduating class of 2013. This increase, along with the need to complete a periodic review of the standard, prompted the Arizona Department of Education to initiate the process of refining and rearticulating the Mathematics Standard. This refinement and articulation project began in June 2007 and was completed in June 2008.

1 National Council of Teachers of Mathematics, Principles and Standards for School Mathematics, NCTM Publications, Reston, VA, 2000, p. 3.

METHODOLOGY

Work teams representing populations from around the state were formed. These groupings were comprised of large and small schools, rural and urban schools, and were ethnically diverse. Included were classroom teachers, curriculum directors, mathematics teacher leaders, Career and Technical Education teachers, second-career teachers, and university/community college faculty. The goal was to revise and articulate the Mathematics Standard K-12 to align with the increased state requirement of four years of high school mathematics.

The mathematics revision teams utilized the National Council of Teachers of Mathematics *Principles and Standards* as a reference in the development of the revised Mathematics Standard. Additionally, the findings and recommendations from the National Mathematics

Advisory Panel, the American Diploma Project Benchmarks, the National Assessment of Educational Progress Framework, the Curriculum Focal Points, the Framework for 21st Century Skills, and other states' frameworks were used as guiding documents.

The revision grade level teams created draft documents with performance objectives articulated to the appropriate grade levels. Over a period of months, these teams and smaller sub-committees of teams refined the draft documents based on clarity, cohesiveness, and comprehensiveness. Reasonableness, usefulness, and appropriateness were key guidelines for the articulation process. The measurability of each performance objective was also a consideration.

External reviews by nationally recognized consultants brought a broader perspective to the refinement process. Another important step in the process was the gathering of public comment. In March 2008, drafts of the Revised Mathematics Standard Articulated by Grade Level, along with a survey to gather feedback, were posted on the Arizona Department of Education website. This provided the public with easy access to the documents, and a survey allowed reviewers a means for submitting comments. Also, crosswalks were created from the Draft 2008 Mathematics Standard to the 2003 Mathematics Standard and were posted on the website. The public had the opportunity to submit comments and suggestions, either electronically or in writing, until the survey closing date of March 28, 2008. Additionally, five public hearings were held in March throughout the state offering further opportunities for public feedback.

After all the public comments were collected, organized, and categorized by grade level and topic, the revision teams met to determine what modifications to the standard document would be appropriate. Upon completion of the revision work, crosswalks were created to assist educators with the transition from the 2003 Arizona Mathematics Standard Articulated by Grade Level to the revised 2008 Mathematics Standard.

ORGANIZATION OF THE MATHEMATICS STANDARD

The Mathematics Standard Articulated by Grade Level is divided into five main strands:

- Number and Operations
- Data Analysis, Probability, and Discrete Mathematics
- Patterns, Algebra, and Functions
- Geometry and Measurement
- Structure and Logic.

Each strand is divided into concepts that broadly define the skills and knowledge that students are expected to know and be able to do. Under each concept are performance objectives (POs) that more specifically delineate the ideas to be taught and learned.

The comprehensive document (K-12) is designed so that teachers can read the performance objectives across grade levels to incorporate learning from previous, current, and future grade levels. The standard is separated into two separate documents due to the addition of College Work Readiness (grades 11-12). The first document spans grade levels K through 6, and the second document covers grades 7 through College Work Readiness. Viewing the Mathematics Standard document from left to right helps the teacher to see the mathematics continuum across the grade levels. There is a purposeful clustering of performance objectives in order to emphasize certain key understandings. Every effort was made to eliminate repetitions. The intent was to build on the learning in previous grade levels, connect important ideas, and highlight new content each year. This coherency supports students in developing new understandings and skills. Looking down each individual column enables a teacher to see the performance objectives that students are expected to know and be able to do at any grade level.

This organization does not imply that the teaching and learning of mathematics should be fragmented or compartmentalized. Mathematics is a highly interconnected discipline; important mathematical ideas from all five mathematics strands need to be continuously integrated as needed to make meaning and connections to other concepts and performance objectives. In each grade level document, these connections are highlighted.

The order of the strands, concepts, and performance objectives (POs) in the Mathematics Standard document are not intended to be a checklist for mathematics instruction. Mathematical concepts develop with a spiraling of ideas/skills that are interconnected and dependent on each other, and this is reflected in the standard document. Effective instruction often incorporates several performance objectives into an integrated experience of learning for the student.
The content in College Work Readiness (grades 11-12) is a new addition to the Mathematics Standard. This content is separated into the five main strands. Performance objectives highlighted in italics in the document have been identified as core to an Algebra II course. As districts/schools create additional high school mathematics courses, they may select from the comprehensive set of performance objectives contained within the five strands.

New to the 2008 Mathematics Standard is the development of more comprehensive grade level documents. The format of these documents will support the implementation of the revised standard. After each concept statement, there are summary expectations appropriate for that specific grade level. These statements provide a roadmap for instruction. Teachers will notice that there are now three columns of information. The first column lists the performance objectives with accompanying strand/concept and content area connections. The middle column highlights explicit connections to Strand 5, Concept 2 performance objectives. These performance objectives are grounded in the core processes of logic, reasoning, problem-solving and proof. The third column provides instructional support to teachers in the form of explanation and examples.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Every student should understand and use all concepts and skills from the previous grade levels. The standard is designed so that new learning builds on preceding skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of all mathematical strands.

Strand 1: Number and Operations

Number sense is the understanding of numbers and how they relate to each other and how they are used in specific context or real-world application. It includes an awareness of the different ways in which numbers are used, such as counting, measuring, labeling, and locating. It includes an awareness of the different types of numbers such as, whole numbers, integers, fractions, and decimals and the relationships between them and when each is most useful. Number sense includes an understanding of the size of numbers, so that students should be able to recognize that the volume of their room is closer to 1,000 than 10,000 cubic feet. Students develop a sense of what numbers are, i.e., to use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to estimate to determine the reasonableness of results.

Concept 1: Number Sense

Understand and apply numbers, ways of representing numbers, and the relationships among numbers and different number systems.

In Grades 9 and 10, students apply the skills they have learned about the real number system to subsets of the real number system for problem solving. By extending number systems to solve problems, students lay a foundation for problem solving with complex numbers in the College Work Readiness Standard.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Justify with examples the relation between the number system being used (natural numbers, whole numbers, integers, rational numbers and irrational numbers) and the question of whether or not an equation has a solution in that number system.	MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry.	A justification includes presenting the reason or cause an equation begins with values from one subset of the real number system, but whose solution is from a different subset of the real number system. Continued on next page

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		Example: • In finding the diagonal of a square whose perimeter is 24 a student explains that while the original problem contains natural numbers (6 and 24), the use of the Pythagorean theorem dictates the square root of a natural number (72) is calculated, causing the solution to the equation to be an irrational number ($6\sqrt{2}$).
PO 2. Sort sets of numbers as finite or infinite, and justify the sort.	MHS-S5C2-08. Use inductive reasoning to make conjectures, use deductive reasoning to analyze and prove a valid conjecture, and develop a counterexample to refute an invalid conjecture.	Example: • The set of integers between 1 and 12 is finite whereas the set of rational numbers between 1 and 12 is infinite.
PO 3. Express that the distance between two numbers is the absolute value of their difference.	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Example: • The distance between -2 and 7 is $\lvert -2-7\rvert = \lvert -9\rvert = 9$ or $\lvert 7-(-2)\rvert = \lvert 9\rvert = 9$

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 1: Number and Operations
Concept 2: Numerical Operations

Understand and apply numerical operations and their relationship to one another.

In Grades 9 and 10, students build on their understanding of rational numbers. Students apply that understanding to solve problems through operations with powers and roots of real numbers. Students use their understanding of operations with roots of real numbers and extend that understanding to operations with complex numbers in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Solve word problems involving absolute value, powers, roots, and scientific notation. Connections: MHS-S4C3-06, MHS-S4C3-07, MHS-S4C3-08	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • Determine the difference in altitude between Death Valley (86 m below sea level) and the summit of Mount St. Helens (2,549 m above sea level).

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Summarize the properties of and connections between real number operations; justify manipulations of expressions using the properties of real number operations.	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures. MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-09. State the inverse, converse, and contrapositive of a given statement and state the relationship between the truth value of these statements and the original statement. MHS-S5C2-10. List related *if… then* statements in logical order.	Students are not expected to use the closure property. Examples: • Solve the equation and justify each step with a property. $-8x + 2x^2 + 10x - 62 = 22$ o $2x^2 - 8x + 10x - 62 = 22$ *commutative property* o $2(x^2 - 4x + 5x - 31) = 22$ *distributive property* o $2(x^2 + x - 31) = 22$ *distributive property* o $x^2 + x - 31 = 11$ *inverse property* o $x^2 + x - 31 - 11 = 0$ *inverse property* o $x^2 + x - 42 = 0$ *property of addition* o $(x + 7)(x - 6) = 0$ *distributive property* o $x + 7 = 0$ or $x - 6 = 0$ *zero property* o $x = -7$ or $x = 6$ *inverse property* • Simplify the expression below and justify each step. $\frac{\frac{1}{2}+\frac{3}{4}}{\frac{2}{3}+\frac{1}{6}}$
PO 3. Calculate powers and roots of rational and irrational numbers.		Calculations do not include roots greater than cube roots.
PO 4. Compute using scientific notation.		Computations include multiplication and division only.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 1: Number and Operations
Concept 3: Estimation

Use estimation strategies reasonably and fluently while integrating content from each of the other strands.

In Grades 9 and 10, students apply estimation skills mastered in the middle grades to effectively solve problems with less common rational numbers. Students analyze problems in context to determine when it is more appropriate to use estimates and approximations in order to extend that analysis to recognize the limitations of estimations in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Determine rational approximations of irrational numbers.		Problems include only square and cube roots, and approximations must be made to the nearest tenth.
PO 2. Use estimation to determine the reasonableness of a solution.	MHS-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	
PO 3. Determine when an estimate is more appropriate than an exact answer.	MHS-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	Example: • Determining price of gas by estimating to the nearest cent is more appropriate because you will not pay in fractions of a cent but gas costs $\frac{3.479}{\text{gallon}}$ in dollars.
PO 4. Estimate the location of the rational or irrational numbers on a number line.		

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 2: Data Analysis, Probability, and Discrete Mathematics

This strand requires students to use data collection, data analysis, statistics, probability, systematic listing and counting, and the study of graphs. This prepares students for the study of discrete functions as well as to make valid inferences, decisions, and arguments. Discrete mathematics is a branch of mathematics that is widely used in business and industry. Combinatorics is the mathematics of systematic counting. Vertex-edge graphs are used to model and solve problems involving paths, networks, and relationships among a finite number of objects.

Concept 1: Data Analysis (Statistics)

Understand and apply data collection, organization, and representation to analyze and sort data.

In Grades 9 and 10, students build on their understanding of data collection and measures of center from the middle grades to effectively represent, analyze, interpret, and make inferences from multiple data sets using multiple summary statistics. In grades 11 and 12 students draw from this deeper analysis to compare and investigate statistical design and more advanced statistical measures.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Draw inferences about data sets from lists, tables, matrices, and plots. Connections: SCHS-S1C4-02	MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • Garlic is sorted by size of cloves and by quality (consumer grade, restaurant grade, and manufacture grade). The matrix below represents the inventory of garlic harvested by Company A in one month. The volume of garlic purchased annually by the restaurant industry is 7,884 cloves. Does Company A need to change their planting practices to meet the demand of the restaurant industry? $\begin{array}{r} \\ \text{small} \\ \text{medium} \\ \text{large} \end{array}\begin{array}{c} \begin{array}{ccc} \text{G1} & \text{G2} & \text{G3} \end{array} \\ \begin{bmatrix} 40 & 80 & 55 \\ 31 & 97 & 110 \\ 24 & 42 & 68 \end{bmatrix} \end{array}$ G1 = Consumer grade G2 = Restaurant grade G3 = Manufacture grade

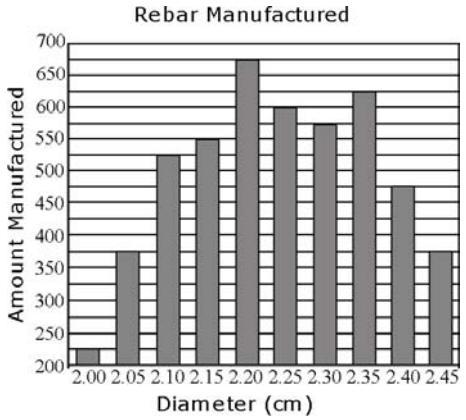
The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Organize collected data into an appropriate graphical representation with or without technology.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Graphical representations include but are not limited to matrices, line graphs, circle graphs, histograms, multi-line graphs, scatterplots, multi-bar graphs, Venn diagram, and arrays.
PO 3. Display data, including paired data, as lists, tables, matrices, and plots with or without technology; make predictions and observations about patterns or departures from patterns.	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Observations of pattern include approximating a line of best-fit and interpreting the correlation in terms of slope. Example: • Company A manufactures rebar used in concrete foundation construction. The tolerance limit for the diameter of each rebar is 2.1cm to 2.4 cm. The data below depicts the number of rebar manufactured at each size in one month. Make a bar graph to display the data and make a prediction about what percentage of rebar will need to be discarded over the next two years. Data: (diameter of rebar in cm, amount manufactured) {(2.00, 225), (2.05, 375), (2.10, 525), (2.15, 550), (2.20, 675), (2.25, 600), (2.30, 575), (2.35, 625), (2.40, 475), (2.45, 375)} Continued on next page

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		Solution:  19.5% of the rebar will be discarded for falling outside of the tolerance limits.
PO 4. Make inferences by comparing data sets using one or more summary statistics. Connections: SCHS-S1C3-06	MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Summary statistics include extreme values, mean, median, mode, range, quartiles, and interquartile range. Example: • The two data sets below depict the housing prices sold in the King River area and Toby Ranch areas of Pinal County, Arizona. Based on the prices below which price range can be expected for a home purchased in Toby Ranch? In the King River area? In Pinal County? o King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} o Toby Ranch homes {5million, 154000, 250000, 250000, 200000, 160000, 190000}

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 5. Determine which measure of center is most appropriate in a given situation and explain why.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Measures of center include mean, median, and mode. Example: • The two data sets below depict the housing prices sold in the King River area and Toby Ranch areas of Arizona. Based on the prices below which measure of center will provide the most accurate estimation of housing prices in Arizona and explain why? o King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} o Toby Ranch homes {5million, 154000, 250000, 250000, 200000, 160000, 190000}
PO 6. Evaluate the reasonableness of conclusions drawn from data analysis. Connections: SCHS-S1C3-02	MHS-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	Example: • A reporter used the two data sets below to calculate the mean housing price in Arizona as $629,000. Why is this calculation not representative of the typical housing price in Arizona? o King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} o Toby Ranch homes {5million, 154000, 250000, 250000, 200000, 160000, 190000}
PO 7. Identify misrepresentations and distortions in displays of data and explain why they are misrepresentations or distortions.	MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Explanations can include but are not limited to sample size, biased survey sample, interval scale, unlabeled scale, uneven scale, and outliers that distort the line-of-best-fit. In a pictogram the symbol scale used can also be a source of distortion.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 8. Design simple experiments or investigations and collect data to answer questions.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	The experimental design should consider sample size and sample space, bias, and the purpose of the investigation. Example: • Collect height, shoe-size, and wrist circumference data for each student. Determine the best way to display the data. Answer the following questions: Is there a correlation between any two of the three indicators? Is there a correlation between all three indicators? What patterns and trends are apparent in the data? What inferences can be made from the data?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 2: Probability

Understand and apply the basic concepts of probability.

In Grades 9 and 10, students apply the law of large numbers to their knowledge of theoretical and experimental probability. Students investigate probability of independent and dependent events, and apply concepts area to determine the geometric probability of a simulation. Students deepen their understanding of probability and experimentation in order to prepare for advanced problem solving with estimations and exact calculations for probability with independent and dependent events; and univariate and bivariate data in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Make predictions and solve problems based on theoretical probability models. Connections: MHS-S2C3-01	MHS-S5C2-08. Use inductive reasoning to make conjectures, use deductive reasoning to analyze and prove a valid conjecture, and develop a counterexample to refute an invalid conjecture.	Theoretical probability models refer to representations including but not limited to pictures, fractions, percents, decimals, tables, tree diagrams, and manipulatives. Questions of probability can be viewed as the ratio of two counting questions (that is, the number of favorable outcomes / the total number of possibilities).
PO 2. Determine the theoretical probability of events, estimate probabilities using experiments, and compare the two.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Compare data from repetitions of the same experiment as part of the comparison done. Experiments are simulations including but are not limited to: flipping coins, spinning spinners, playoff eliminations, item selection, and rolling a number cube.

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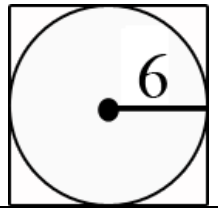
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 3. Use simulations to model situations involving independent and dependent events.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Example: • A bag of colored marbles is held by the teacher. The teacher drew a blue marble and handed it to a student in the first row. The teacher then drew a red marble and gave it to a student in the second row. What was the theoretical probability of the simulation? Model this probability using two different representations. (see representations in MHS-S2C2-01)
PO 4. Explain and use the law of large numbers (that experimental results tend to approach theoretical probabilities after a large number of trials).	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	The law of large numbers states that as the sample size increases, the experimental probability will approach the theoretical probability. Example: • Have multiple groups flip coins. One group flips a coin 5 times, one group flips a coin 20 times, and one group flips a coin 100 times. Which group's results will most likely approach the theoretical probability?
PO 5. Use concepts and formulas of area to calculate geometric probabilities. Connections: MHS-S4C1-01, MHS-S4C4-02, MHS-S4C4-03, MHS-S4C4-04, MHS-S4C4-05	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	Example: • If you choose a point in the square, what is the probability that it is not in the circle? 

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 3: Systematic Listing and Counting

Understand and demonstrate the systematic listing and counting of possible outcomes.

In Grades 9 and 10, students use the counting techniques learned in the middle grades to calculate and solve problems related to combinations and permutations. Students represent problems and solutions using algebraic symbols in order to lay a foundation for work with Pascal's Triangle and the binomial theorem in College Work Readiness.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Apply the addition and multiplication principles of counting, representing these principles algebraically using factorial notation. Connections: MHS-S2C2-01, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	High school students should be able to solve a variety of counting problems using both visual and numerical representations that extend their Grade 8 experiences. They should have had varied counting experiences that, over time, have helped to build these understandings and are now able to analyze and solve counting problems directly through numerical methods. They are able to make the connection that questions of probability can simply be viewed as the ratio of two counting questions (that is, the number of favorable outcomes / the total number of possibilities). Examples: • What is the number of letter arrangements in the word GRADE? Solution: 5! • An art show has 7 entries. The top three places will be awarded ribbons. In how many different ways can you award the ribbons? Solution: $\left(\frac{7!}{(4!3!)}\right)$ Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• The class of 18 students will be arranged in groups of 3. How many different groups can be made? Solution: $\left(\frac{18!}{(15!3!)}\right)$ • How many numbers can be made from the digits 1, 2, 3, 4, if you are not allowed to repeat a digit?
PO 2. Apply appropriate means of computing the number of possible arrangements of items using permutations where order matters, and combinations where order does not matter. Connections: MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • A bookstore will display seven books on sale along a special shelf in the store's front window. How many different ways can these books be arranged on this shelf? Solution: 7! • A school chorus is going on tour. In how many ways can the chorus teacher arrange the 20 members into hotel rooms containing four people?
PO 3. Determine the number of possible outcomes of an event. Connections: MHS-S2C1-02, MHS-S2C4-01, MHS-S5C1-02	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • What is the number of games played in a double elimination tournament with 16 teams (e.g., the College World Series Baseball Tournament)? Note: A double-elimination tournament is a contest in which a team or player is no longer eligible to win the championship after having lost two games or matches. The number of competitors is typically a power of two to insure there is an even number of competitors in each round. A double-elimination tournament is broken into two brackets, a winners' bracket and a losers' bracket. After the first round, the winners move into the winners' bracket and the losers move into the losers' bracket. The losers in the losers' bracket drop out of the competition. The losers of the winners' bracket drop down into the losers bracket. Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• A game begins by rolling a six-sided number cube, flipping a coin, or spinning a fair three-part spinner. A player gets to choose his or her first move by picking one of these items. The next move depends upon the result of the first move. If the six-sided number cube shows an even number, then flip a coin; if it shows an odd number, roll a numbered four-sided game piece. If the coin shows a "head", flip the coin again; otherwise roll a numbered four-sided game piece. If the spinner was selected, flip a coin. o Represent the total possible outcomes of this game using a tree diagram. o How many total possible outcomes are there for this game? o Write a numerical representation (i.e., an equation) that could calculate these outcomes. o If you win the game by getting a "head" as the final result, what item would you select on your first move? Explain your answer. Continued on next page

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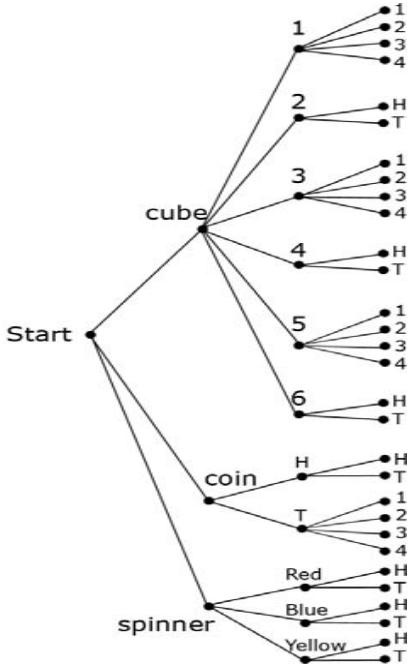
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		Solutions:  o There are 30 possible outcomes for this game. o One way to numerically represent the tree diagram is to add the total possible outcomes from each of the three first moves together. For example, 18 + 6 + 6 = 30 o Students identify each of the branches that meet the "win" criteria, and then look at the probability of the win happening within the choice of the item. Continued on next page

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Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		Selecting the six-sided number cube for the first move results in three branches that have a "head" as the final result. The probability of winning with this move is 3 out of 18 or 3/18 or 1/6. Selecting the coin for the first move results in one branch that has a "head" as the final result. The probability of winning with this move is 1 out of 6 or 1/6. Selecting the spinner for the first move results in three branches that have a "head" as the final result. The probability of winning with this move is 3 out of 6 or 3/6 or 1/2. Players of this game should choose the spinner as their first move, since they will have a greater chance (50%) of winning the game. • The following problem is a challenging problem that works well when students collaborate in groups: A fair spinner numbered 1-8 is spun. If the arrow lands on numbers 1-4 roll a number cube. If the arrow lands on numbers 5-8 spin again. If the number cubes show even numbers then flip a coin, but if odd numbers show then roll the cube again. The second spin that lands on an even number must flip a coin, but a second spin that lands on an odd number must roll a number cube. Represent the outcomes using a tree diagram, write the numerical representation of the outcomes, and determine the total number of possible outcomes for the simulation.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 4: Vertex-Edge Graphs

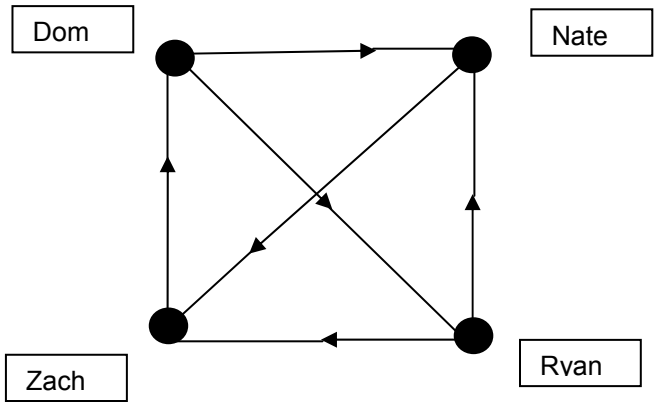
Understand and apply vertex-edge graphs.

In Grades 9 and 10, students apply their understanding from grades 7 and 8 of Euler/Hamilton paths, directed graphs, and algorithmic reasoning to model and solve network problems. The understanding of networks students gain in grades 9 and 10 extends to problem solving using circuits, shortest paths, minimum weight spanning trees, and adjacency matrices in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Solve network problems using graphs and matrices. Connections: MHS-S2C1-01, MHS-S2C1-03, MHS-S2C3-03, MHS-S3C3-15, MHS-S4C3-01, MHS-S4C3-03	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Problems can be solved with either a graph or a matrix, but it is not necessary to use both skills to solve a given problem. A matrix can be used to represent information found in a directed graph and then manipulated to discover more about the situation. By grade 8, students learn about round-robin tournaments and how to represent them using vertex-edge graphs. They analyze game results, find Hamilton paths, and discuss implications for ranking the players in the tournament. In grades 9 and 10, students can expand their initial methods of analysis to now include a matrix method to rank the players in the tournament. Grade 8 Example: • Four players (Dom, Nate, Ryan, & Zach) are playing in a round-robin tennis tournament, where every player plays every other player. Dom beats Nate and Ryan, Nate beats Zach, Ryan beats Nate and Zach, and Zach beats Dom. o Represent this round-robin tournament using a directed graph. Continued on next page

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		o Find all Hamilton paths in this graph. o "A winner" can be defined as the first player in a Hamilton path. How many possible tournament "winners" are in this example? o What conclusions can you draw from this example? Grades 9-10 Example: • Below is a vertex-edge graph that represents six games played during a tennis tournament. Use a matrix method to analyze and interpret results from each game to rank the players.  o Represent this round-robin tournament using a matrix. An entry of "1" in your matrix should indicate a win, and a "0" entry should represent a loss. Read the matrices from row to column (i.e., from side to top). Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		o What symbol should be placed along the main diagonal of the matrix? Explain why. What game does the main diagonal of the matrix represent during the tournament? o Compute the row sums for each matrix. What can you conclude from this information regarding the ranking of these players? o If ties exist, compute the square of the matrix using a graphing calculator. Interpret the results. o Who would you rank as the tournament winner? Explain. Solutions: • Tournament Matrix Dom Nate Ryan Zach Dom X 1 1 0 Nate 0 X 0 1 Ryan 0 1 X 1 Zach 1 0 0 X o Answers will vary. Students will need to choose a different symbol that is not "0" or "1" because the main diagonal shows the match where each player plays himself. This obviously does not happen during any tennis tournament. In the tournament matrix above, am "X" was chosen as the different symbol. o The row sums show the number of matches each player has won during the tournament. Dom row sum = 2 Nate row sum = 1 Ryan row sum = 2 Zach row sum = 1 Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

<table>
<tr><th><u>Performance Objectives</u></th><th><u>Process Integration</u></th><th><u>Explanations and Examples</u></th></tr>
<tr><td>Students are expected to:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>

These sums indicate ties between: a) Dom and Ryan and b) Nate and Zach. To resolve these ties, students compute the square of the matrix, replacing the X with a 0 prior to squaring the matrix.
Each entry in the squared matrix represents the paths of length 2 between vertices in the directed graph, which is the number of “two-stage wins.”

<table>
<tr><th></th><th>Dom</th><th>Nate</th><th>Ryan</th><th>Zach</th></tr>
<tr><td>Dom</td><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>Nate</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Ryan</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Zach</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
</table>
The row sums of the squared matrix show the number of “two-stage wins” for each player:
Dom row sum = 3
Nate row sum = 1
Ryan row sum = 2
Zach row sum = 2

Since there was a tie between Dom and Ryan for first place (they each beat two other players), we look at the number of two-stage wins for these players in the squared matrix and analyze the results. Dom has three, two-stage wins (1. Dom beat Ryan, who beat Zach; 2. Dom beat Ryan, who beat Nate; and 3. Dom beat Nate, who beat Zach) and Ryan has two, two-stage wins. Therefore, we may conclude that Dom won the tournament.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 3: Patterns, Algebra, and Functions
Concept 1: Patterns

Identify patterns and apply pattern recognition to reason mathematically while integrating content from each of the other strands.

In Grades 9 and 10, students recognize sequences as arithmetic or geometric and use their algebraic skills to model, represent, and extend sequences. The representation and modeling of sequences will lead students to use their skills to solve problems in context in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Recognize, describe, and analyze sequences using tables, graphs, words, or symbols; use sequences in modeling.	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Example: • The top row is the sequence. The middle row is the difference between the terms of the first row. The third row is the difference between the terms of the second row. Describe the pattern for the sequence, model the sequence with a different representation, and describe and model the rule for the sequence. Justify your reasoning. <table><tr><td>2</td><td>3</td><td>6</td><td>11</td><td>18</td><td>27</td><td>38</td><td>51</td></tr><tr><td></td><td>1</td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td></tr><tr><td></td><td></td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr></table>
PO 2. Determine a specific term of a sequence.		Examples: • Given the formula $A_n = 2n - 1$, find the 17^{th} term of the sequence. • What is the 9^{th} term in the sequence 3, 5, 7, 9, …?
PO 3. Create sequences using explicit and recursive formulas involving both subscripts and function notation. Connections: MHS-S3C4-03, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Sequences include iterative (explicit) and recursive sequences. Examples: • Generate the 5^{th}-11^{th} terms of a sequence if $A_1 = 2$ and $A_{(n+1)} = (A_n)^2 - 1$ • Use the formula: $A_n = A_1 + d(n - 1)$ where d is the common difference to generate a sequence whose first three terms are: -7, -4, and -1.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 3: Patterns, Algebra, and Functions

Patterns occur everywhere in nature. Algebraic methods are used to explore, model and describe patterns, relationships, and functions involving numbers, shapes, iteration, recursion, and graphs within a variety of real-world problem solving situations. Iteration and recursion are used to model sequential, step-by-step change. Algebra emphasizes relationships among quantities, including functions, ways of representing mathematical relationships, and the analysis of change.

Concept 2: Functions and Relationships

Describe and model functions and their relationships.

In Grades 9 and 10, students deepen their understanding of functions, both linear and quadratic, and they learn the practical and mathematical limitations of modeling functions. In grades 9 and 10 linear and quadratic functions begin students' formal instruction to the library of functions, while in grades 11 and 12 students investigate many other functions.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Sketch and interpret a graph that models a given context, make connections between the graph and the context, and solve maximum and minimum problems using the graph. Connections: MHS-S4C3-05, MHS-S4C3-06, MHS-S4C3-07, MHS-S4C3-08, SSHS-S1C1-04, SSHS-S2C1-04	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MHS-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem. MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • A rocket is launched from 180 feet above the ground at time $t = 0$. The equation that models this situation is given by $h = -16t^2 + 96t + 180$, where t is measured in seconds and h is height above the ground measured in feet. o What is a reasonable domain restriction for t in this context? o Determine the height of the rocket two seconds after it was launched. o Determine the maximum height obtained by the rocket. o Determine the time when the rocket is 100 feet above the ground. o Determine the time at which the rocket hits the ground. o How would you refine your answer to the first question based on your response to the second and fifth questions?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Determine if a relationship represented by an equation, graph, table, description, or set of ordered pairs is a function. Connections: MHS-S3C3-03	MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	
PO 3. Use function notation; evaluate a function at a specified value in its domain. Connections: MHS-S3C3-03, MHS-S3C3-04, MHS-S3C3-07		Examples: • Use function notation to express the following: $\{x : x^2 + 4x - 12 = 0,\ x \in R\}$ • Evaluate the following: If $f(x) = x^2 + 4x - 12$, find $f(2)$.
PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Represent a problem graphically, algebraically, in a table, and with a written description (Rule of Four). Example: • The following table represents the temperatures of cities A and B during two weeks of the winter. Graph the information; describe any inferences that can be drawn from the data; and write an equation to determine the approximate temperature of city B in terms of the temperature of city A. Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

<table>
<tr><th><u>Performance Objectives</u></th><th><u>Process Integration</u></th><th><u>Explanations and Examples</u></th></tr>
<tr><td>Students are expected to:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>City A</th><th>City B</th></tr>
<tr><td>-14</td><td>-4</td></tr>
<tr><td>-13</td><td>-2</td></tr>
<tr><td>-16</td><td>-6</td></tr>
<tr><td>-21</td><td>-11</td></tr>
<tr><td>-20</td><td>-10</td></tr>
<tr><td>-8</td><td>2</td></tr>
<tr><td>-8</td><td>1</td></tr>
<tr><td>-12</td><td>-2</td></tr>
<tr><td>-4</td><td>6</td></tr>
<tr><td>-3</td><td>6</td></tr>
<tr><td>0</td><td>10</td></tr>
<tr><td>0</td><td>10</td></tr>
<tr><td>2</td><td>12</td></tr>
<tr><td>6</td><td>16</td></tr>
</table>
</td></tr>
<tr><td>PO 5. Recognize and solve problems that can be modeled using a system of two equations in two variables.

Connections: MHS-S4C3-08</td><td>MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.

MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).</td><td>Example:
• Safford is 394 miles from Kayenta. Tamara leaves Kayenta traveling 65 miles per hour and her brother leaves Safford traveling 50 miles per hour. What is their distance from Kayenta when they meet if Tamara leaves 1 hour later than her brother?</td></tr>
</table>

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 6. Recognize and solve problems that can be modeled using a quadratic function. Connections: MHS-S4C3-08	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • Lava coming from the eruption of a volcano follows a negative parabolic path. During a recent eruption, the path of a piece of lava was tracked. The lava traveled to a maximum height of 1000 ft in eight seconds. The equation for the lava is given as $f(x) = -x^2 + 16x + 936.$ At what height is a piece of lava that has traveled for only two seconds? • A football is kicked from ground level. The equation $h = -3t^2 + 9t - 0.75$ gives the height h of the football in yards after t seconds. What is the height of the ball after one second? When is the ball 6 yards high? When is the ball at 0 yards? What events does this represent?
PO 7. Determine domain and range of a function from an equation, graph, table, description, or set of ordered pairs. Connections: MHS-S3C3-12, MHS-S3C3-13, MHS-S3C3-14	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain.

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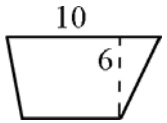
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 3: Patterns, Algebra, and Functions
Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

In Grades 9 and 10, students extend their understanding of algebraic expressions with rational numbers to polynomial, rational, and square root expressions. Students deepen their understanding of the structure of algebra to analyze equations, solve systems of equations, perform operations on matrices, and generalize solution strategies to solve polynomial equations and problems. This lays the groundwork for students in grades 11 and 12 to perform operations on these expressions and extend their work with matrices and systems of equations.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Create and explain the need for equivalent forms of an equation or expression.	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	Students will use the properties of equality to create the expressions and equations and justify their equivalency. Example: • Given the following trapezoid find the unknown base. The area of the trapezoid is 54 cm^2. Explain the manipulations the formula underwent and the reason for the manipulations. 
PO 2. Solve formulas for specified variables.	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	Example: • Solve for r: $V = \frac{4}{3}\pi r^3$
PO 3. Write an equation given a table of values, two points on the line, the slope and a point on the line, or the graph of the line.	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Determine from two linear equations whether the lines are parallel, perpendicular, coincident, or intersecting but not perpendicular. Connections: MHS-S4C3-04, MHS-S4C3-07	MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry. MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	The linear equations should include but not be limited to horizontal or vertical lines.
PO 5. Solve linear equations and equations involving absolute value, with one variable. Connections: MHS-S1C2-01	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	The equations should represent a given context. Students will use the properties of equality to solve the equations. Equations can be linear or involve absolute value, but do not need to involve both. Examples: • Carlos built a tennis ball launcher that catapulted a ball 78 feet, give or take 5 feet. Write and solve an equation with absolute value to determine the maximum and minimum distance the ball traveled. Solution: $5=\lvert f-78\rvert$ maximum of 83 feet and minimum of 73 feet. • $-\frac{7}{3}y-8=111$ • $-\frac{2}{5}x+\lvert 5\rvert=31$ • $\frac{3+x}{7}=\frac{x-9}{4}$

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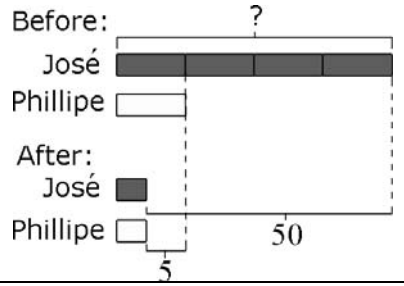
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 6. Solve linear inequalities in one variable.	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	
PO 7. Solve systems of two linear equations in two variables. Connections: MHS-S4C3-05	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	The system solution methods can include but are not limited to graphical, elimination/linear combination, and substitution. Systems can be written algebraically or can be represented in context. Example: • José had 4 times as many trading cards as Phillipe. After José gave away 50 cards to his little brother and Phillipe gave 5 cards to his friend for this birthday, they each had an equal amount of cards. Write a system to describe the situation and solve the system. 

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 8. Simplify and evaluate polynomials, rational expressions, expressions containing absolute value, and radicals.		The radical expressions are limited to square roots. The absolute value expressions are limited to variables with a degree of one when inside the absolute value symbols. Evaluate in terms of a given value for the variable. The solutions for square roots should be represented in simplest form ($2\sqrt{3}$). Example: • Simplify: $\dfrac{2(x^5 - \frac{3}{4}x + 12)}{\frac{5}{3}(-x - 74)}$
PO 9. Multiply and divide monomial expressions with integer exponents.	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	Example: • Simplify the following expression $(x^2y^3)(x^{-4}y^2)$ $= x^{-2}y^5$ $= \dfrac{y^5}{x^2}$
PO 10. Add, subtract, and multiply polynomial and rational expressions.		Rational expressions must have like denominators with a degree of 0 or 1. Examples: • $\dfrac{12}{x+3} \bullet \dfrac{27}{x+3}$ • $\dfrac{x^3 - 5x^2 + 7x - 11}{17} - \dfrac{3x^3 + 18}{17}$ A possible enrichment topic would be division of polynomials.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 11. Solve square root equations involving only one radical.	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	Examples: • $\frac{7}{8}\sqrt{2x-5}=21$ • $\sqrt{x+2}=5$
PO 12. Factor quadratic polynomials in the form of $ax^2 + bx + c$ where *a, b,* and *c* are integers. Connections: MHS-S3C3-13, MHS-S4C3-08, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	
PO 13. Solve quadratic equations. Connections: MHS-S3C2-07, MHS-S3C3-12, MHS-S4C3-08	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Quadratic functions are commonly used to maximize area or model the height of an object moving under the force of gravity. Example: • The path of a golf ball is approximately parabolic. The function $h(t)=-25t^2-5t+12$ most closely represents the height of the golf ball *h* in feet after *t* seconds. Approximately how long is the golf ball in the air? • $\frac{2}{x}=\frac{x+7}{4}$ • $(x-5)^2=0$ • $5x^2+18x=-32-8x$

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 14. Factor higher order polynomials. Connections: MHS-S3C3-12		Students should extract the greatest common factor (whether a constant, a variable, or a combination of each). If the resulting expression is quadratic, students should factor the expression further. Example: • Factor $x^3 - 2x^2 - 35x$
PO 15. Solve problems using operations with matrices.		Matrix operations include addition and subtraction of matrices and scalar multiplication. Examples: • The following is an inventory matrix for Company A's jellybean, lollipop, and gum flavors. The price per unit is \$0.03 for jelly beans, gum, and lollipops. Determine the gross profit for each flavor and for the entire lot. $\begin{array}{c} \\ C1 \\ C2 \\ C3 \end{array} \begin{array}{c} \begin{array}{ccccccc} F1 & F2 & F3 & F4 & F5 & F6 & F7 \end{array} \\ \begin{bmatrix} 327 & 818 & 465 & 211 & 127 & 134 & 705 \\ 513 & 222 & 312 & 446 & 645 & 671 & 101 \\ 878 & 901 & 51 & 156 & 711 & 423 & 344 \end{bmatrix} \end{array}$ C1 = Jelly beans C2 = Lollipops C3 = Gum F1 = Vanilla F2 = Banana F3 = Strawberry F4 = Tangerine F5 = Coconut F6 = Mint F7 = Licorice Continued on next page

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Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• Find 2A – B + C given Matrices A, B and C below. Matrix *A* $\begin{bmatrix} -7 & 19 & 15 \\ 41 & -63 & 20 \\ 2 & 0 & -8 \end{bmatrix}$ Matrix *B* $\begin{bmatrix} 23 & 18 & 55 \\ -18 & -47 & 11 \\ 39 & -6 & -8 \end{bmatrix}$ Matrix *C* $\begin{bmatrix} -4 & 7 & 12 \\ 51 & 9 & 80 \\ 13 & 72 & 8 \end{bmatrix}$

Strand 3: Patterns, Algebra, and Functions
Concept 4: Analysis of Change

Analyze how changing the values of one quantity corresponds to change in the values of another quantity.

In Grades 9 and 10, students apply their understanding of rate change and simple rates in grades 7 and 8 to linear functions. Students use rates and rate of change to solve problems, including interest problems. Students in grades 11 and 12 solve problems using rate of change and analyze and interpret rate of change in financial contexts.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Determine the slope and intercepts of the graph of a linear function, interpreting slope as a constant rate of change. Connections: MHS-S3C3-04, MHS-S4C3-06, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Solve problems involving rate of change. Connections: MHS-S4C2-01, MHS-S4C2-02, MHS-S4C2-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Rate of change is limited to linear change. Example: • The ratio of Brand A to Brand B MP3 players sold at Electronics House is 8:3. Of the next 100 of Brand A and Brand B devices sold, how many do you estimate will be Brand A?
PO 3. Solve interest problems. Connections: MHS-S3C1-03, SSHS-S5C5-04		Interest problems include compounded interest but do not include continuous interest. Students should understand the recursive nature of interest calculation. Each time one must take the solution (principal and interest earned) for one year and apply it as the principal for the next year.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 4: Geometry and Measurement

Geometry is a natural place for the development of students' reasoning, higher thinking, and justification skills culminating in work with proofs. Geometric modeling and spatial reasoning offer ways to interpret and describe physical environments and can be important tools in problem solving. Students use geometric methods, properties and relationships, transformations, and coordinate geometry as a means to recognize, draw, describe, connect, analyze, and measure shapes and representations in the physical world. Measurement is the assignment of a numerical value to an attribute of an object, such as the length of a pencil. At more sophisticated levels, measurement involves assigning a number to a characteristic of a situation, as is done by the consumer price index. A major emphasis in this strand is becoming familiar with the units and processes that are used in measuring attributes.

Concept 1: Geometric Properties

Analyze the attributes and properties of 2- and 3- dimensional figures and develop mathematical arguments about their relationships.

In Grades 9 and 10, students develop their reasoning skills, both inductive and deductive. Students employ their understanding of the properties of two- and three-dimension figures, investigated in the middle grades, to solve problems. Students investigate trigonometric ratios and their application to triangles in preparation for the advanced trigonometric study undertaken in College Work Readiness.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Use the basic properties of a circle (relationships between angles, radii, intercepted arcs, chords, tangents, and secants) to prove basic theorems and solve problems.	MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry. MHS-S5C2-12. Construct a simple formal deductive proof. MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	The properties of a circle include but are not limited to theorems based on the AIMS Reference Sheet circle formulas. Examples: • Students should investigate the method Eratosthenes used to calculate the diameter of the moon. • Given the circle below with radius of 10 and chord length of 12, find the distance from the chord to the center of the circle.  Continued on next page

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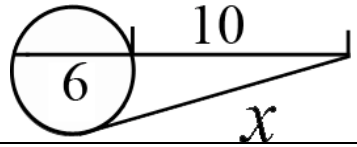
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• Find the unknown length in the picture below. 
PO 2. Visualize solids and surfaces in 3-dimensional space when given 2-dimensional representations and create 2-dimensional representations for the surfaces of 3-dimensional objects.		The two-dimensional representations should include nets and multiple views of the solid.
PO 3. Create and analyze inductive and deductive arguments concerning geometric ideas and relationships. Connections: MHS-S4C1-01, MHS-S4C1-04, MHS-S4C1-05, MHS-S4C1-07, MHS-S4C1-08, MHS-S4C3-02, MHS-S4C3-04	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-08. Use inductive reasoning to make conjectures, use deductive reasoning to analyze and prove a valid conjecture, and develop a counterexample to refute an invalid conjecture. MHS-S5C2-12. Construct a simple formal deductive proof. MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry.	Key ideas include but are not limited to parallelism, perpendicularity, properties of intersecting lines, the circumference formula, and the area formula.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Apply properties, theorems, and constructions about parallel lines, perpendicular lines, and angles to prove theorems. Connections: MHS-S4C1-01, MHS-S4C1-05, MHS-S4C1-06, MHS-S4C1-07, MHS-S4C1-08, MHS-S4C1-09, MHS-S4C1-10, MHS-S4C1-11	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-12. Construct a simple formal deductive proof. MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry.	Constructions include but are not limited to complementary angles, supplementary angles, linear pairs, one or two transversals crossing two parallel lines, the sum of interior angles of a polygon, exterior angles of a polygon, and vertical angles. Properties used to prove theorems should include properties about angles, arcs, radii, tangents, chords, secants, and relationships among these.
PO 5. Explore Euclid's five postulates in the plane and their limitations.	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-11. Draw a simple valid conclusion from a given *if…then* statement and a minor premise.	Euclid's five postulates are: 1: A line segment can be drawn joining any two points. 2: Any line segment can be extended indefinitely in a line. 3: Given a line segment, a circle can be drawn having the segment as a radius and one endpoint as a center. 4: All right angles are congruent. 5: If l is any line and P is any point not on l, then there exists exactly one line through P that is parallel to l. The 5th postulate is applied only to Euclidean geometry. It cannot be applied to a curve.
PO 6. Solve problems using angle and side length relationships and attributes of polygons. Connections: MHS-S4C1-04, MHS-S4C1-07, MHS-S4C2-04, MHS-S4C3-04, MHS-S4C4-01, MHS-S4C4-03, MHS-S4C4-04, MHS-S4C4-05	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • Find the measure of each interior angle of a regular hexagon. • Find the value of x if the perimeter of a triangle is 27 and the side lengths are represented by x, x+2, and x+7.

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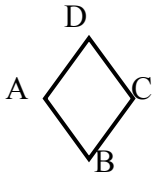
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 7. Use the hierarchy of quadrilaterals in deductive reasoning. Connections: MHS-S4C1-03, MHS-S4C1-04, MHS-S4C1-06	MHS-S5C2-09. State the inverse, converse, and contrapositive of a given statement and state the relationship between the truth value of these statements and the original statement. MHS-S5C2-10. List related *if… then* statements in logical order. MHS-S5C2-11. Draw a simple valid conclusion from a given *if…then* statement and a minor premise.	A trapezoid is not considered a parallelogram. Examples: • A rectangle is _____ a square. (sometimes, always, never) **Justify** your selection. • A square is _____a rectangle. (sometimes, always, never) **Justify** your selection. • Prove that a figure ABCD is a rhombus.  Solution: Students will first need to prove the figure is a parallelogram, then they can use one of the unique characteristics of a rhombus to prove the figure is a rhombus. These characteristics include: the diagonals are perpendicular, one pair of adjacent sides is congruent, or a diagonal bisects opposite angles. Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• Consider the following statements regarding the hierarchy of quadrilaterals. Place the statements in order, and determine whether the original, inverse, converse, and contrapositive statements are true. o If the figure has four congruent sides and angles, then it is a square. o If both pairs of sides of the figure are parallel then it is a parallelogram. o If the figure is a square, then it is a rectangle. o If a figure has four sides, then it is a quadrilateral. o If the figure has four congruent sides, then it is a rhombus. • What conclusion can be made from the following conditional statement and minor premise? o If a quadrilateral has two pairs of congruent consecutive sides and all four sides are not congruent, then the figure is a kite. o In quadrilateral ABCD $\overline{AB} \cong \overline{BC}, \quad \overline{BC} \neq \overline{CD}, \quad and\ \overline{CD} \cong \overline{DA}$

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 8. Prove similarity and congruence of triangles. Connections: MHS-S4C1-03, MHS-S4C1-04, MHS-S4C1-10, MHS-S4C1-11, MHS-S4C2-01, MHS-S4C2-03, MHS-S4C2-04, MHS-S4C3-04, MHS-S4C4-04	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-11. Draw a simple valid conclusion from a given *if…then* statement and a minor premise. MHS-S5C2-12. Construct a simple formal deductive proof. MHS-S5C2-13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry.	Similarity postulates include SSS, SAS, and AA. Congruence postulates include SSS, SAS, ASA, AAS, and H-L.
PO 9. Solve problems using the triangle inequality property. Connections: MHS-S4C1-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • What are the minimum and maximum lengths of a piece of wood given the two other pieces of wood used to build a triangle are 24 ft and 7 ft?

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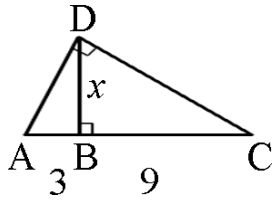
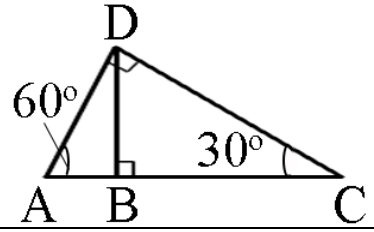
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 10. Solve problems using right triangles, including special triangles. Connections: MHS-S1C2-02, MHS-S1C3-01, MHS-S3C3-11, MHS-S4C1-04, MHS-S4C1-08, MHS-S4C1-11, MHS-S4C3-01, MHS-S4C3-02, MHS-S4C3-03, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Find the value of x in the given triangle where $\overline{AD} \perp \overline{DC}$ and $\overline{AC} \perp \overline{DB}$ $m\angle A = 60°, m\angle C = 30°$  • Find the measure of the missing segment in the given triangle where $\overline{AD} \perp \overline{DC}$, $\overline{AC} \perp \overline{DB}$, $m\angle A = 60°, m\angle C = 30°, \overline{AC} = 12, \overline{AB} = 3$ 

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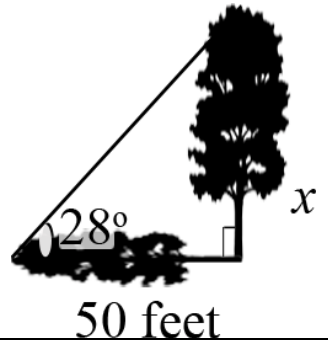
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 11. Solve problems using the sine, cosine, and tangent ratios of the acute angles of a right triangle. Connections: MHS-S3C3-02, MHS-S3C4-02, MHS-S4C1-04, MHS-S4C1-08, MHS- MHS-S4C1-10,S4C4-05, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	The ratios do not include arcsin ($\sin^{-1}$), arccos ($\cos^{-1}$), and arctan ($\tan^{-1}$). Both tables and technology are useful for this objective. Example: • Find the height of a tree to the nearest tenth if the angle of elevation of the sun is 28° and the shadow of the tree is 50 ft. 

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 4: Geometry and Measurement
Concept 2: Transformation of Shapes

Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.

In Grades 9 and 10, students analyze the effect of transformations on the attributes of geometric figures. Students extend the analysis in grades 9 and 10 to analyze the effects of transformations on the library of functions in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Determine whether a transformation of a 2-dimensional figure on a coordinate plane represents a translation, reflection, rotation, or dilation and whether congruence is preserved. Connections: MHS-S4C1-08, MHS-S4C2-02, MHS-S4C2-03, MHS-S4C2-04, MHS-S4C4-04	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	
PO 2. Determine the new coordinates of a point when a single transformation is performed on a 2-dimensional figure. Connections: MHS-S3C4-02, MHS-S4C1-06, MHS-S4C1-08, MHS-S4C2-01, MHS-S4C2-03, MHS-S4C3-03, MHS-S4C4-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	

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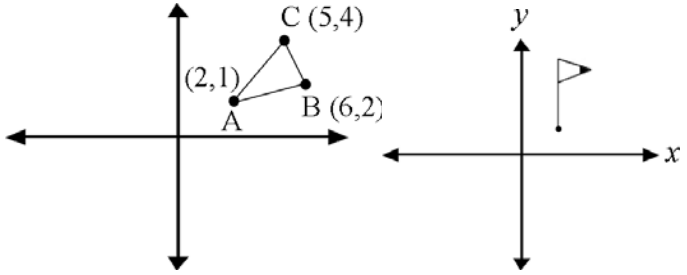
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 3. Sketch and describe the properties of a 2-dimensional figure that is the result of two or more transformations. Connections: MHS-S4C1-03, MHS-S4C1-06, MHS-S4C1-08, MHS-S4C2-01, MHS-S4C2-02, MHS-S4C2-04	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	Example: • Sketch the image of the figures below when reflected over the *x*-axis and dilated using a scale factor of 2, and describe the properties of the image. 
PO 4. Determine the effects of a single transformation on linear or area measurements of a 2-dimensional figure. Connections: MHS-S3C4-02, MHS-S4C1-06, MHS-S4C1-08, MHS-S4C2-01, MHS-S4C2-02, MHS-S4C2-03, MHS-S4C4-04	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	Examples: • Determine the length of the sides of a new triangle created by dilating the sides of a triangle with side lengths of 3, 6 and 7 using a scale factor of 2. • Determine the area of a new triangle created by dilating a given triangle with area 27 sq ft using a scale factor of $\frac{1}{3}$.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 4: Geometry and Measurement
Concept 3: Coordinate Geometry

Specify and describe spatial relationships using rectangular and other coordinate systems while integrating content from each of the other strands.

In Grades 9 and 10, students make connections between algebra and geometry by investigating the attributes of algebraic functions and geometric figures. Students explore the relationships between the figure/function and its graph, laying the foundation for deeper investigation of representations of functions and their attributes in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Determine how to find the midpoint between two points in the coordinate plane. Connections: MHS-S1C1-03, MHS-S1C2-03, MHS-S3C3-02, MHS-S4C1-03, MHS-S4C1-10, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	Problems include finding the midpoint given both endpoints, and finding the unknown endpoint given the midpoint and one endpoint. Examples: • An example of an informal method of determining the midpoint of a line segment is: o The line segment is graphed on a coordinate grid. Students find half of the vertical distance and half of the horizontal distance. The intersection of those is the midpoint. • An example of a formal method of determining the midpoint of a line segment is: o Given the endpoints (-10, 7) and (3, -21) use a formula to find the midpoint.
PO 2. Illustrate the connection between the distance formula and the Pythagorean Theorem. Connections: MHS-S1C1-03, MHS-S3C3-01, MHS-S3C3-08, MHS-S4C1-03, MHS-S4C1-10, MHS-S5C1-01, MHS-S5C1-02		

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 3. Determine the distance between two points in the coordinate plane. Connections: MHS-S1C1-03, MHS-S1C2-02, MHS-S1C2-03, MHS-S3C3-02, MHS-S3C3-08, MHS-S4C1-03, MHS-S4C1-10, MHS-S4C1-11, MHS-S4C2-02, MHS-S5C1-01, MHS-S5C1-02	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	
PO 4. Verify characteristics of a given geometric figure using coordinate formulas for distance, midpoint, and slope to confirm parallelism, perpendicularity, and congruence. Connections: MHS-S3C3-04, MHS-S3C3-08, MHS-S4C1-03, MHS-S4C1-04, MHS-S4C1-06, MHS-S4C1-07, MHS-S4C1-08, MHS-S4C2-01, MHS-S4C3-01, MHS-S4C3-03	MHS-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Examples: • Use slope to verify the polygon formed by connecting the points (-3, -2), (5, 3), (9, 9), (1, 4) is a parallelogram. • Use the distance formula to verify the polygon formed by connecting the points (-3, -2), (5, 3), (9, 9), (1, 4) is a parallelogram.
PO 5. Graph a linear equation or linear inequality in two variables. Connections: MHS-S3C2-01, MHS-S3C4-01	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.	
PO 6. Describe how changing the parameters of a linear function affect the shape and position of its graph. Connections: MHS-S3C2-02	MHS-S5C2-07. Find structural similarities within different algebraic expressions and geometric figures.	

The bulleted items within a performance objective indicate the specific content to be taught.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 7. Determine the solution to a system of linear equations in two variables from the graphs of the equations. Connections: MHS-S3C3-04		
PO 8. Graph a quadratic function and interpret *x*-intercepts as zeros. Connections: MHS-S3C2-06		The minimum information necessary to graph a quadratic function is the vertex and a point on either side of the vertex.

Strand 4: Geometry and Measurement
Concept 4: Measurement

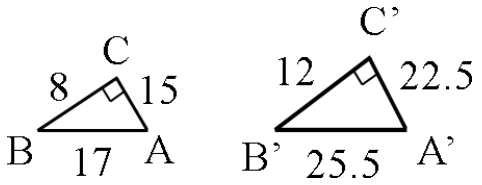
Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

In Grades 9 and 10, students extend work from grades 7 and 8 with proportional reasoning and geometric formulas for perimeter, area, surface area, and volume of two- and three-dimensional figures to analyze change in dimensions and solve problems in context.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Use dimensional analysis to keep track of units of measure when converting. Connections: MHS-S1C2-03, MHS-S3C3-01, MHS-S3C3-02, MHS-S3C3-09, MHS-S3C4-02, MHS-S4C1-06, MHS-S4C4-02, MHS-S4C4-03, MHS-S4C4-05, SCHS5C2-02, SCHS5C2-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Convert 24,000 seconds into days. $24000\,\text{sec} \bullet \frac{1\,\text{min}}{60\,\text{sec}} \bullet \frac{1\,\text{hr}}{60\,\text{min}} \bullet \frac{1\,\text{day}}{24\,\text{hr}}$ • Convert 12 feet per second to miles per hour. $\frac{12\,ft}{1\text{sec}} \bullet \frac{60\text{sec}}{1\text{min}} \bullet \frac{60\text{min}}{1hr} \bullet \frac{1mi}{5280\,ft}$

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Find the length of a circular arc; find the area of a sector of a circle. Connections: MHS-S2C2-05, MHS-S4C1-01, MHS-S4C1-06, MHS-S4C4-01, MHS-S5C1-01		An angle is defined as the arc measure formed by two rays with a common endpoint (vertex), not the degree of separation of two rays.
PO 3. Determine the effect that changing dimensions has on the perimeter, area, or volume of a figure. Connections: MHS-S2C2-05, MHS-S4C1-01, MHS-S4C4-01, MHS-S4C4-02	MHS-S5C2-02. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem. MHS-S5C2-10. List related *if… then* statements in logical order.	
PO 4. Solve problems involving similar figures using ratios and proportions. Connections: MHS-S2C2-05, MHS-S4C1-01, MHS-S4C1-06, MHS-S4C1-08, MHS-S4C2-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Find the scale factor for the similar triangles below: $\Delta ABC \longrightarrow \Delta A'B'C'$  • The aspect ratio of display screens at a company is $\frac{2}{7}$. The screen size of one item is 12cm. What is a possible screen size for another item from the same company?

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 5. Calculate the surface area and volume of 3-dimensional figures and solve for missing measures. Connections: MHS-S2C2-05, MHS-S4C1-06, MHS-S4C1-11, MHS-S4C4-01, MHS-S4C4-04	MHS-S5C2-02. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Missing measures can include but are not limited to slant height, altitude, height, diagonal of a prism, edge length, and radius.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 5: Structure and Logic

This strand emphasizes the core processes of problem solving. Students draw from the content of the other four strands to devise algorithms and analyze algorithmic thinking. Strand One and Strand Three provide the conceptual and computational basis for these algorithms. Logical reasoning and proof draws its substance from the study of geometry, patterns, and analysis to connect remaining strands. Students use algorithms, algorithmic thinking, and logical reasoning (both inductive and deductive) as they make conjectures and test the validity of arguments and proofs. Concept two develops the core processes as students evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications.

Concept 1: Algorithms and Algorithmic Thinking

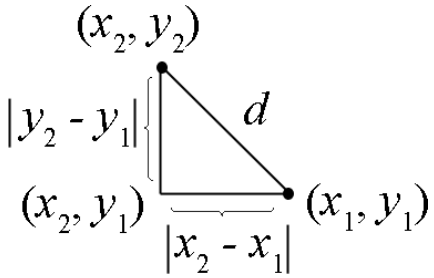
Use reasoning to solve mathematical problems.

In Grades 9 and 10, students apply their understanding of algorithms and algebraic structure from grades 7 and 8 to analyze, determine the equivalence of, and use algorithms to solve problems. Students deepen these analysis skills in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Select an algorithm that explains a particular mathematical process; determine the purpose of a simple mathematical algorithm. Connections: MHS-S2C1-02, MHS-S2C3-01, MHS-S2C3-02, MHS-S2C3-03, MHS-S3C3-12, MHS-S3C3-13, MHS-S3C4-01, MHS-S4C1-10, MHS-S4C1-11, MHS-S4C3-01, MHS-S4C3-02, MHS-S4C3-03, MHS-S4C4-02, MHS-S5C1-02	MHS-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MHS-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Analyze algorithms for validity and equivalence recognizing the purpose of the algorithm. Connections: MHS-S2C1-04, MHS-S2C3-01, MHS-S2C3-02, MHS-S2C3-03, MHS-S3C1-03, MHS-S3C3-12, MHS-S3C3-13, MHS-S3C4-01, MHS-S4C1-10, MHS-S4C1-11, MHS-S4C3-01, MHS-S4C3-02, MHS-S4C3-03, MHS-S4C4-02	MHS-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Example: • An example for analyzing an algorithm for equivalence is analyzing the multiple ways to find the slope of a line. • An example for analyzing an algorithm for validity is comparing an algorithm for finding the distance between two points using the distance formula, to an algorithm finding the square root of the sum of the horizontal distance and vertical distance between two points on a coordinate grid.  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Strand 5: Structure and Logic
Concept 2: Logic, Reasoning, Problem Solving, and Proof

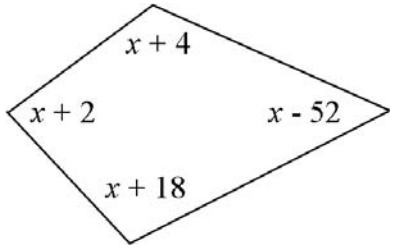
Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications.

In Grades 9 and 10, students formalize the development of inductive, deductive, and proportional reason, introduced in grades 7 and 8, as they make and defend generalizations and justify their reasoning using accepted standards of mathematical evidence and proof. Students' grasp of logical structure is extended to mathematical modeling in grades 11 and 12.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 1. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.		

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).		Example: • Find the measure of each angle in the quadrilateral below.  o Because the quadrilateral can be divided into two triangles, the sum of whose angles is 180, the sum of the angles of the quadrilateral is 360. $x + 2 + x + 18 + x - 52 + x + 4 = 360$ $4x - 28 = 360$ $4x = 396$ $x = 97$ Continued on next page

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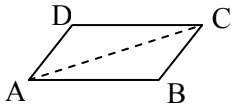
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
		Therefore, $x + 2 = 99$ $x + 18 = 115$ $x - 52 = 45$ $x + 4 = 101$ o Check by adding the angles to verify that their sum is 360. o Students can also justify each step according to the property used.
PO 3. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.		
PO 4. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning.		Students should know that conclusions or rules reached in inductive reasoning can then be used to reason deductively.
PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning.		Informal reasoning may be used in paragraph proofs, with manipulatives like geo boards, and in communicating geometric ideas through multiple representations. Formal reasoning is generally found in two-column proofs, flow chart proofs, and implication proofs (one-column with implication arrows).

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

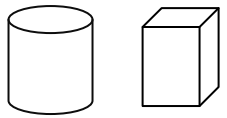
<table>
<tr><th>Performance Objectives</th><th>Process Integration</th><th>Explanations and Examples</th></tr>
<tr><td>Students are expected to:</td><td>Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.</td><td></td></tr>
<tr><td>PO 6. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.</td><td></td><td>Synthesize means to combine separate elements to form a coherent whole.
Students will use the properties of equality to analyze mathematical arguments.
Example:
• Study the following proof. Two of the reasons for the given statements are incorrect. Find the incorrect reasons. Recopy the Given, Prove, and the diagram. Rewrite the proof with the incorrect reasons corrected.

Given: $\square ABCD$
Prove: $\Delta ABC \cong \Delta CDA$
 

<table><tr><td>1. $\square ABCD$</td><td>1. Given</td></tr><tr><td>2. $\overline{AC} \cong \overline{AC}$</td><td>2. Reflexive property</td></tr><tr><td>3. $\overline{AB} // \overline{DC}$</td><td>3. Definition of a parallelogram</td></tr><tr><td>4. $\angle DCA \cong \angle BAC$</td><td>4. If 2 parallel lines are cut by a transversal, corresponding angles are congruent</td></tr><tr><td>5. $\angle D \cong \angle B$</td><td>5. Opposite angles of a parallelogram are congruent</td></tr><tr><td>6. $\Delta ABC \cong \Delta CDA$</td><td>6. SAS</td></tr></table></td></tr>
</table>

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 7. Find structural similarities within different algebraic expressions and geometric figures.		Examples: • The structures of the two algebraic statements below are similar and can be solved in the same manner. $x^2 = 16$ and $(x+2)^2 = 25$ • The structures of the two geometry figures below are similar in that they have a lateral area and two base areas. Their surface area can be found in the same manner.  • The similarity between the structures of an algebraic expression/equation and a geometric figure can be shown by in the following manner. • Consider the functions f(x) = x and g(x) = x + 3, where g(x) has a value that is 3 greater than f(x). Then consider the graph of f(x) and g(x) where the values of the graph of g(x) are 3 higher than that of f(x).

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 8. Use inductive reasoning to make conjectures, use deductive reasoning to analyze and prove a valid conjecture, and develop a counterexample to refute an invalid conjecture.		In deductive reasoning, a conclusion is alleged to follow with strict necessity from the premises (irrespective of the truth of the premises); in inductive reasoning, a conclusion is alleged to follow with mere probability from the premises (irrespective of the truth of the premises). Example: • The following argument is deductive: All humans are mortal. Socrates is human. Therefore, Socrates is mortal. • The following argument is inductive: Most humans are right-handed. Judy is a human. Therefore, Judy is probably right handed.
PO 9. State the inverse, converse, and contrapositive of a given statement and state the relationship between the truth value of these statements and the original statement.		The truth value of a statement is whether the statement is always, sometimes, or never true.
PO 10. List related *if… then* statements in logical order.		

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL (GRADES 9 AND 10)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 11. Draw a simple valid conclusion from a given *if…then* statement and a minor premise.		Example: • Given: If two angles have the same measure, then they are congruent. Minor Premise: $m\angle A = 60°$ and $m\angle B = 60°$ Conclusion: $\angle A \cong \angle B$
PO 12. Construct a simple formal deductive proof.		Formal deductive proofs can be in the form two-column proofs, flow chart proofs, and one column proofs using implication arrows. Students will use the properties of equality in the construction of a formal proof.
PO 13. Identify and explain the roles played by definitions, postulates, propositions and theorems in the logical structure of mathematics, including Euclidean geometry.		Axioms/Postulates/Common Notions are statements that are unproven/unprovable, but are accepted without proof. Propositions/Theorems are statements that have been proven (or can be proven) from postulates and/or from other theorems. Example: • Euclid's proof of the Pythagorean Theorem relies directly upon previously proven theorems, which in turn relies upon postulates/axioms constructed with commonly agreed upon definitions.

The bulleted items within a performance objective indicate the specific content to be taught.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Every student should understand and use all concepts and skills from the previous grade levels. The standard is designed so that new learning builds on preceding skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of all mathematical strands.

Strand 1: Number and Operations

Number sense is the understanding of numbers and how they relate to each other and how they are used in specific context or real-world application. It includes an awareness of the different ways in which numbers are used, such as counting, measuring, labeling, and locating. It includes an awareness of the different types of numbers such as, whole numbers, integers, fractions, and decimals and the relationships between them and when each is most useful. Number sense includes an understanding of the size of numbers, so that students should be able to recognize that the volume of their room is closer to 1,000 than 10,000 cubic feet. Students develop a sense of what numbers are, i.e., to use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to estimate to determine the reasonableness of results.

Concept 1: Number Sense

Understand and apply numbers, ways of representing numbers, and the relationships among numbers and different number systems.

In Grades 11 and 12, students apply skills from grades 9 and 10 in extending the real number system to the complex number system. Students further their understanding of radicals and exponents from grades 9 and 10 to convert fluently between radical and exponential forms of expressions.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Solve problems and equations that require the number system to be extended from real to complex numbers. Connections: MCWR-S1C2-01, MCWR-S1C2-02, MCWR-S1C2-03, MCWR-S1C2-05, MCWR-S1C2-06	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Examples: • Within which number system can $x^2 = -2$ be solved? Explain how you know. • Solve $x^2 + 2x + 2 = 0$ over the complex numbers.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Convert between radical and exponential forms of numerical expressions. Connections: MCWR-S3C3-01, MCWR-S3C3-02, MCWR-S3C3-05		Example: • $\sqrt[3]{5^2} = 5^{\frac{2}{3}}$; $5^{\frac{2}{3}} = \sqrt[3]{5^2}$

Strand 1: Number and Operations
Concept 2: Numerical Operations

Understand and apply numerical operations and their relationship to one another.

In Grades 11 and 12, students compare operations with real numbers from grades 9 and 10 to operations with complex numbers, applying DeMoirve's Theorem for calculations with complex numbers. Students investigate different forms of complex numbers and polar coordinates.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Explore different forms of complex numbers; determine if the properties of the real number system extend to complex numbers and matrices. Connections: MCWR-S1C1-01, MCWR-S1C2 -02, MCWR-S1C2-03, MCWR-S1C2-05, MCWR-S1C2-06	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Examples: • Given *a* and *b* are complex numbers, does $\sqrt{a} \bullet \sqrt{b} = \sqrt{ab}$? Explain your answer. • Simplify: $(i\sqrt{6})^2$. $= i^2(\sqrt{6})^2$ $= -1(6)$ $= -6$ • Rewrite 2 + 3i in another form.

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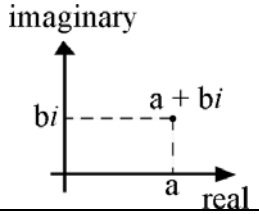
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Perform computations with complex numbers. Connections: MCWR-S1C1-01, MCWR-S1C2-01, MCWR-S1C2-03, MCWR-S1C2-05, MCWR-S1C2-06		Examples: • Multiply 7 – 4*i* and 10 + 6*i*. • Simplify $\frac{2-4i}{1+i}$ and express the answer in the form *a* + *bi*.
PO 3. Describe the relationship between real and complex numbers including plotting complex numbers as points in a plane. Connections: MCWR-S1C1-01, MCWR-S1C2-01, MCWR-S1C2-02, MCWR-S1C2-05, MCWR-S1C2-06	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • Plot the points corresponding to 3 – 2*i* and 1 + 4*i*. Add these complex numbers and plot the result. How is this point related to the two others? 

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Define polar coordinates; relate polar coordinates to Cartesian coordinates.	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Examples: • Represent complex numbers using polar coordinates, e.g., $a + bi = r(\cos\theta + \sin\theta)$. • Convert the polar coordinates $\left(2, \frac{\pi}{3}\right)$ to (x, y) form.
PO 5. Convert complex numbers to trigonometric form and then multiply the results. Connections: MCWR-S1C1-01, MCWR-S1C2-01, MCWR-S1C2-02, MCWR-S1C2-03, MCWR-S1C2-06		Examples: • Write $3 + 3i$ and $2 - 4i$ in trigonometric form. Solution: $z_1 = 3\sqrt{2}(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = 2\sqrt{5}(\cos\theta_2 + i\sin\theta_2)$ • Now multiply the results. What do you notice about the product?
PO 6. Apply DeMoivre's Theorem to calculate products, powers, and roots of complex numbers. Connections: MCWR-S1C1-01, MCWR-S1C2-01, MCWR-S1C2-02, MCWR-S1C2-03, MCWR-S1C2-05	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MCWR-S5C2-02. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Simplify $(1 - i)^{23}$. • Find the sixth root of z = - 64. Note that, in polar form, $z = 64(\cos\pi + i\sin\pi)$.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 1: Number and Operations
Concept 3: Estimation

Use estimation strategies reasonably and fluently while integrating content from each of the other strands.

In Grades 11 and 12, students deepen their analysis of estimation problems begun in grades 9 and 10 to investigate the concepts of error and tolerance.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Recognize the limitations of estimations by assessing the amount of error resulting from estimation and determining whether the error is within acceptable tolerance limits. Connections: MCWR-S2C1-01, MCWR-S2C1-02, MCWR-S2C2-03, MCWR-S4C4-01, SCHS-S5C3-04, SCHS-S6C3-05	MCWR-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	The margin of error and tolerance limit varies according to the measure, tool used, and context.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 2: Data Analysis, Probability, and Discrete Mathematics

This strand requires students to use data collection, data analysis, statistics, probability, systematic listing and counting, and the study of graphs. This prepares students for the study of discrete functions as well as to make valid inferences, decisions, and arguments. Discrete mathematics is a branch of mathematics that is widely used in business and industry. Combinatorics is the mathematics of systematic counting. Vertex-edge graphs are used to model and solve problems involving paths, networks, and relationships among a finite number of objects.

Concept 1: Data Analysis (Statistics)

Understand and apply data collection, organization, and representation to analyze and sort data.

In Grades 11 and 12, students use analysis techniques refined in grades 9 and 10 to investigate statistical design and more advanced statistical measures.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Solve problems by estimating and computing with one-variable and two-variable data. Connections: MCWR-S1C3-01, MCWR-S2C2-03	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	A one-variable data set might be a list of employees and the number of days of sick leave they took in a calendar year; a two variable data set might be a list of employees, their age, and the number of days of sick leave they took in a calendar year.
PO 2. Compare data sets using graphs and summary statistics, including variance and standard deviation, with or without technology. Connections: MCWR-S1C3-03, MCWR-S2C1-03, MCWR-S2C1-05, MCWR-S2C1-09, SCHS-S1C3-06, SCHS-S1C4-02, SSHS-S1C1-01, SSHS-S2C1-01, SSHS-S4C1-03	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • Given a set of test scores: 99, 96, 94, 93, 90, 88, 86, 77, 70, 68, find the mean and standard deviation. Explain how the values vary about the mean. What information does this give the teacher?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

<table>
<tr><th>Performance Objectives</th><th>Process Integration</th><th>Explanations and Examples</th></tr>
<tr><td>Students are expected to:</td><td></td><td></td></tr>
<tr><td>PO 3. Compute and explain summary statistics for distributions of data including measures of center and spread, including variance and standard deviation.

Connections: MCWR-S2C1-02, MCWR-S2C2-02, SCHS-S1C3-06</td><td>MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.</td><td>Students should be able to identify unimodality, symmetry, and the shape of a curve to determine whether a curve could reasonably be approximated by a normal distribution.

Common examples of distributions that are approximately normal include physical performance measurements (e.g., weightlifting, timed runs), heights, and weights.

Example:
• The table below shows the individual weights of items shipped from a company. Find the mean weight of the objects and the standard deviation. What information does this give the shipping department?

<table>
<tr><th>WEIGHT (in grams)</th><th>Frequency</th></tr>
<tr><td>2.99</td><td>1</td></tr>
<tr><td>3.01</td><td>4</td></tr>
<tr><td>3.03</td><td>4</td></tr>
<tr><td>3.05</td><td>7</td></tr>
<tr><td>3.07</td><td>17</td></tr>
<tr><td>3.09</td><td>24</td></tr>
<tr><td>3.11</td><td>13</td></tr>
<tr><td>3.13</td><td>6</td></tr>
<tr><td>3.15</td><td>2</td></tr>
<tr><td>3.17</td><td>1</td></tr>
</table>
</td></tr>
</table>

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Explain how sampling methods, bias, and the phrasing of questions asked during data collections impact the conclusions that can be drawn. Connections: MCWR-S2C1-05, SCHS-S1C3-04, SSHS-S1C10-01, SSHS-S2C9-05	MCWR-S5C2-03. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	Students will explain how to design a survey that is random and not biased in nature. Example: • Thomas designed a survey to determine what students thought about the last student assembly. There were five possible answers: strongly agree, somewhat agree, not sure somewhat disagree and strongly disagree. He included the following statements: 1. "The assembly ran too long.", 2. "The assembly did not have enough student games", 3. "The assembly program had enough student led parts.", 4. " It took too long to get the assembly program started.", and 5. "I would like to have another assembly like this one.". He asked 5 senior homeroom classes, 4 sophomore homeroom classes, and 5 junior homeroom classes, and 5 freshman P.E. classes to take the survey. Analyze the survey Thomas created and the sample of students he asked. How (if at all) will each affect the conclusions drawn from the survey? How (if at all) might each be changed to improve the quality of the information gathered?
PO 5. Identify misleading uses of data and explain why they are misleading. Connections: MCWR-S2C1-02, MCWR-S2C1-04, SCHS-S1C3-03, SSHS-S1C10-01, SSHS-S2C9-05	MCWR-S5C2-11. Determine under what conditions a given statement (algebraic, geometric) is true.	As a strategy, collect reports published in the media and ask students to consider the source of the data, the design of the study, and the way the data are analyzed and displayed.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 6. Explain the differences between randomized experiments and observational studies and determine the appropriateness of using each in given situations. Connections: SCHS-S1C2-03	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Students should be able to explain techniques for randomly selecting study subjects from a population and how those techniques differ from those used to randomly assign existing subjects to control groups or experimental groups in a statistical experiment.
PO 7. Determine when arguments based on data mistake correlation for causation. Connections: SCHS-S1C3-02, SCHS-S1C3-03	MCWR-S5C2-11. Determine under what conditions a given statement (algebraic, geometric) is true.	Some data leads observers to believe that there is a cause and effect relationship when a strong relationship is observed, but the criteria for determining a cause and effect relationship is clear and consistent. Students should be careful not to assume correlation, as it does not imply causation. The determination that one thing causes another requires data from a randomized experiment. Example: • Diane did a study for a health class about the effects of a student's end-of-year math test scores on height. Based on a graph of her data, she found that there was a direct relationship between students' math scores and height. She concluded that "doing well on your end-of-course math tests makes you tall." Is this conclusion justified? Explain any flaws in Diane's reasoning.
PO 8. Draw a line of best fit for a scatterplot with or without technology, describe how the correlation coefficient relates to fit, and explain when it is appropriate to use the regression equation to make predictions. Connections: MCWR-S3C2-01, SCHS-S1C3-01	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Examples: • Measure the wrist and neck size of each person in your class and make a scatterplot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fit of the linear equations. Continued on next page

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Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• Min lights a candle and records its height in centimeters every minute. The results recorded as (time, height) are (0, 20), (1, 18.3), (2, 16.5), (3, 14.8), (4, 13.2), (5, 11.5), (5, 10.0), (7, 8.2), (9, 4.9), and (10, 3.1). Find the line of best fit to express the candle's height as a function of time and state the meaning of the slope in terms of the burning candle. Predict the height in 0.75 of an hour.
PO 9. Use matrices to organize and represent data. Connections: MCWR-S2C1-02, MCWR-S3C3-04, SCHS-S1C4-03		Example: • Write an inventory matrix for the following situation. A teacher is buying supplies for two art classes. For class 1, the teacher buys 24 tubes of paint, 12 brushes, and 17 canvases. For class 2, the teacher buys 20 tubes of paint, 14 brushes and 15 canvases. Solution: $\begin{matrix} & P & B & C \\ \text{Class 1} & 24 & 12 & 17 \\ \text{Class 2} & 20 & 14 & 15 \end{matrix}$

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 2: Probability

Understand and apply the basic concepts of probability.

In Grades 11 and 12, students apply their knowledge of probability and experimental design to make predictions and solve advanced problems with estimation and exact calculations for probabilities of independent and dependent events and one- and two-variable data.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Apply probability concepts to calculate the probability of events and to make informed decisions in practical situations. Connections: MCWR-S2C2-04	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • You and two friends go to the grocery store and each buys a soda. If there are five different kinds of soda, and each friend is equally likely to buy each variety, what is the probability that no one buys the same kind?
PO 2. Use the principal characteristics of the normal distribution to estimate probabilities. Connections: MCWR-S2C1-03	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	The principal characteristics of the normal distribution include: • a single peak, or mode, at the line of symmetry; • the right side of a curve is a mirror image of the left side; • the curve drops off smoothly on both sides, flattening toward the x-axis but never quite reaching it, stretching infinitely far in both directions; and • inflection points on either side of the mode where the curve changes from concave-down to concave-up.
PO 3. Estimate probabilities and predict outcomes using one- and two-variable data. Connections: MCWR-S1C3-01, MCWR-S2C1-01, SCHS-S1C1-04	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • You are on a chess team made up of 15 players. What is the probability that you will be chosen if a 3-person team is selected at random?

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Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Determine the conditional probability of an event given that another event occurs, decide if two events are dependent or independent, and determine the probability of an event given the probability of the complementary event. Connections: MCWR-S2C2-01	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Examples: • What is the probability of drawing a heart from a standard deck of cards on a second draw, given that a heart was drawn on the first draw and not replaced? Are these events independent or dependent? • Given the probability of not receiving a spam email in one day without an email filter is $\frac{1}{280500}$. What is the probability you will receive a spam email in one day without using an email filter?

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 3: Systematic Listing and Counting

Understand and demonstrate the systematic listing and counting of possible outcomes.

In Grades 11 and 12, students apply counting techniques from grades 9 and 10 to calculate and solve problems related to combinations and permutations using Pascal's Triangle and the binomial theorem.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Use the binomial theorem and Pascal's Triangle to solve problems. Connections: MCWR-S2C3-02	MCWR-S5C2-09. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Use Pascal's Triangle to expand the expression $(2x-1)^4$. • Find the middle term in the expansion of $(x^2+2)^{18}$.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

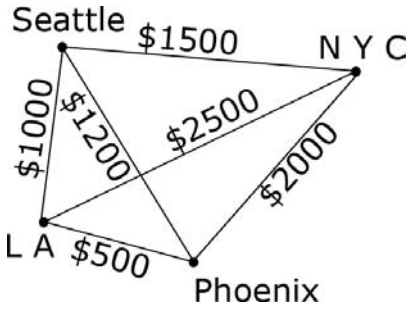
Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Demonstrate the connections between the binomial coefficients, entries of Pascal's triangle, and combinations. Connections: MCWR-S2C3-01	MCWR-S5C2-02. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: 1 1 1 1 2 1 1 3 3 1 $(x+1)^3 = x^3+3x^2+3x+1$ 1 4 6 4 1 ↑ ↑ ↑ ↑ ↑ $_4C_0$ $_4C_1$ $_4C_2$ $_4C_3$ $_4C_4$

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 2: Data Analysis, Probability, and Discrete Mathematics
Concept 4: Vertex-Edge Graphs

Understand and apply vertex-edge graphs.

In Grades 11 and 12, students extend their understanding of networks to devise, analyze, and apply algorithms for solving problems related to circuits, shortest paths, minimum weight spanning trees, and adjacency matrices.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices. Connections: MCWR-S2C4-02, MCWR-S2C4-03, MCWR-S2C4-04	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Example: • A businesswoman in Phoenix is planning a trip to visit clients in Seattle, Los Angeles and New York City before returning to Phoenix. The figure below gives the cost in dollars of traveling from one city to another. Find the order in which these cities should be visited so the total travel cost is at a minimum.  Note that the businesswoman's trip is the same as a circuit that starts at vertex 1 (Phoenix), visits each other vertex exactly once, and returns to vertex 1. In other words, the circuit is a Hamiltonian circuit, and the businesswoman's task is to find the Hamiltonian circuit of least total weight (given the weighted graph).

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings. Connections: MCWR-S2C4-01, MCWR-S2C4-03, MCWR-S2C4-04, SSHS-S4C1-03	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Examples: • Find a minimal route that includes every street (e.g., for trash pick up). • Find the shortest network connecting specified sites.
PO 3. Devise, analyze, and apply algorithms for solving vertex-edge graph problems. Connections: MCWR-S2C4-01, MCWR-S2C4-02, MCWR-S2C4-04	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	In exploring minimum spanning tree situations students devise, analyze, and apply algorithms as they adopt strategies to confront the problem. Such strategies can lead to Kruskal's algorithm, Prim's algorithm, or the "nearest neighbor" algorithm. Example: • Susan is a city planner in charge of the development of roads for a recreational area. The graph shows locations in the area, the possible roads that could be built between locations, and the cost in thousands of dollars to build each road. Find the smallest possible cost of building enough roads to connect the locations. **Algorithm to Find a Minimum Spanning Tree in a Connected Graph** Given a connected graph with weights on the edges: Step 1. List the edges of the graph by increasing weights. Step 2. Choose the edge with the smallest weight. Step 3. Continue to choose the next edge with the smallest weight as long as choosing that edge does not create a circuit. Step 4. Stop when the result is a spanning tree. Continued on next page

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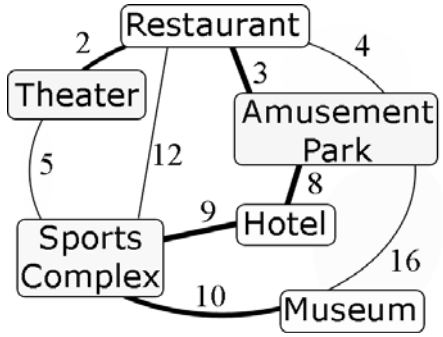
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		The graph shown is the original graph and also shows the spanning tree (bolded edges) that would be produced by applying the algorithm. The smallest possible cost to build roads connecting all the sites would be to build a road between the theater and restaurant (2), between the restaurant and amusement park (3), between the amusement park and hotel (8), between the hotel and the sports complex (9), and between the sports complex and the museum (10). There is a minimum total cost of $32,000 to build the roads at the recreational area. 
PO 4. Extend work with adjacency matrices for graphs, such as interpreting row sums and using the nth power of the adjacency matrix to count paths of length *n* in a graph. Connections: MCWR-S2C4-01, MCWR-S2C4-02, MCWR-S2C4-03, MCWR-S3C3-09		The adjacency matrix of a simple graph is a matrix with rows and columns labeled by graph vertices, with a 1 or a 0 in position (v_i, v_j) according to whether v_i and v_j are adjacent or not. A "1" indicates that there is a connection between the two vertices, and a "0" indicates that there is no connection.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 3: Patterns, Algebra, and Functions

Patterns occur everywhere in nature. Algebraic methods are used to explore, model and describe patterns, relationships, and functions involving numbers, shapes, iteration, recursion, and graphs within a variety of real-world problem solving situations. Iteration and recursion are used to model sequential, step-by-step change. Algebra emphasizes relationships among quantities, including functions, ways of representing mathematical relationships, and the analysis of change.

Concept 1: Patterns

Identify patterns and apply pattern recognition to reason mathematically while integrating content from each of the other strands.

In Grades 11 and 12, students employ modeling and algebraic skills developed in grades 9 and 10 to analyze sequences and series, distinguish between explicit and recursive formulas, and solve problems involving recursion.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Analyze sequences and series and use them in modeling, including • ***explicit formulas for nth terms,*** • ***sums of finite arithmetic series, and*** • ***sums of finite geometric series.*** Connections: MCWR-S3C1-02, MCWR-S3C1-03, MCWR-S3C1-04, MCWR-S3C1-05	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Models include algebraic formulas. Examples: • Write a recursive formula for the geometric sequence 5, 10, 20, 40, … and determine the 100^{th} term. • Find the sum of the first 10 terms of the arithmetic sequence 3, 7, 11, 15, …
PO 2. Apply recursive formulas for arithmetic and geometric sequences to solve problems. Connections: MCWR-S3C1-01, MCWR-S3C1-03, MCWR-S3C1-04		Example: • There are 2,500 fish in a pond. Each year the population decreases by 25 percent, but 1,000 fish are added to the pond at the end of the year. Find the population in five years. Also, find the long-term population.
PO 3. Distinguish between explicit and recursive formulas and convert between them, making good choices about when to use which. Connections: MCWR-S3C1-01, MCWR-S3C1-02, MCWR-S3C1-04	MCWR-S5C2-05. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.	An explicit rule for the *n*th term of a sequence gives a_n as a function of the term's position *n*; a recursive rule gives the first term of a sequence, and a recursive equation relates a_n to the preceding term(s).

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 4. Solve problems involving recursion. Connections: MCWR-S3C1-01, MCWR-S3C1-02, MCWR-S3C1-03, MCWR-S3C1-05, SSHS-S5C5-03	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Example: • Write a recursion equation to model the following situation: You buy a $10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of $250. Find the number of months needed to pay off the car.
PO 5. Use and interpret sigma notation to represent summation. Connections: MCWR-S3C1-01, MCWR-S3C1-04		Examples: • Write the sum of 1+ 4 + 9 + 16 + 25 + … + n^2 using sigma notation. • Evaluate $\sum_{k=1}^{20}(2k-1)$.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 3: Patterns, Algebra, and Functions
Concept 2: Functions and Relationships

Describe and model functions and their relationships.

In Grades 11 and 12, students build on their previous experience analyzing linear and quadratic functions to express and solve problems that can be modeled using linear, quadratic, logarithmic, exponential, cubic, reciprocal, absolute value, and step and other piecewise-defined functions. Students combine functions, analyze properties of functions and their inverses, and the key attributes of functions represented algebraically and graphically.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Express and solve problems that can be modeled using linear, quadratic, logarithmic, exponential, cubic, reciprocal, absolute value, and step and other piecewise-defined functions; interpret their solutions in terms of the context. Connections: MCWR-S2C1-08, MCWR-S3C2-03, MCWR-S3C2-04, MCWR-S3C2-05, MCWR-S3C2-06, SCHS-S5C4-03	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Example: • Make a model to describe the path a bullet takes after being fired from a gun 3.5 m from the ground traveling 400 m/s and hitting the ground 2,200 m from where it was shot (assuming a constant deceleration). How far would it travel in 4 seconds?
PO 2. Use function notation flexibly and evaluate a function at a value represented by an algebraic expression. Connections: MCWR-S3C2-07, MCWR-S3C2-12	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Let $f(x) = 2(x+3)^2$. Find $f(3)$, $f(-\frac{1}{2})$, $f(a)$, and $f(a-h)$.
PO 3. Graph absolute value, and step and other piecewise-defined functions identifying their key characteristics. Connections: MCWR-S3C2-01, MCWR-S3C2-07	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Key characteristics include but are not limited to maximum, minimum, intercepts, symmetry, vertex, end behavior, and asymptotes. Continued on next page

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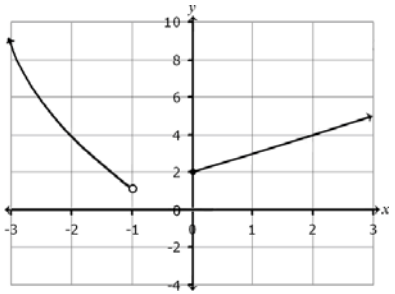
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		Examples: • Describe key characteristics of the graph of $f(x) = \lvert x - 3 \rvert + 5$. • Sketch the graph and identify the key characteristics of the function described below. $F(x) = \begin{cases} x + 2 \text{ for } x \geq 0 \\ -x^2 \text{ for } x < -1 \end{cases}$ 
PO 4. Graph exponential functions identifying their key characteristics. Connections: MCWR-S3C2-01, MCWR-S3C2-07, MCWR-S3C2-13	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Key characteristics include but are not limited to maximum, minimum, intercepts, symmetry, vertex, end behavior, and asymptotes. Example: • Determine an exponential function of the form $f(x) = ab^x$ using data points from the table. Graph the function and identify the key characteristics of the graph. x | $f(x)$ 0 | 1 1 | 3 3 | 27

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 5. Sketch the graphs and determine the key characteristics of power functions in the form f(x) = ax^n, a≠ 0, for positive integral values of n. Connections: MCWR-S3C2-01, MCWR-S3C2-07	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Key characteristics include but are not limited to maximum, minimum, intercepts, symmetry, vertex, end behavior, and asymptotes. Example: • Compare the graphs of $y = 3x^2$ and $y = 3x^3$.
PO 6. Graph polynomial functions identifying their key characteristics Connections: MCWR-S3C2-01, MCWR-S3C2-07, MCWR-S3C2-11, MCWR-S3C2-12, MCWR-S3C3-08	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Key characteristics include but are not limited to maximum, minimum, intercepts, symmetry, vertex, end behavior, and asymptotes. Example: • How is the graph of $f(x) = -5(x-3)^2 + 2$ related to the graph of $f(x) = x^2$?
PO 7. Find domain, range, intercepts, zeros, asymptotes, and points of discontinuity of functions.	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Let $R(x) = \frac{2}{\sqrt{x-2}}$. Find the domain of $R(x)$. Also find the range, zeros, and asymptotes of $R(x)$.
PO 8. Find the major and minor axes, intercepts and asymptotes of conic sections.		Example: • Graph $\frac{(x-1)^2}{9} - \frac{(y+3)^2}{4} = 0$. o Describe the conic section including its domain, range, intercepts, and asymptotes.
PO 9. Find domain, range, intercepts, period, amplitude, and asymptotes of trigonometric functions. Connections: SCHS-S5C5-02	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Graph $f(x) = 2\tan x - 1$. Describe its domain, range, intercepts, and asymptotes.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 10. Given a function • ***find the inverse of the function,*** • ***determine whether the inverse is a function,*** • ***explain why the graph of a function and its inverse are reflections of each other over the line y = x.*** Connections: SCHS-S5C2-06	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Examples: • Find the inverse function of $h(x) = (x - 2)^3$ and determine whether $h^{-1}(x)$ is a function. • Graph h(x) and $h^{-1}(x)$ and explain how they relate to each other graphically.
PO 11. Find approximate solutions for polynomial equations with or without graphing technology. Connections: MCWR-S3C2-06, MCWR-S3C2-12, MCWR-S3C3-08, SCHS-S5C2-06	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Example: • Use the trace function on your graphing calculator to approximate the solution of $x^4 - 3x^3 + 2x - 7 = 0$ to the nearest tenth.
PO 12. Use theorems of polynomial behavior (including but not limited to the Fundamental Theorem of Algebra, Remainder Theorem, the Rational Root Theorem, Descartes Rule of Signs, the Conjugate Root Theorem) to find the zeros of a polynomial function. Connections: MCWR-S3C2-06, MCWR-S3C2-11, MCWR-S3C3-08	MCWR-S5C2-02. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Examples: • Use Descartes' Rule of Signs to determine how many positive and how many negative real zeros the polynomial can have. Then determine the possible number of real zeros. $P(x) = 2x^3 - x^2 - x + 5$ • List all possible rational zeros given by the Rational Root Theorem for the polynomial below. $F(x) = 12x^5 + 3x^4 + 6x^3 - 2x - 8$

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 13. Relate logarithms and exponential functions as inverses, prove basic properties of a logarithm using properties of its inverse, and apply those properties to solve problems. Connections: MCWR-S3C2-01	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Properties of Logarithms (These apply to all bases, including base *e*.): • $\log_a 1=0$ • $\log_a a=1$ • $\log_a a^x=x$ • $a^{\log_a x} = x$ • $a^x \bullet a^y = a^{x+y}$ and $\log_a (xy) = \log_a x + \log_a y$ • $\frac{a^x}{a^y} = a^{x-y}$ and $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$ Examples: • Find the inverse of $f(x) = 3(10)^{2x}$. • Use the properties of logarithms to evaluate $\ln\frac{1}{e^3}$.
PO 14. Combine functions by composition, as well as by addition, subtraction, multiplication, and division including any necessary restrictions on the domain.	MCWR-S5C2-06. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.	Examples: • Let $f(x) = x^3$ and $g(x) = x - 2$. Find $f(g(x))$ and f(f(g(x))). • Let $f(x) = 7x + 2$ and $g(x) = x^2$. Find $f(x) \bullet g(x)$.
PO 15. Determine if functions are even, odd, or neither both algebraically and graphically. Connections: MCWR-S3C2-03, MCWR-S3C2-04, MCWR-S3C2-05, MCWR-S3C2-06	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Is $f(x) = \tan x$ even, odd, or neither? Explain your answer. • Is $f(x) = x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 16. Identify the degree of a given polynomial function and write a polynomial function of a given degree. Connections: MCWR-S3C2-01, MCWR-S3C2-06	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Write an equation with a degree of three that has solutions $x = 2$, $x = 5i$ and $x = -5i$. • Write a 4th degree polynomial function whose roots are ± 4 and $3i$. • What is the degree of the polynomial: $2x^2y^2 + 3x^2 - 4x^3 - 1$?
PO 17. Develop an informal notion of limits.	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Students can estimate limits from graphs and tables of values to develop an informal notion of limits. They can also come to a conceptual understanding that a limit, if one exists, is the value that the dependent variable approaches as the independent variable approaches a given value. We write $\lim_{x \to a} f(x) = L$ and say "the limit of *f*(*x*), as *x* approaches *a*, equals *L"* if we can make the values of *f(x)* arbitrarily close to *L* (as close to *L* as we like) by taking *x* to be sufficiently close to *a*, but not equal to *a*. Students can best develop this understanding through exploration and investigation (e.g.; exploring how many rectangles of a given size can fit below a curve but above the horizontal axis on a coordinate grid).

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 3: Patterns, Algebra, and Functions
Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

In Grades 11 and 12, students expand their understanding of and operations on expressions learned in grades 9 and 10 to include radical expressions and division of expressions. Students solve larger systems, expand the representations of and operations performed on matrices, and perform operations on vectors. Students deepen their understanding of algebraic structure through analysis and justification. Finally, students analyze the relationships among the solutions of equations and functions; and attributes of their graphical and algebraic representations.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Rewrite and describe the need for equivalent forms of algebraic expressions. Connections: MCWR-S1C1-02, MCWR-S3C3-02	MCWR-S5C2-11. Determine under what conditions a given statement (algebraic, geometric) is true.	Examples: • Simplify $2(x^3 – 3x^2 + x – 6) – (x – 3)(x + 4)$, explaining why you take each step. • Simplify the expression below and eliminate any negative exponent(s). o $\frac{(2x^3)^2(3x^4)}{(x^2)^3}$ • The Pythagorean Theorem is usually written in the following way: $a^2 + b^2 = c^2$. Why might the theorem need to be rewritten in terms of c? Rewrite the theorem in terms of c and write a problem situation to match the equivalent form of the Pythagorean Theorem you just made. • Motion can be described by the formula below, where t = time elapsed, u=initial velocity, a = acceleration, and s = distance traveled. $s = ut+½at^2$ Why might the equation need to be rewritten in terms of a? Rewrite the equation in terms of a.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Apply the laws of exponents including rational and negative exponents to rewrite expressions in alternative forms. Connections: MCWR-S1C1-02, MCWR-S3C3-01		Examples: • Rewrite using fractional exponents: $\sqrt[5]{16} = \sqrt[5]{2^4} = 2^{\frac{4}{5}}$ • Rewrite $\frac{\sqrt{x}}{x^2}$ in at least three alternate forms. Solution: $x^{-\frac{3}{2}} = \frac{1}{x^{\frac{3}{2}}} = \frac{1}{\sqrt{x^3}} = \frac{1}{x\sqrt{x}}$
PO 3. Solve systems of three linear equations in three variables with or without technology. Connections: MCWR-S3C3-04	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Solve the system of equations: $x - 2y + 3z = 5$, $x + 3z = 11$, $5y - 6z = 9$. • The opera theater contains 1,200 seats, with three different price levels. One level costs $45 dollars per seat, one level costs $50 per seat, and one level costs $60 per seat. The opera needs to gross $63,750 on seat sales. There are twice as many $60 seats as $45 seats. How many seats in each level need to be sold?
PO 4. Use matrices to represent everyday problems that involve systems of linear equations. Connections: MCWR-S2C1-09, MCWR-S3C3-03, MCWR-S3C3-09	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • A chemist has three acidic solutions with varying concentrations. The first is 10% acid, the second is 20% acid, and the third is 25% acid. How many milliliters of each should the chemist use to make 200 mL of 16% solution if she has to use three times as much of the 10% solution as the 25% solution?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 5. Simplify radical expressions by performing operations on them. Connections: MCWR-S1C1-02	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Evaluate $\sqrt[4]{2^{-4}}$. • Simplify $\sqrt[3]{x^3+3x^2+3x+1}$.
PO 6. Divide a polynomial by a lower degree polynomial. Connections: MCWR-S3C2-14	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Divide $2x^3 - 3x^2 + x - 6$ by $x^2 + 2$. • Simplify: $\frac{x^3-1}{x-1}$.
PO 7. Find complex solutions for quadratic equations. Connections: MCWR-S3C3-08	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Find all solutions of the equation below and express them in the form *a* + *bi.* $2x^2 + 5 = 2x$
PO 8. Describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial expression with and without technology.	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Quadratic functions are commonly used to maximize area or model the height of an object moving under the force of gravity. Examples: • Solve $x^4 + x^3 - 7x - x + 6 = 0$, given that $x - 2$ and $x + 3$ are factors of $x^4 + x^3 - 7x - x + 6$. • Factor and solve $x^3 + 4x^2 - 59x - 126 = 0$. Sketch its graph and locate the x-intercepts (zeros). What is the relationship between the factors, solutions, and x-intercepts/zeros of the polynomial?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 9. Use matrix operations and the inverse of a matrix to solve problems. Connections: MCWR-S3C3-04		Students will perform multiplication, addition, subtraction, and scalar multiplication of matrices. They will use the inverse of a matrix to solve a matrix equation. Example: • Solve the system of equations by converting to a matrix equation and using the inverse of the coefficient matrix. $\begin{cases} 5x+2y=4 \\ 3x+2y=0 \end{cases}$ Solution: Make matrix A with $A=\begin{bmatrix} 5 & 2 \\ 3 & 2 \end{bmatrix}$ Matrix $X=\begin{bmatrix} x \\ y \end{bmatrix}$ Matrix $B=\begin{bmatrix} 4 \\ 0 \end{bmatrix}$ $X=A^{-1}B$ $\begin{bmatrix} x \\ y \end{bmatrix}=\begin{bmatrix} 2 & -2 \\ -3 & 5 \end{bmatrix}\begin{bmatrix} 4 \\ 0 \end{bmatrix}=\begin{bmatrix} 8 \\ -12 \end{bmatrix}$
PO 10. Represent vectors as matrices.		A matrix is a two dimensional array with rows and columns; a vector is a one dimensional array that is either one row or one column of the matrix. Students will use matrices of vectors to represent and transform geometric objects in the coordinate plane. They will explain the relationship between the ordered pair representation of a vector and its graphical representation.

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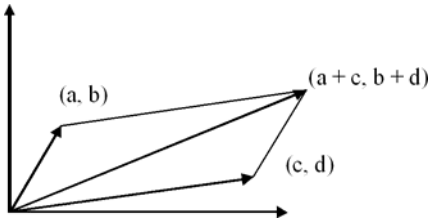
Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 11. Add, subtract, and compute the dot product of two-dimensional vectors; multiply a two-dimensional vector by a scalar.		Addition of vectors can determine the resultant of two given vectors.  Example: • Find $3\boldsymbol{u} - 4\boldsymbol{v}$ given $\boldsymbol{u} = \langle -2, -8 \rangle$ and $\boldsymbol{v} = \langle 2, 8 \rangle$.

Strand 3: Patterns, Algebra, and Functions
Concept 4: Analysis of Change

Analyze how changing the values of one quantity corresponds to change in the values of another quantity.

In Grades 11 and 12, students apply their understanding of rate of change from grades 9 and 10 to using functions and problems involving finance.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Analyze and describe how a change in an independent variable leads to a change in a dependent variable. Continued on next page Connections: SCHS-S5C2-01, SSHS-S5C2-02	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Examples: • A computer store sells about 200 computers at the price of $1,000 per computer. For each $50 increase in price, about ten fewer computers are sold. How much should the computer store charge per computer in order to maximize their profit? • In order to reduce forest fires, agencies flash burn underbrush periodically to insure it does not become too thick. Write a possible equation relating the time between burns and the thickness of the underbrush. Based on your equation, explain how the frequency of burns affects the thickness of the underbrush.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Identify patterns in a function's rate of change, including intervals of increase, decrease, and constancy; if possible, relate them to the function's verbal description or its graph. Connections: SCHS-S3C3-03, SCHS-S5C2-01	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Example: • Let $f(x) = 5x^3 - x^2 - 5x + 1$. Graph the function and identify end behavior and any intervals of constancy, increase, and decrease.
PO 3. Analyze change in various contexts by modeling and solving word problems using functions and equations. Connections: MCWR-S3C2-01	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Example: • A cell phone company has three plans: 1. $59.95/month for 700 minutes and $0.25 for each additional minute, 2. $39.95/month for 400 minutes and $0.15 for each additional minute, and 3. $89.95/month for 1,400 minutes and $0.05 for each additional minute. Graph the equation for each plan, and analyze the change as the number of minutes used increases. When is it beneficial to enroll in Plan 1? Plan 2? Plan 3?
PO 4. Compare relative magnitudes of functions and their rates of change. Connections: MCWR-S3C2-16, MCWR-S4C2-01, MCWR-S4C2-02, MCWR-S4C2-03, MCWR-S4C2-04	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Contrast the growth of the $f(x)=x^3$ and $f(x)=3^x$.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 5. Solve problems involving compound interest. Connections: MCWR-S3C4-06, SSHS-S5C5-03	MCWR-S5C2-01. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.	Students will compare interest rate calculations and annual percentage rate calculations to distinguish between the two rates. Examples: • A couple wants to buy a house in five years. They need to save a down payment of $8,000. They deposit $1,000 in a bank account earning 3.25% interest, compounded quarterly. How much will they need to save each month in order to meet their goal? • A function $f(n) = 1000(1 + 0.05)^n$ is used to model the amount of money in a savings account that earns 5% interest, compounded annually. Identify the domain and range of this function. What restrictions on the domain of this function should be considered for the model to correctly reflect the situation?
PO 6. Demonstrate the relationship between • simple interest and linear growth • compound interest and exponential growth. Connections: MCWR-S3C4-05, SSHS-S5C5-03, SSHS-S5C5-06	MCWR-S5C2-10. Differentiate, interpret, apply, and develop concepts in the context of personal and professional situations.	Students will investigate formulas and graphs for different situations with simple and compound interest. Examples: • Sketch and analyze the graphs of the following two situations. What information can you conclude about the types of growth each type of interest has? o Lee borrows $9,000 from his mother to buy a car. His mom charges him 5% interest a year, but she does not compound the interest. o Lee borrows $9,000 from a bank to buy a car. The bank charges 5% interest compounded annually. • Calculate the future value of a given amount of money, with and without technology. • Calculate the present value of a certain amount of money for a given length of time in the future, with and without technology.

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The performance objectives highlighted in italics have been identified as core to an Algebra II course.

MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 7. Determine the total cost of purchasing consumer durables over time given different down payments, financing options, and fees. Connections: SSHS-S5C5-03, SSHS-S5C5-05	MCWR-S5C2-10. Differentiate, interpret, apply, and develop concepts in the context of personal and professional situations.	Examples: • Calculate the following fees with a mortgage: o discount points o origination fee o maximum brokerage fee on a net or gross loan o documentary stamps o prorated expenses (interest, county and/or city property taxes, and mortgage on an assumed mortgage) • Compare the cost of paying a higher interest rate and lower points versus a lower interest rate and more points.
PO 8. Apply a variety of strategies to use tax tables and determine, calculate, and complete yearly federal income tax.	MCWR-S5C2-10. Differentiate, interpret, apply, and develop concepts in the context of personal and professional situations.	
PO 9. Develop a personal budget including debit, checking, and savings accounts by interpreting multiple personal budget examples. Connections: SSHS-S5C5-01, SSHS-S5C5-03, SSHS-S5C5-04, SSHS-S5C5-05, SSHS-S5C5-06	MCWR-S5C2-09. Use mathematical models to represent and analyze personal and professional situations.	
PO 10. Determine an effective retirement savings plan to meet personal financial goals including IRAs, ROTH accounts, and annuities. Connections: SSHS-S5C5-05	MCWR-S5C2-09. Use mathematical models to represent and analyze personal and professional situations.	An IRA is an “Individual Retirement Account,” and a ROTH is a specific type of IRA, with a more complex tax-advantaged structure.
PO 11. Compare and contrast the role of insurance as a device to mitigate risk and calculate expenses of various options. Connections: SSHS-S5C5-01	MCWR-S5C2-09. Use mathematical models to represent and analyze personal and professional situations.	Different types of insurance to be discussed include but are not limited to: health, automobile, property, rental, and life insurance.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 4: Geometry and Measurement

Geometry is a natural place for the development of students' reasoning, higher thinking, and justification skills culminating in work with proofs. Geometric modeling and spatial reasoning offer ways to interpret and describe physical environments and can be important tools in problem solving. Students use geometric methods, properties and relationships, transformations, and coordinate geometry as a means to recognize, draw, describe, connect, analyze, and measure shapes and representations in the physical world. Measurement is the assignment of a numerical value to an attribute of an object, such as the length of a pencil. At more sophisticated levels, measurement involves assigning a number to a characteristic of a situation, as is done by the consumer price index. A major emphasis in this strand is becoming familiar with the units and processes that are used in measuring attributes.

Concept 1: Geometric Properties

Analyze the attributes and properties of 2- and 3- dimensional figures and develop mathematical arguments about their relationships.

In Grades 11 and 12, students use their understanding of Euclidean geometry, from grades 9 and 10, to perform geometric constructions and explore non-Euclidean geometries.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Perform basic geometric constructions using a variety of methods, including • perpendicular bisector of a line segment, • bisector of an angle • perpendicular or parallel lines. Connections: MCWR-S1C3-01		Students can use straightedges and compasses, patty/tracing paper, or technology. Examples: • Construct a triangle given the lengths of two sides and the measure of the angle between the two sides. • Construct the circumcenter of a given triangle.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Explore geometries other than Euclidean geometry in which the parallel postulate is not true.	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MCWR-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.	Students will explain why parallel lines meet in spherical geometry. They will compare and contrast properties of triangles drawn in Euclidean geometry with those drawn in non-Euclidean geometry.
PO 3. Apply the law of cosines and the law of sines to find missing sides and angles of triangles. Connections: MCWR-S4C1-04	MCWR-S5C2-02. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Example: • Tara wants to fix the location of a mountain by taking measurements from two positions 3 miles apart. From the first position, the angle between the mountain and the second position is 78^{o}. From the second position, the angle between the mountain and the first position is 53^{o}. How can Tara determine the distance of the mountain from each position, and what is the distance from each position?
PO 4. Use basic trigonometric identities including Pythagorean, reciprocal, half-angle and double-angle, and sum and difference formulas to solve equations and problems. Connections: MCWR-S4C1-03	MCWR-S5C2-02. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).	Students can derive and apply basic trigonometric identities (e.g. $\sin^2\theta + \cos^2\theta = 1$, $\tan^2\theta + 1 = \sec^2\theta$) and the Law of Sines and Law of Cosines. Example: • Use an appropriate half angle formula to find the exact value of $\cos\frac{\pi}{12}$.

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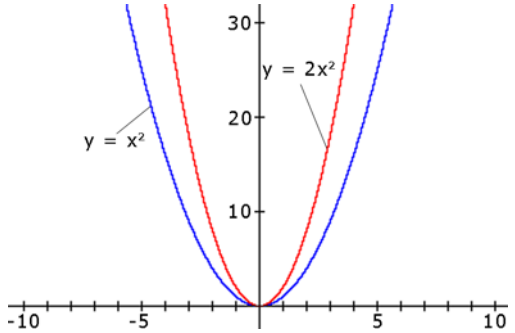
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 4: Geometry and Measurement
Concept 2: Transformation of Shapes

Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.

In Grades 11 and 12, students extend their study of transformations from geometric figures and linear and quadratic equations in grades 9 and 10 to more advanced functions. Students analyze shifts, stretches, and compressions in the graphs of functions and their effects on the function's equation.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Describe how changing the parameters of a quadratic function affects the shape and position of its graph (f(x) = a(x-h)^2+k). Connections: MCWR-S3C2-01, MCWR-S3C2-06, MCWR-S3C2-07, MCWR-S3C2-10, MCWR-S3C2-11, MCWR-S3C2-15, MCWR-S3C3-07, MCWR-S3C3-08, MCWR-S3C4-01	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MCWR-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.	Students will apply transformations to functions. Examples: • Explain the effect on the shape and position in the graph when changing $y = x^2$ to $y = 2x^2$.  • How is the graph of $f(x) = 1 - 5(x-3)^2 + 2$ related to the graph of $f(x) = x^2$? • What effects do values between 0 and 1 for *a, h,* and *k* have on the shape and position of the graph of f(x) = a(x-h)^2 + k?

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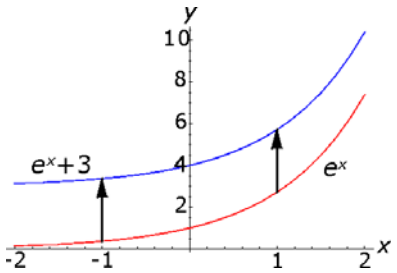
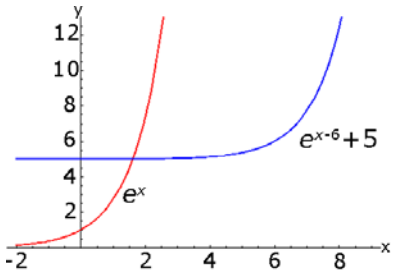
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 2. Describe how changing the parameters of an exponential function affects the shape and position of its graph (f(x) = ab^x). Connections: MCWR-S3C2-01, MCWR-S3C2-04, MCWR-S3C2-13, MCWR-S3C2-15, MCWR-S3C3-02, MCWR-S3C3-08, S3C4-01	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MCWR-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.	Examples: • Explain the effect on the shape and position in the graph when changing $f(x) = e^x$ to $f(x) = e^x + 3$.  • Explain the effect on the shape and position in the graph when changing $f(x) = e^x$ to $f(x) = e^{x-6} + 5$.  • Explain in what way *a, h,* and *k* affect the shape and position of the graph f(x) = $ab^{(x+h)}$ + k. What effect do values between 0 and 1 have? What effect do negative values have?

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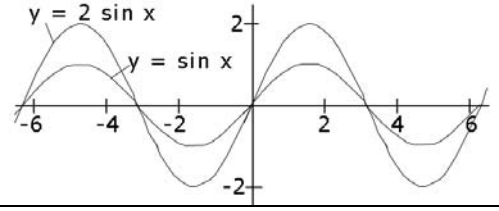
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 3. Describe how changing the parameters of a trigonometric function affects the shape and position of its graph (*f(x) = A sin B(x-C)+D* or the other trigonometric functions). Connections: MCWR-S3C2-09, MCWR-S3C4-01, MCWR-S3C4-02	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MCWR-S5C2-04. Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.	Students will draw and analyze graphs of translations of trigonometric functions, investigating period, amplitude, and phase shift**.** Example: • Explain the effect on the shape and position of the graph when it is changed from $y = \sin x$ to $y = 2 \sin x$. 

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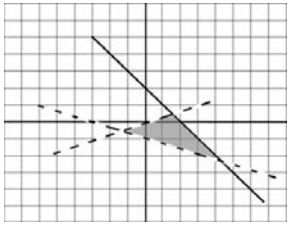
MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 4: Geometry and Measurement
Concept 3: Coordinate Geometry

Specify and describe spatial relationships using rectangular and other coordinate systems while integrating content from each of the other strands.

In Grades 11 and 12, students expand their understanding coordinate systems from the rectangular coordinate system to the polar coordinate system. Students investigate systems of equations, conic sections, and trigonometric functions in terms of their key characteristics.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Graph the solution set of a system of two or three linear inequalities and given an ordered pair determine whether it is a solution to the system. Connections: MCWR-S3C3-03, MCWR-S3C3-04, MCWR-S3C3-09	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Graph the system of linear inequalities below and determine if (3, 2) is a solution to the system. $\begin{cases} x - 3y > 0 \\ x + y \le 2 \\ x + 3y > -3 \end{cases}$ Solution:  (3, 2) is not an element of the solution set. Continued on next page

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
		• A publishing company publishes a total of no more than 100 magazines every year. At least 30 of these are women's magazines, but the company always publishes at least as many women's magazines as men's magazines. Find a system of inequalities that describes the possible number of men's and women's magazines that the company can produce each year consistent with these policies. Graph the solution set.
PO 2. Determine an equation of a circle given its center and radius; given an equation of a circle, find its center and radius. Connections: MCWR-S3C3-01, MCWR-S3C3-07, MCWR-S4C2-01	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Write an equation for a circle with a radius of 2 units and center at (1, 3). • Write an equation for a circle given the endpoints of the diameter are (-2, 7) and (4, -8). • Find the center and radius of the circle $4x^2 + 4y^2 - 4x + 2y - 1 = 0$.
PO 3. Graph equations of conic sections explaining the relationship between their algebraic form and key characteristics of the graph. Connections: MCWR-S3C2-08		Examples: • Graph the circle described by the equation $(x + 4)^2 + (y - 1)^2 = 9$. • Write and graph an equation for a parabola with focus (2, 3) and directrix $y = 1$.
PO 4. Graph all six trigonometric functions identifying their key characteristics. Connections: MCWR-S3C2-09, MCWR-S3C4-01, MCWR-S3C4-02, MCWR-S4C2-03	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Key characteristics of trigonometric functions include period, amplitude, and asymptotes. Example: • Draw the graph of $f(x) = \sin x$ and $f(x) = \cos x$. What are the similarities and differences of the two graphs?
PO 5. Evaluate all six trigonometric functions at angles between (0 degrees and 360 degrees, 0 and 2π radians) using the unit circle in the coordinate plane. Continued on next page	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Examples: • Evaluate all six trigonometric functions of $\theta = \frac{\pi}{3}$. • Evaluate all six trigonometric functions of $\theta = 225^{\circ}$.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
Connections: MCWR-S3C2-09, MCWR-S3C4-01, MCWR-S3C4-02, MCWR-S4C2-03, MCWR-S4C3-04		
PO 6. Convert between rectangular and polar coordinates. Connections: MCWR-S1C2-04, MCWR-S4C3-07	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Students will represent complex numbers using polar coordinates. $a + bi = r(\cos\theta + \sin\theta)$ Example: • Convert the rectangular coordinates $(\sqrt{6}, \sqrt{6})$ to polar coordinates with $r > 0$ and $0 < \theta < 2\pi$.
PO 7. Graph equations given in polar coordinates. Connections: MCWR-S1C2-04, MCWR-S4C3-06	MCWR-S5C2-07. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.	Example: • Sketch graphs of the following equations: $r = 2\sin\theta$ $r = 3\cos 2\theta$

Strand 4: Geometry and Measurement
Concept 4: Measurement

Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

In Grades 11 and 12, students employ their skills converting between and among metric and US Customary measure to explore the relationship and convert between degree and radian measure.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Explain, use, and convert between degree and radian measures for angles. Connections: MCWR-S4C3-05, SCHS-S5C4-06	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning.	Examples: • Convert $\frac{2\pi}{3}$ to degree measure. • Convert 135^{o} to radian measure and explain your steps, including explaining the conversion factor used.

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 5: Structure and Logic

This strand emphasizes the core processes of problem solving. Students draw from the content of the other four strands to devise algorithms and analyze algorithmic thinking. Strand One and Strand Three provide the conceptual and computational basis for these algorithms. Logical reasoning and proof draws its substance from the study of geometry, patterns, and analysis to connect remaining strands. Students use algorithms, algorithmic thinking, and logical reasoning (both inductive and deductive) as they make conjectures and test the validity of arguments and proofs. Concept two develops the core processes as students evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications.

Concept 1: Algorithms and Algorithmic Thinking

Use reasoning to solve mathematical problems.

In Grades 11 and 12, students utilize their skills analyzing algorithms for equivalency and purpose learned in grades 9 and 10 to solve problems using a variety of approaches, including estimations; generalizations; and formal and informal methods of proof.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:		
PO 1. Use a variety of approaches (inductive and deductive reasoning, estimations, generalizations, formal and informal methods of proof) to analyze algorithms.	MCWR-S5C2-05. Summarize and communicate mathematical ideas using formal and informal reasoning. MCWR-S5C2-08. Use inductive and deductive reasoning to make, analyze, and validate or refute conjectures and/or proofs.	

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Strand 5: Structure and Logic
Concept 2: Logic, Reasoning, Problem Solving, and Proof

Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications.

In Grades 11 and 12, students build on their problem solving skills from grades 9 and 10 to formalize the development of reason as they make and defend generalizations and justify their reasoning using accepted standards of mathematical evidence and proof. Students synthesize and analyze mathematical information from multiple sources.

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 1. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.		When students solve problems, they can use strategies including thinking ahead about strategy, testing ideas with special cases, trying different approaches, checking for errors and reasonableness of solutions as a regular part of routine work, and devising independent ways to verify results.
PO 2. Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).		Example: • The swimming pool at Roanoke Park is 24 feet long and 18 feet wide. The park district has determined that they have enough money to put a walkway of uniform width, with a maximum area of 288 square feet, around the pool. How could you find the maximum width of a new walkway?

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 3. Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.		Example: • A student writes: $3x^2 + 6x + x^2 + 7 = 3x^1 + 6x + 7$. Explain why this is incorrect.
PO 4. Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.		
PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning.		Example: • Analyze the following equations and explain what you know about the solutions. Then solve the equations over the complex number system. o $\sqrt{5x-6} = -2$ o $\sqrt{2x-5} = x+7$
PO 6. Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.		Synthesize means to combine separate elements to create a coherent whole. Students will use a variety of sources, including multiple representations, for the synthesis.
PO 7. Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.		

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MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL
COLLEGE WORK READINESS (GRADES 11 AND 12)

Performance Objectives	***Process Integration***	***Explanations and Examples***
Students are expected to:	Some of the Strand 5 Concept 2 performance objectives are listed throughout the grade level document in the Process Integration Column (2nd column). Since these performance objectives are connected to the other content strands, the process integration column is not used in this section next to those performance objectives.	
PO 8. Use inductive and deductive reasoning to make, analyze, and validate or refute conjectures and/or proofs.		Examples: • Show that $\sqrt{a+b} \neq \sqrt{a} + \sqrt{b}$. • Show that the product of two odd numbers is always odd.
PO 9. Use mathematical models to represent and analyze personal and professional situations. Connections: SCHS-S1C3-05		
PO 10. Differentiate, interpret, apply, and develop concepts in the context of personal and professional situations.		
PO 11. Determine under what conditions a given statement (algebraic, geometric) is true.		Examples: • Is this statement $(a^x)^y = a^{xy}$ true for all x, for some x, or for no x? Explain your answer. • Write a counterexample for the statement: The product of two complex numbers is a complex number. Write a counterexample for the statement: The product of two complex numbers is a real number. Based on your counterexamples, what is the truth value of the original statement?

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Science Standard Articulated by Grade Level 2004

High School

Science Standard Articulated by Grade Level

INTRODUCTION

Students are naturally curious about the world and their place in it. Sustaining this curiosity and giving it a scientific foundation must be a high priority in Arizona schools. Application of scientific thinking enables Arizona students to strengthen skills that people use every day: solving problems creatively, thinking critically, working cooperatively in teams, using technology effectively, and valuing lifelong learning.

Science education is much more than merely learning content. It is the active process of investigation and the critical review of evidence related to the world around us, both visible and invisible. Science is a dynamic process of gathering and evaluating information, looking for patterns, and then devising and testing possible explanations. Active engagement in scientific investigation leads students to think critically and to develop reasoning skills that allow them to become independent, lifelong learners. Science methods and thought processes have application well beyond the bounds of science and support learning goals in all subject areas.

The Arizona Science Standard Articulated by Grade Level has been written for ALL students. The science standard is set with the expectation that science instruction occurs at all grade levels – beginning in early grades with simple exploration, progressing to increasingly organized and sophisticated science investigations in higher grades.

Underlying all of the science standard strands are the five unifying concepts as identified in the National Science Education Standards (1995):

- Systems, Order, and Organization
- Evidence, Models, and Explanation
- Constancy, Change, and Measurement
- Evolution and Equilibrium
- Form and Function

This conceptual framework provides students with productive and insightful ways of considering and integrating a range of basic ideas that explain the natural world. Because the understanding and abilities associated with major conceptual and procedural schemes need to be developed over an entire education, the unifying concepts and processes transcend disciplinary boundaries.

These unifying concepts can be introduced in early grades and developed appropriately through the elementary grades and high school. Students should be explicitly shown how each of these unifying concepts apply to and connect life, physical, and Earth and space sciences. These science content areas can be taught in conjunction with each other, as well as with other subject areas in an interdisciplinary approach. The unifying concepts in science education help focus instruction and provide a link to other disciplines.

BACKGROUND

The state Board of Education adopted the Arizona Academic Standards in 1998 to define what Arizona's students need to know and be able to do by the end of twelfth grade. Developed by committees comprised of educators, parents, students, and business and community leaders, these standards were written in grade-level clusters with benchmarks at 3, 5, 8, and high school.

RATIONALE

Requirements in the *No Child Left Behind Act of 2001* (NCLB) and the need for periodic review of the state academic standards prompted the decision by the Arizona Department of Education (ADE) to refine and articulate the academic standard for science by grade level. This refinement and articulation project was started in April 2003, and was completed in May 2004.

METHODOLOGY

The Science Standard Revision Committee was composed of a statewide representation of scientists and science educators to reflect school districts large and small, rural and urban, as well as the ethnic diversity of Arizona. National science consultants, university professors, and community members advised the committee and provided valuable reviews of the work in progress. The goal was to articulate, or align, the current academic standards by grade level (K-8) and in high school with the state requirement of two years of high school science.

The committee utilized several nationally recognized publications to establish content guidelines during the development of the draft:

- National Research Council (NRC)
    - *National Science Education Standards*
    - *Inquiry and the National Science Education Standards*
    - *Designing Mathematics or Science Curriculum Programs*
- The American Association for the Advancement of Science
    - *Atlas of Science Literacy*
    - *Benchmarks for Science Literacy*
    - *Design for Science Literacy*
    - *Science for All Americans*
- *Science Framework for the 1996 and 2000 National Assessment of Educational Progress (NAEP)*

The committee created draft documents by first reviewing the existing standards. The performance objectives were articulated, or aligned, to the appropriate grade levels. Over a period of months, subcommittees, composed of representatives of the full committee, met to refine the documents. A guiding principle in the articulation process was whether a performance objective was reasonable, useful, and appropriate. The measurability of each performance objective was also considered.

External reviews by nationally recognized consultants and reviews by university and local experts provided additional guidance and perspective to the committees.

Public review of the Science Standard Articulated by Grade Level occurred during the month of February 2004. A draft of the standard was placed on the ADE website with the option for individuals to make comments online. Six public hearings occurred throughout the state to collect additional comments. After all public comments were collected and organized, the committee met to review them and to recommend appropriate modifications to the standard. This final draft was presented to the state Board of Education in May 2004 for adoption as the Arizona Science Standard Articulated by Grade Level.

The Arizona high school science standard was designed to support the instruction and assessment of students. Science instruction should involve students actively using scientific processes to understand course content and make connections to real life and related areas of study. The goal in the development of the standard was to assure that the six strands and five unifying concepts are interwoven into a fabric of science that represents the true nature of science. Students have the opportunity to develop both the skills and content knowledge necessary to be scientifically literate members of the community.

Strands 1, 2, and 3 (Inquiry Process, History and Nature of Science, and Science in Personal and Social Perspective) contain the processes and connections desired of Arizona students and must, therefore, be reflected in all science courses. These strands are designed to be explicitly taught *and* embedded *within* each of the content Strands 4, 5, and 6, and are not intended to be taught in isolation. The processes, skills, and content of the first three strands are designed to “umbrella” and complement the content of Life Science, Physical Science, and Earth and Space Science.

At the high school level, Strands 4, 5, and 6 (Life Science, Physical Science, and Earth and Space Science) contain content area knowledge and skills that are, by nature, course specific. These strands were written to provide frameworks for complete courses in Life, Physics, Chemistry, and Earth and Space sciences.

The high school science Arizona Instrument to Measure Standards (AIMS) will be administered as an end of course test. For each course tested, all performance objectives in Strands 1, 2 and 3 may be included on the assessment. Depending on the course tested, performance objectives from Strand 4, 5, or 6, will be measured. For example, an end of course AIMS for high school biology could include performance objectives from Strands 1, 2, 3, and 4. A blueprint of the Science AIMS will be available following test development.

SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 1: Inquiry Process

Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

Concept 1: Observations, Questions, and Hypotheses

Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.

PO 1. Evaluate scientific information for relevance to a given problem. (See R09-S3C1, R10-S3C1, R11-S3C1, and R12-S3C1)

PO 2. Develop questions from observations that transition into testable hypotheses.

PO 3. Formulate a testable hypothesis.

PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).

Concept 2: Scientific Testing (Investigating and Modeling)

Design and conduct controlled investigations.

PO 1. Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.

PO 2. Identify the resources needed to conduct an investigation.

PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis:

- Identify dependent and independent variables in a controlled investigation.
- Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes).
- Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators).

PO 4. Conduct a scientific investigation that is based on a research design.

PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.

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The bulleted items within a performance objective indicate specific content to be taught.

SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 3: Analysis, Conclusions, and Refinements

Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.

PO 1. Interpret data that show a variety of possible relationships between variables, including:

- *positive relationship*
- *negative relationship*
- *no relationship*

PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.

PO 3. Critique reports of scientific studies (e.g., published papers, student reports).

PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including:

- sample size
- trials
- controls
- analyses

PO 5. Design models (conceptual or physical) of the following to represent "real world" scenarios:

- carbon cycle
- water cycle
- phase change
- collisions

PO 6. Use descriptive statistics to analyze data, including:

- mean
- frequency
- range

(See MHS-S2C1-10)

PO 7. Propose further investigations based on the findings of a conducted investigation.

Concept 4: Communication

Communicate results of investigations.

PO 1. For a specific investigation, choose an appropriate method for communicating the results. (See W09-S3C2-01 and W10-S3C3-01)

PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)

PO 3. Communicate results clearly and logically.

PO 4. Support conclusions with logical scientific arguments.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

Concept 1: History of Science as a Human Endeavor

Identify individual, cultural, and technological contributions to scientific knowledge.

PO 1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.

PO 2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

PO 3. Analyze how specific changes in science have affected society.

PO 4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.

Concept 2: Nature of Scientific Knowledge

Understand how science is a process for generating knowledge.

PO 1. Specify the requirements of a valid, scientific explanation (theory), including that it be:

- logical
- subject to peer review
- public
- respectful of rules of evidence

PO 2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.

PO 3. Distinguish between pure and applied science.

PO 4. Describe how scientists continue to investigate and critically analyze aspects of theories.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

Concept 1: Changes in Environments

Describe the interactions between human populations, natural hazards, and the environment.

PO 1. Evaluate how the processes of natural ecosystems affect, and are affected by, humans.

PO 2. Describe the environmental effects of the following natural and/or human-caused hazards:

- flooding
- drought
- earthquakes
- fires
- pollution
- extreme weather

PO 3. Assess how human activities (e.g., clear cutting, water management, tree thinning) can affect the potential for hazards.

PO 4. Evaluate the following factors that affect the quality of the environment:

- urban development
- smoke
- volcanic dust

PO 5. Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Science and Technology in Society

Develop viable solutions to a need or problem.

PO 1. Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems:

- various forms of alternative energy
- storage of nuclear waste
- abandoned mines
- greenhouse gases
- hazardous wastes

PO 2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.

PO 3. Support a position on a science or technology issue.

PO 4. Analyze the use of renewable and nonrenewable resources in Arizona:

- water
- land
- soil
- minerals
- air

PO 5. Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).

Concept 3: Human Population Characteristics

Analyze factors that affect human populations.

PO 1. Analyze social factors that limit the growth of a human population, including:

- affluence
- education
- access to health care
- cultural influences

PO 2. Describe biotic (living) and abiotic (nonliving) factors that affect human populations.

PO 3. Predict the effect of a change in a specific factor on a human population.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 4: Life Science

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

Concept 1: The Cell

Understand the role of the cell and cellular processes.

PO 1. Describe the role of energy in cellular growth, development, and repair.

PO 2. Compare the form and function of prokaryotic and eukaryotic cells and their cellular components.

PO 3. Explain the importance of water to cells.

PO 4. Analyze mechanisms of transport of materials (e.g., water, ions, macromolecules) into and out of cells:

- passive transport
- active transport

PO 5. Describe the purposes and processes of cellular reproduction.

Concept 2: Molecular Basis of Heredity

Understand the molecular basis of heredity and resulting genetic diversity.

PO 1. Analyze the relationships among nucleic acids (DNA, RNA), genes, and chromosomes.

PO 2. Describe the molecular basis of heredity, in viruses and living things, including DNA replication and protein synthesis.

PO 3. Explain how genotypic variation occurs and results in phenotypic diversity.

PO 4. Describe how meiosis and fertilization maintain genetic variation.

Concept 3: Interdependence of Organisms

Analyze the relationships among various organisms and their environment.

PO 1. Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

PO 2. Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.

PO 3. Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 4: Biological Evolution

Understand the scientific principles and processes involved in biological evolution.

PO 1. Identify the following components of natural selection, which can lead to speciation:
- potential for a species to increase its numbers
- genetic variability and inheritance of offspring due to mutation and recombination of genes
- finite supply of resources required for life
- selection by the environment of those offspring better able to survive and produce offspring

PO 2. Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.

PO 3. Describe how the continuing operation of natural selection underlies a population's ability to adapt to changes in the environment and leads to biodiversity and the origin of new species.

PO 4. Predict how a change in an environmental factor (e.g., rainfall, habitat loss, non-native species) can affect the number and diversity of species in an ecosystem.

PO 5. Analyze how patterns in the fossil record, nuclear chemistry, geology, molecular biology, and geographical distribution give support to the theory of organic evolution through natural selection over billions of years and the resulting present day biodiversity.

PO 6. Analyze, using a biological classification system (i.e., cladistics, phylogeny, morphology, DNA analysis), the degree of relatedness among various species.

Concept 5: Matter, Energy, and Organization in Living Systems (Including Human Systems)

Understand the organization of living systems, and the role of energy within those systems.

PO 1. Compare the processes of photosynthesis and cellular respiration in terms of energy flow, reactants, and products.

PO 2. Describe the role of organic and inorganic chemicals (e.g., carbohydrates, proteins, lipids, nucleic acids, water, ATP) important to living things.

PO 3. Diagram the following biogeochemical cycles in an ecosystem:
- water
- carbon
- nitrogen

PO 4. Diagram the energy flow in an ecosystem through a food chain.

PO 5. Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 5: Physical Science

Physical Science affords students the opportunity to increase their understanding of the characteristics of objects and materials they encounter daily. Students gain an understanding of the nature of matter and energy, including their forms, the changes they undergo, and their interactions. By studying objects and the forces that act upon them, students develop an understanding of the fundamental laws of motion, knowledge of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

Concept 1: Structure and Properties of Matter

Understand physical, chemical, and atomic properties of matter.

PO 1. Describe substances based on their physical properties.

PO 2. Describe substances based on their chemical properties.

PO 3. Predict properties of elements and compounds using trends of the periodic table (e.g., metals, non-metals, bonding – ionic/covalent).

PO 4. Separate mixtures of substances based on their physical properties.

PO 5. Describe the properties of electric charge and the conservation of electric charge.

PO 6. Describe the following features and components of the atom:

- protons
- neutrons
- electrons
- mass
- number and type of particles
- structure
- organization

PO 7. Describe the historical development of models of the atom.

PO 8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes).

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Motions and Forces

Analyze relationships between forces and motion.

PO 1. Determine the rate of change of a quantity (e.g., rate of erosion, rate of reaction, rate of growth, velocity).

PO 2. Analyze the relationships among position, velocity, acceleration, and time:
- graphically
- mathematically

PO 3. Explain how Newton's 1st Law applies to objects at rest or moving at constant velocity.

PO 4. Using Newton's 2nd Law of Motion, analyze the relationships among the net force acting on a body, the mass of the body, and the resulting acceleration:
- graphically
- mathematically

PO 5. Use Newton's 3rd Law to explain forces as interactions between bodies (e.g., a table pushing up on a vase that is pushing down on it; an athlete pushing on a basketball as the ball pushes back on her).

PO 6. Analyze the two-dimensional motion of objects by using vectors and their components.

PO 7. Give an example that shows the independence of the horizontal and vertical components of projectile motion.

PO 8. Analyze the general relationships among force, acceleration, and motion for an object undergoing uniform circular motion.

PO 9. Represent the force conditions required to maintain static equilibrium.

PO 10. Describe the nature and magnitude of frictional forces.

PO 11. Using the Law of Universal Gravitation, predict how the gravitational force will change when the distance between two masses changes or the mass of one of them changes.

PO 12. Using Coulomb's Law, predict how the electrical force will change when the distance between two point charges changes or the charge of one of them changes.

PO 13. Analyze the impulse required to produce a change in momentum.

PO 14. Quantify interactions between objects to show that the total momentum is conserved in both collision and recoil situations.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 3: Conservation of Energy and Increase in Disorder

Understand ways that energy is conserved, stored, and transferred.

PO 1. Describe the following ways in which energy is stored in a system:
- mechanical
- electrical
- chemical
- nuclear

PO 2. Describe various ways in which energy is transferred from one system to another (e.g., mechanical contact, thermal conduction, electromagnetic radiation.)

PO 3. Recognize that energy is conserved in a closed system.

PO 4. Calculate quantitative relationships associated with the conservation of energy.

PO 5. Analyze the relationship between energy transfer and disorder in the universe (2^{nd} Law of Thermodynamics).

PO 6. Distinguish between heat and temperature.

PO 7. Explain how molecular motion is related to temperature and phase changes.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 4: Chemical Reactions

Investigate relationships between reactants and products in chemical reactions.

PO 1. Apply the law of conservation of matter to changes in a system.

PO 2. Identify the indicators of chemical change, including formation of a precipitate, evolution of a gas, color change, absorption or release of heat energy.

PO 3. Represent a chemical reaction by using a balanced equation.

PO 4. Distinguish among the types of bonds (i.e., ionic, covalent, metallic, hydrogen bonding).

PO 5. Describe the mole concept and its relationship to Avogadro's number.

PO 6. Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and molarity using the mole concept and Avogadro's number.

PO 7. Predict the properties (e.g., melting point, boiling point, conductivity) of substances based upon bond type.

PO 8. Quantify the relationships between reactants and products in chemical reactions (e.g., stoichiometry, equilibrium, energy transfers).

PO 9. Predict the products of a chemical reaction using types of reactions (e.g., synthesis, decomposition, replacement, combustion).

PO 10. Explain the energy transfers within chemical reactions using the law of conservation of energy.

PO 11. Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.

PO 12. Compare the nature, behavior, concentration, and strengths of acids and bases.

PO 13. Determine the transfer of electrons in oxidation/reduction reactions.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 5: Interactions of Energy and Matter

Understand the interactions of energy and matter.

PO 1. Describe various ways in which matter and energy interact (e.g., photosynthesis, phase change).

PO 2. Describe the following characteristics of waves:
- wavelength
- frequency
- period
- amplitude

PO 3. Quantify the relationships among the frequency, wavelength, and the speed of light.

PO 4. Describe the basic assumptions of kinetic molecular theory.

PO 5. Apply kinetic molecular theory to the behavior of matter (e.g., gas laws).

PO 6. Analyze calorimetric measurements in simple systems and the energy involved in changes of state.

PO 7. Explain the relationship between the wavelength of light absorbed or released by an atom or molecule and the transfer of a discrete amount of energy.

PO 8. Describe the relationship among electric potential, current, and resistance in an ohmic system.

PO 9. Quantify the relationships among electric potential, current, and resistance in an ohmic system.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 6: Earth and Space Science

Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995). By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live.

Concept 1: Geochemical Cycles

Analyze the interactions between the Earth's structures, atmosphere, and geochemical cycles.

PO 1. Identify ways materials are cycled within the Earth system (i.e., carbon cycle, water cycle, rock cycle).

PO 2. Demonstrate how dynamic processes such as weathering, erosion, sedimentation, metamorphism, and orogenesis relate to redistribution of materials within the Earth system.

PO 3. Explain how the rock cycle is related to plate tectonics.

PO 4. Demonstrate how the hydrosphere links the biosphere, lithosphere, cryosphere, and atmosphere.

PO 5. Describe factors that impact current and future water quantity and quality including surface, ground, and local water issues.

PO 6. Analyze methods of reclamation and conservation of water.

PO 7. Explain how the geochemical processes are responsible for the concentration of economically valuable minerals and ores in Arizona and worldwide.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Energy in the Earth System (Both Internal and External)

Understand the relationships between the Earth's land masses, oceans, and atmosphere.

PO 1. Describe the flow of energy to and from the Earth.

PO 2. Explain the mechanisms of heat transfer (convection, conduction, radiation) among the atmosphere, land masses, and oceans.

PO 3. Distinguish between weather and climate.

Internal Energy:

PO 4. Demonstrate the relationship between the Earth's internal convective heat flow and plate tectonics.

PO 5. Demonstrate the relationships among earthquakes, volcanoes, mountain ranges, mid-oceanic ridges, deep sea trenches, and tectonic plates.

PO 6. Distinguish among seismic S, P, and surface waves.

PO 7. Analyze the seismic evidence (S and P waves) used to determine the structure of the Earth.

PO 8. Describe how radioactive decay maintains the Earth's internal temperature.

External Energy:

PO 9. Explain the effect of heat transfer on climate and weather.

PO 10. Demonstrate the effect of the Earth's rotation (i.e.*,* Coriolis effect) on the movement of water and air.

PO 11. Describe the origin, life cycle, and behavior of weather systems (i.e., air mass, front, high and low systems, pressure gradients).

PO 12. Describe the conditions that cause severe weather (e.g., hurricanes, tornadoes, thunderstorms).

PO 13. Propose appropriate safety measures that can be taken in preparation for severe weather.

PO 14. Analyze how weather is influenced by both natural and artificial Earth features (e.g.*,* mountain ranges, bodies of water, cities, air pollution).

PO 15. List the factors that determine climate (e.g.*,* altitude, latitude, water bodies, precipitation, prevailing winds, topography).

PO 16. Explain the causes and/or effects of climate changes over long periods of time (e.g.*,* glaciation, desertification, solar activity, greenhouse effect).

PO 17. Investigate the effects of acid rain, smoke, volcanic dust, urban development, and greenhouse gases, on climate change over various periods of time.

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SCIENCE STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 3: Origin and Evolution of the Earth System

Analyze the factors used to explain the history and evolution of the Earth.

Earth Origin/System:

PO 1. Describe the scientific theory of the origin of the solar system (solar nebular hypothesis).

PO 2. Describe the characteristics, location, and motions of the various kinds of objects in our solar system, including the Sun, planets, satellites, comets, meteors, and asteroids.

PO 3. Explain the phases of the Moon, eclipses (lunar and solar), and the interaction of the Sun, Moon, and Earth (tidal effect).

Earth History/Evolution:

PO 4. Interpret a geologic time scale.

PO 5. Distinguish between relative and absolute geologic dating techniques.

PO 6. Investigate scientific theories of how life originated on Earth (high temperature, low oxygen, clay catalyst model).

PO 7. Describe how life on Earth has influenced the evolution of the Earth's systems.

PO 8. Sequence major events in the Earth's evolution (e.g., mass extinctions, glacial episodes) using relative and absolute dating data.

PO 9. Analyze patterns in the fossil record related to the theory of organic evolution.

Concept 4: Origin and Evolution of the Universe

Analyze the factors used to explain the origin and evolution of the universe.

PO 1. Describe the Big Bang Theory as an explanation for the origin of the universe.

PO 2. Describe the fusion process that takes place in stars.

PO 3. Analyze the evolution of various types of stars using the Hertzsprung-Russell (HR) diagram.

PO 4. Compare the evolution (life cycles) of stars of different masses (low and high mass).

PO 5. Explain the formation of the light elements in stars and the heavier elements (what astronomers call "metals") in supernova explosions.

PO 6. Explain the evolution and life cycles of galaxies.

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Social Studies Standard Articulated by Grade Level 2006

High School

Social Studies Standard Articulated by Grade Level

INTRODUCTION

To maintain the Union that supports our freedoms, we must rely on the knowledge, skills, and character of its citizens and those they elect to public office. Critical to the preservation and improvement of America's republican form of government is the study of our founding principles, namely those detailed in the United States Constitution, the Declaration of Independence, and *The Federalist Papers*. The standard includes the study of rich and diverse contributions that people of many backgrounds have made to American life and institutions while emphasizing our shared heritage. Well-informed citizens understand our political, cultural and economic interaction with the rest of the world. Geographic knowledge expands the understanding of our development and identity in the world. The standard requires that students attain knowledge of essential facts, concepts, people, and events as well as a firm grasp of reasoning, inquiry, and research skills. Students must learn how to frame and test hypotheses, distinguish logical from illogical reasoning, develop informed opinions based on different points of view, and employ reflective thinking and evaluation. In this way students will be prepared to fulfill their responsibilities as citizens of our democratic republic. The standard presents academic content and skills in the four interrelated disciplines of history, geography, civics/government, and economics that are essential to an understanding of our human experience, past and present.

BACKGROUND

The state Board of Education began the development process for the Arizona academic standards in 1996 to define what Arizona students need to know and be able to do by the end of twelfth grade. The Social Studies Standards were adopted in 2000 and partially revised in 2003. Developed by committees comprised of educators, subject matter experts, and business and community leaders, the Social Studies Standard was fully revised and written in articulated grade-specific performance objectives in 2004 - 2005.

RATIONALE

Requirements in the *No Child Left Behind Act of 2001* (NCLB) and the practice of periodic review of the state academic standards prompted the decision by the Arizona Department of Education to refine and articulate the academic standards for mathematics, reading, writing, and science by grade level. An articulation of the social studies standard was included in the process in order to provide consistency across content areas. The skills and content of social studies are not only a critical component of a comprehensive curriculum they also support student success in other areas.

METHODOLOGY

A committee to articulate the social studies standard was formed consisting of a representative sample of educators from around the state. It represented large and small schools, rural and urban districts, and ethnic diversity. Subject matter experts, university professors, and community members advised the committees. The goal was to articulate, or align, the current academic standards by grade level (K-12).

The Social Studies Articulation Committee utilized information from the National Council for the Social Studies, the National Council for Geographic Education, the Arizona Council on Economics Education, the Arizona Geographic Alliance, the Bill of Rights Institute, and other sources to promote quality instruction based on current, pedagogical, and research-based practices.

The articulation process included a restructuring of the Arizona Academic Content Standards to better facilitate the alignment of performance objectives by grade level, while maintaining the content integrity of the existing standards. Over a period of months, the articulation committees and smaller sub-committees refined the documents. Reasonableness, usefulness, and appropriateness were the guidelines for the articulation process.

External reviews by nationally recognized consultants and reviews by university and local experts provided additional guidance and perspective to the committee.

SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Strand 1: American History

A study of American History is integral for students to analyze our national experience through time, to recognize the relationships of events and people, and to interpret significant patterns, themes, ideas, beliefs, and turning points in Arizona and American history. Students will be able to apply the lessons of American History to their lives as citizens of the United States.

Concept 1: Research Skills for History

Historical research is a process in which students examine topics or questions related to historical studies and/or current issues. By using primary and secondary sources effectively students obtain accurate and relevant information. An understanding of chronological order is applied to the analysis of the interrelatedness of events. These performance objectives also appear in Strand 2: World History. They are intended to be taught in conjunction with appropriate American or World History content, when applicable.

PO 1. Interpret historical data displayed in maps, graphs, tables, charts, and geologic time scales.

PO 2. Distinguish among dating methods that yield calendar ages (e.g., dendrochronology), numerical ages (e.g., radiocarbon), correlated ages (e.g., volcanic ash), and relative ages (e.g., geologic time).

PO 3. *Formulate questions that can be answered by historical study and research.*

PO 4. Construct graphs, tables, timelines, charts, and narratives to interpret historical data.

PO 5. Evaluate primary and secondary sources for:

a. authors' main points
b. purpose and perspective
c. facts vs. opinions
d. different points of view on the same historical event (e.g., Geography Concept 6 – geographical perspective can be different from economic perspective)
e. credibility and validity

PO 6. Apply the skills of historical analysis to current social, political, geographic, and economic issues facing the world.

PO 7. Compare present events with past events:

a. cause and effect
b. change over time
c. different points of view

Concept 2: Early Civilizations Pre 1500

The geographic, political, economic and cultural characteristics of early civilizations made significant contributions to the later development of the United States.

PO 1. Describe Prehistoric Cultures of the North American continent:

a. Paleo-Indians, including Clovis, Folsom, and Plano
b. Moundbuilders, including Adena, Hopewell, and Mississippian
c. Southwestern, including Mogollon, Hohokam, and Ancestral Puebloans (Anasazi)

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
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Concept 3: Exploration and Colonization 1500s – 1700s

The varied causes and effects of exploration, settlement, and colonization shaped regional and national development of the U.S.

PO 1. Review the reciprocal impact resulting from early European contact with indigenous peoples:
- a. religious (e.g., conversion attempts)
- b. economic (e.g., land disputes, trade)
- c. social (e.g., spread of disease, partnerships)
- d. food (e.g., corn)
- e. government (e.g., Iroquois Confederacy, matriarchal leadership, democratic influence)

PO 2. Describe the reasons for colonization of America (e.g., religious freedom, desire for land, economic opportunity, and a new life).

PO 3. Compare the characteristics of the New England, Middle, and Southern colonies:
- a. Colonial governments geographic influences, resources, and economic systems
- b. religious beliefs and social patterns

PO 4. Describe the impact of key colonial figures (e.g., John Smith, William Penn, Roger Williams Anne Hutchinson, John Winthrop).

Concept 4: Revolution and New Nation 1700s – 1820

The development of American constitutional democracy grew from political, cultural, and economic issues, ideas, and events.

PO 1. Assess the economic, political, and social reasons for the American Revolution:
- a. British attempts to tax and regulate colonial trade as a result of the French and Indian War
- b. colonists' reaction to British policy ideas expressed in the Declaration of Independence

PO 2. Analyze the effects of European involvement in the American Revolution on the outcome of the war.

PO 3. Describe the significance of major events in the Revolutionary War:
- a. Lexington and Concord
- b. Bunker Hill
- c. Saratoga
- d. writing and ratification of the Declaration of Independence
- e. Yorktown

PO 4. Analyze how the new national government was created:
- a. Albany Plan of Union influenced by the Iroquois Confederation
- b. Articles of Confederation
- c. Constitutional Convention
- d. struggles over ratification of the Constitution
- e. creation of the Bill of Rights

PO 5. Examine the significance of the following in the formation of a new nation:
- a. presidency of George Washington
- b. economic policies of Alexander Hamilton
- c. creation of political parties under Thomas Jefferson and Alexander Hamilton
- d. the establishment of the Supreme Court as a co-equal third branch of government under John Marshall with cases such as Marbury v. Madison.

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PO 6. Examine the experiences and perspectives of the following groups in the new nation:
- a. property owners
- b. African Americans
- c. women
- d. Native Americans
- e. indentured servants

Concept 5: Westward Expansion 1800 – 1860

Westward expansion, influenced by political, cultural, and economic factors, led to the growth and development of the U.S.

PO 1. Trace the growth of the American nation during the period of western expansion:
- a. Northwest Territory
- b. Louisiana Territory
- c. Florida
- d. Texas
- e. Oregon Country
- f. Mexican Cession
- g. Gadsden Purchase
- h. Alaska

PO 2. Analyze how the following events affected the political transformation of the developing nation:
- a. Jefferson's Presidency
- b. War of 1812
- c. Jackson's Presidency

PO 3. Identify how economic incentives and geography influenced early American explorations:
- a. explorers (e.g., Lewis and Clark, Pike, Fremont)
- b. fur traders
- c. miners
- d. missionaries (e.g., Father Kino, Circuit Riders)

PO 4. Describe the impact of European-American expansion on native peoples.

PO 5. Describe the impact of the following aspects of the Industrial Revolution on the United States:
- a. transportation improvements (e.g., railroads, canals, steamboats)
- b. factory system manufacturing
- c. urbanization
- d. inventions (e.g., telegraph, cotton gin, interchangeable parts)

Concept 6: Civil War and Reconstruction 1850 – 1877

Regional conflicts led to the Civil War and resulted in significant changes to American social, economic, and political structures.

PO 1. Explain the economic, social, and political causes of the Civil War:
- a. economic and social differences between the North, South, and West
- b. balance of power in the Senate (e.g., Missouri and 1850 Compromises)
- c. extension of slavery into the territories (e.g., Dred Scott Decision, the Kansas-Nebraska Act)
- d. role of abolitionists (e.g., Frederick Douglass and John Brown)
- e. debate over popular sovereignty/states rights
- f. Presidential election of 1860

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PO 2. Analyze aspects of the Civil War:
- a. changes in technology
- b. importance of resources
- c. turning points
- d. military and civilian leaders
- e. effect of the Emancipation Proclamation
- f. effect on the civilian populations

PO 3. Analyze immediate and long term effects of Reconstruction in post Civil War America:
- a. various plans for reconstruction of the South
- b. Lincoln's assassination
- c. Johnson's impeachment
- d. Thirteenth, Fourteenth and Fifteenth Amendments
- e. resistance to and end of Reconstruction (e.g., Jim Crow laws, KKK, Compromise of 1877)

Concept 7: Emergence of the Modern United States 1875 – 1929

Economic, social, and cultural changes transformed the U.S. into a world power.

PO 1. Analyze how the following aspects of industrialization transformed the American economy beginning in the late 19th century:
- a. mass production
- b. monopolies and trusts (e.g., Robber Barons, Taft- Hartley Act)
- c. economic philosophies (e.g., laissez faire, Social Darwinism, free silver)
- d. labor movement (e.g., Bisbee Deportation)
- e. trade

PO 2. Assess how the following social developments influenced American society in the late nineteenth and early twentieth centuries:
- a. Civil Rights issues (e.g., Women's Suffrage Movement, Dawes Act, Indian schools, lynching, Plessy v. Ferguson)
- b. changing patterns in Immigration (e.g., Ellis Island, Angel Island, Chinese Exclusion Act, Immigration Act of 1924)
- c. urbanization and social reform (e.g., health care, housing, food & nutrition, child labor laws)
- d. mass media (e.g., political cartoons, muckrakers, yellow journalism, radio)
- e. consumerism (e.g., advertising, standard of living, consumer credit)
- f. Roaring Twenties (e.g., Harlem Renaissance, leisure time, jazz, changed social mores)

PO 3. Analyze events which caused a transformation of the United States during the late nineteenth and early twentieth centuries:
- a. Indian Wars (e.g., Little Bighorn, Wounded Knee)
- b. Imperialism (e.g., Spanish American War, annexation of Hawaii, Philippine-American War)
- c. Progressive Movement (e.g., Sixteenth through Nineteenth Amendments, child labor)
- d. Teddy Roosevelt (e.g., conservationism, Panama Canal, national parks, trust busting)
- e. corruption (e.g., Tammany Hall, spoils system)
- f. World War I (e.g., League of Nations, Isolationism)
- g. Red Scare/Socialism
- h. Populism

PO 4. Analyze the effect of direct democracy (initiative, referendum, recall) on Arizona statehood.

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Concept 8: Great Depression and World War II 1929 – 1945

Domestic and world events, economic issues, and political conflicts redefined the role of government in the lives of U.S. citizens.

PO 1. Describe causes and consequences of the Great Depression:

a. economic causes of the Depression (e.g., economic policies of 1920s, investment patterns and stock market crash)
b. Dust Bowl (e.g., environmental damage, internal migration)
c. effects on society (e.g., fragmentation of families, Hoovervilles, unemployment, business failure, breadlines)
d. changes in expectations of government (e.g., New Deal programs)

PO 2. Describe the impact of American involvement in World War II:

a. movement away from isolationism
b. economic recovery from the Great Depression
c. homefront transformations in the roles of women and minorities
d. Japanese, German, and Italian internments and POW camps
e. war mobilization (e.g., Native American Code-Talkers, minority participation in military units, media portrayal)
f. turning points such as Pearl Harbor, D-Day, Hiroshima/Nagasaki

Concept 9: Postwar United States 1945 – 1970s

Postwar tensions led to social change in the U.S. and to a heightened focus on foreign policy.

PO 1. Analyze aspects of America's post World War II foreign policy:

a. international activism (e.g., Marshall Plan, United Nations, NATO)
b. Cold War (e.g., domino theory, containment, Korea, Vietnam)
c. Arms Race (e.g., Cuban Missile Crisis, SALT)
d. United States as a superpower (e.g., political intervention and humanitarian efforts)

PO 2. Describe aspects of American post-World War II domestic policy:

a. McCarthyism
b. Civil Rights (e.g., Birmingham, 1964 Civil Rights Act, Voting Rights Act, Constitutional Amendments)
c. Supreme Court Decisions (e.g., the Warren and Burger Courts)
d. Executive Power (e.g., War Powers Act, Watergate)
e. social reforms Great Society and War on Poverty
f. Space Race and technological developments

PO 3. Describe aspects of post World War II American society:

a. postwar prosperity (e.g., growth of suburbs, baby boom, GI Bill)
b. popular culture (e.g., conformity v. counter-culture, mass-media)
c. protest movements (e.g., anti-war, women's rights, civil rights, farm workers, César Chavez)
d. assassinations (e.g., John F. Kennedy, Martin Luther King, Jr., Robert F. Kennedy, Malcolm X)
e. shift to increased immigration from Latin America and Asia

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 10: Contemporary United States 1970s – Present

Current events and issues continue to shape our nation and our involvement in the global community.

PO 1. *Describe current events using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).*

PO 2*. Identify the connection between current and historical events and issues using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).*

PO 3. Describe how key political, social, environmental, and economic events of the late 20th century and early 21st century (e.g., Watergate, OPEC/oil crisis, Central American wars/Iran-Contra, End of Cold War, first Gulf War, September 11) affected, and continue to affect, the United States.

Strand 2: World History

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PO 6. Apply the skills of historical analysis to current social, political, geographic, and economic issues facing the world.

PO 7. Compare present events with past events:

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Early Civilizations

The geographic, political, economic and cultural characteristics of early civilizations significantly influenced the development of later civilizations.

PO 1. Describe the development of early prehistoric people, their agriculture, and settlements.

PO 2. Analyze the development and historical significance of Hinduism, Judaism, Buddhism, Christianity, and Islam.

PO 3. Analyze the enduring Greek and Roman contributions and their impact on later civilization:

a. development of concepts of government and citizenship (e.g., democracy, republics, codification of law, and development of empire)
b. scientific and cultural advancements (e.g., network of roads, aqueducts, art and architecture, literature and theater, mathematics, and philosophy)

PO 4. Analyze the enduring Chinese contributions and their impact on other civilizations:

a. development of concepts of government and citizenship (e.g., Confucianism, empire)
b. scientific, mathematical, and technical advances (e.g., roads, aqueducts)
c. cultural advancements in art, architecture, literature, theater, and philosophy,

Concept 3: World in Transition

People of different regions developed unique civilizations and cultural identities characterized by increased interaction, societal complexity and competition.

PO 1. Contrast the fall of Rome with the development of the Byzantine and Arab Empires (e.g., religion, culture, language, governmental structure).

PO 2. Compare feudalism in Europe and Japan and its connection with religious and cultural institutions.

PO 3. Compare the development of empires (e.g., Roman, Han, Mali, Incan/Inkan, Ottoman) throughout the world.

PO 4. Describe the interaction of European and Asian civilizations from the 12th to the 16th centuries:

a. Crusades
b. commerce and the Silk Road
c. impact on culture
d. plague

Concept 4: Renaissance and Reformation

The rise of individualism challenged traditional western authority and belief systems resulting in a variety of new institutions, philosophical and religious ideas, and cultural and social achievements.

PO 1. Analyze the results of Renaissance thoughts and theories:

a. rediscovery of Greek and Roman ideas
b. humanism and its emphasis on individual potential and achievements
c. scientific approach to the natural world
d. Middle Eastern contributions (e.g., mathematics, science)
e. innovations in the arts and sciences.

PO 2. Explain how the ideas of the Protestant Reformation and the Catholic Reformation (e.g., secular authority, individualism, migration, literacy and vernacular, the arts) affected society.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 5: Encounters and Exchange

Innovations, discoveries, exploration, and colonization accelerated contact, conflict, and interconnection among societies world wide, transforming and creating nations.

PO 1. Describe the religious, economic, social, and political interactions among civilizations that resulted from early exploration:

a. reasons for European exploration
b. impact of expansion and colonization on Europe
c. impact of expansion and colonization on Africa, the Americas, and Asia
d. role of disease in conquest
e. role of trade
f. navigational technology
g. impact and ramifications of slavery and international slave trade
h. contrasting motivations and methods for colonization

Concept 6: Age of Revolution

Intensified internal conflicts led to the radical overthrow of traditional governments and created new political and economic systems.

PO 1. Contrast the development of representative, limited government in England with the development and continuation of absolute monarchies in other European nations:

a. absolute monarchies (e.g., Louis XIV, Peter the Great, Philip II)
b. the Magna Carta, the English Bill of Rights, and parliamentary government
c. the ideas of John Locke

PO 2. Explain how new ideas (i.e., Heliocentrism, Scientific Method, Newton's Laws) changed the way people understood the world.

PO 3. Explain how Enlightenment ideas influenced political thought and social change:

a. Deism
b. role of women
c. political thought
d. social change

PO 4. Analyze the developments of the French Revolution and rule of Napoleon:

a. Reign of Terror
b. rise of Napoleon
c. spread of nationalism in Europe
d. defeat of Napoleon and Congress of Vienna

PO 5. Explain the revolutionary and independence movements in Latin America (e.g., Mexico, Haiti, South America).

PO 6. Analyze the social, political, and economic development and impact of the Industrial Revolution:

a. origins in England's textile and mining industries
b. urban growth and the social impact of industrialization
c. unequal spread of industrialization to other countries
d. political and economic theories (nationalism, anarchism, capitalism, socialism)

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 7: Age of Imperialism

Industrialized nations exerted political, economic, and social control over less developed areas of the world.

PO 1. Explain the rationale (e.g., need for raw materials, domination of markets, advent of national competition, spread of European culture/religion) for imperialism.

PO 2. Trace the development of the British Empire around the world (e.g., America, Southeast Asia, South Pacific, India, Africa, the Suez).

PO 3. Describe the division of the world into empires and spheres of influence during the 18th and 19th centuries (e.g., British, French, Dutch, Spanish, American, Belgian).

PO 4. Analyze the effects of European and American colonialism on their colonies (e.g., artificially drawn boundaries, one-crop economies, creation of economic dependence, population relocation, cultural suppression).

PO 5. Analyze the responses to imperialism (e.g., Boxer Rebellion, Sepoy Rebellion, Opium Wars, Zulu Wars) by people under colonial rule at the end of the 19th century.

PO 6. Explain Japanese responses to European/American imperialism from a closed door policy to adoption of Euro-American ideas.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 8: World at War

Global events, economic issues and political ideologies ignited tensions leading to worldwide military conflagrations and diplomatic confrontations in a context of development and change.

PO 1. Examine the causes of World War I:
- a. rise of nationalism in Europe
- b. unification of Germany and Otto Von Bismarck's leadership
- c. rise of ethnic and ideological conflicts - the Balkans, Austria-Hungary, the decline of the Ottoman Empire

PO 2. Analyze the impact of the changing nature of warfare in World War I:
- a. trench warfare
- b. mechanization of war – machine gun, gasoline, submarine, tanks, chemical
- c. American involvement

PO 3. Explain the end of World War I and its aftermath:
- a. Russian Revolution
- b. Treaty of Versailles
- c. end of empires (e.g., Austro-Hungarian, Ottoman, Russian)
- d. continuation of colonial systems (e.g., French Indochina, India, Philippines)

PO 4. Examine the period between World War I and World War II:
- a. rise of fascism and dictatorships
- b. postwar economic problems
- c. new alliances
- d. growth of the Japanese empire
- e. challenges to the world order

PO 5. Analyze aspects of World War II:
- a. political ideologies (e.g., Totalitarianism, Democracy)
- b. military strategies (e.g., air warfare, atomic bomb, Russian front, concentration camps)
- c. treatment of civilian populations
- d. Holocaust

PO 6. Examine genocide as a manifestation of extreme nationalism in the 20th century (e.g., Armenia, Holocaust, Cambodia, Bosnia, Rwanda, Kosovo and Sudan).

PO 7. Analyze the political, economic and cultural impact of the Cold War:
- a. superpowers – Soviet Union, United States, China
- b. division of Europe
- c. developing world
- d. Korean and Vietnam Wars

PO 8. Compare independence movements of emerging nations (e.g., Africa, Asia, Middle East, Latin America).

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 9: Contemporary World

The nations of the contemporary world are shaped by their cultural and political past. Current events, developments and issues continue to shape the global community.

PO 1. Explain the fall of the Soviet Union and its impact on the world.

PO 2. Explain the roots of terrorism:

a. background and motives
b. religious conflict (e.g., Northern Ireland, Chechnya, Southwestern Philippines, southern Thailand, Kashmir)
c. background of modern Middle East conflicts (e.g., Israeli – Palestinian conflict, Persian Gulf conflicts, Afghanistan)
d. economic and political inequities and cultural insensitivities

PO 3. Describe the development of political and economic interdependence during the second half of the twentieth century:

a. economics, global wage inequalities
b. technology
c. multinational corporations
d. growth of international governmental organizations (e.g., World Trade Organization)
e. growth of non-governmental organizations (e.g., Red Cross, Red Crescent)

PO 4. Examine environmental issues from a global perspective (e.g., pollution, population pressures, global warming, scarcity of resources).

***PO 5**. Connect current events with historical events and issues using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).*

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
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Strand 3: Civics/Government

The goal of the civics strand is to develop the requisite knowledge and skills for informed, responsible participation in public life; to ensure, through instruction, that students understand the essentials, source, and history of the constitutions of the United States and Arizona, American institutions and ideals (ARS 15-710). Students will understand the foundations, principles, and institutional practices of the United States as a representative democracy and constitutional republic. They will understand the importance of each person as an individual with human and civil rights and our shared heritage in the United States. Students will understand politics, government, and the responsibilities of good citizenship. Citizenship skills include the capacity to influence policies and decisions by clearly communicating interests and the ability to build coalitions through negotiation, compromise, and consensus. In addition, students will learn that the United States influences and is influenced by global interaction.

Concept 1: Foundations of Government

The United States democracy is based on principles and ideals that are embodied by symbols, people and documents.

PO 1. Examine the foundations of democratic representative government:
- a. Greek direct democracy
- b. Roman republic

PO 2. Trace the English roots of American democracy:
- a. Magna Carta
- b. English Bill of Rights
- c. Representative government – Parliament, colonial assemblies, town meetings

PO 3. Describe the philosophical roots American Democracy:
- a. moral and ethical ideals from Judeo-Christian tradition
- b. John Locke and social contract
- c. Charles de Montesquieu and separation of powers

PO 4. Examine the fundamental principles (e.g., equality, natural rights of man, rule of law) in the Declaration of Independence.

Concept 2: Structure of Government

The United States structure of government is characterized by the separation and balance of powers.

PO 1. Analyze why the weak central government and limited powers of the Articles of Confederation demonstrated the need for the Constitution.

PO 2. Analyze the creation of United States Constitution:
- a. representative government as developed by the Great Compromise and the Three-Fifths Compromise
- b. Federalism
- c. Separation of Powers/Checks and Balances
- d. Judicial Review
- e. Amendment Process

PO 3. Examine the United States federal system of government:
- a. powers of the national government
- b. powers of the state governments
- c. powers of the people

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

PO 4. Describe the steps leading to the adoption of the Constitution:
- a. Federalist and Anti-Federalist positions (e.g., The Federalist Papers)
- b. Bill of Rights
- c. Ratification

PO 5. Analyze the structure, powers, and roles of the legislative branch of the United States government:
- a. specific powers delegated in Article I of the Constitution
- b. role of competing factions and development of political parties
- c. lawmaking process
- d. different roles of Senate and House
- e. election process and types of representation
- f. influence of staff, lobbyists, special interest groups and political action committees (PACs)

PO 6. Analyze the structure, powers, and roles of the executive branch of the United States government:
- a. specific powers delegated in Article II of the Constitution
- b. roles and duties of the president
- c. development and function of the executive branch, including the cabinet and federal bureaucracy
- d. election of the president through the nomination process, national conventions, and electoral college

PO 7. Analyze the structure, powers, and roles of the judicial branch of the United States government, including landmark United States Supreme Court decisions:
- a. specific powers delegated by the Constitution in Article III
- b. judicial review developed in Marbury v. Madison, McCulloch v. Maryland, and Gibbons v. Ogden
- c. dual court system of state and federal courts

PO 8. Analyze the structure, power, and organization of Arizona's government as expressed in the Arizona Constitution:
- a. direct democracy by initiative, referendum, and recall processes
- b. election process such as redistricting, (e.g., gerrymandering, clean elections), voter registration, and primaries
- c. the structure and processes of Arizona's legislature
- d. the roles of the Governor, Secretary of State, Treasurer, Attorney General, and Superintendent of Public Instruction
- e. appointment and continuing election of judges.

PO 9. Analyze the forms, structure, powers and roles of local government:
- a. county government, boards of supervisors, sheriffs, county attorneys, and others
- b. mayor, council, city manager, and other city officials
- c. issues of large urban area governments (e.g., transportation, zoning growth management and funding, urban planning, water and sanitation, pollution, annexation)
- d. special districts, governance funding and purpose (e.g., school, sanitation, water, fire, library, community college)

PO 10. Examine the sovereignty of tribal governments and their relationship to state and federal governments (e.g., jurisdiction, land use, water and mineral rights, gaming pacts).

PO 11. Identify other forms of government under U.S. federal auspices (e.g., protectorates, territories, federal districts).

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 3: Functions of Government

Laws and policies are developed to govern, protect, and promote the well-being of the people.

PO 1. Analyze the functions of government as defined in the Preamble to the Constitution.

PO 2. Examine how the Constitution guarantees due process of law through Constitutional mandates and Amendments.

a. Constitutional mandates (e.g., the right of habeas corpus, no bill of attainder, and the prohibition of ex post facto laws)
b. Fourth, Fifth, Sixth, Seventh, and Eighth Amendments
c. protection provided by the Fourteenth Amendment

PO 3. Examine various sources of government funding:

a. federal - income tax, duties , excise taxes, corporate tax
b. state - income tax, sales tax
c. local - property tax, sales tax

PO 4. Describe the regulatory functions of government pertaining to consumer protection, environment, health, labor, transportation, and communication.

PO 5. Describe the factors and processes that determine major domestic policies (e.g., Social Security, education, health care, parks, environmental protection).

Concept 4: Rights, Responsibilities, and Roles of Citizenship

The rights, responsibilities and practices of United States citizenship are founded in the Constitution and the nation's history.

PO 1. Analyze basic individual rights and freedoms guaranteed by Amendments and laws:

a. freedom of religion, speech, press, assembly, and petition in the First Amendment
b. right to bear arms in the Second Amendment
c. Ninth Amendment and guarantee of people's unspecified rights
d. civil rights in the Thirteenth and Fourteenth Amendments
e. voting rights in the Fifteenth, Nineteenth, Twenty-third, Twenty fourth, and Twenty-sixth Amendments; Native American citizenship and voting rights (Arizona, 1948); Voting Rights Act of 1965
f. conflicts which occur between rights (e.g., the tensions between the right to a fair trial and freedom of the press, and between majority rule and individual rights)
g. right to work laws

PO 2. Define citizenship according to the Fourteenth Amendment.

PO 3. Examine the basic political, social responsibilities of citizenship:

a. connections between self-interest, the common good, and the essential element of civic virtue (e.g., George Washington's Farewell Speech), volunteerism
b. obligations of upholding the Constitution
c. obeying the law, serving on juries, paying taxes, voting, and military service
d. analyzing public issues, policy making, and evaluating candidates

PO 4. Demonstrate the skills and knowledge (e.g., group problem solving, public speaking, petitioning and protesting) needed to accomplish public purposes.

PO 5. Describe the role and influence of political parties, interest groups, and mass media:

a. political perspectives (e.g., liberalism, conservatism, progressivism, libertarianism)
b. influence of interest groups, lobbyists, and PAC's on elections, the political process and policy making
c. influence of the mass media on elections, the political process and policy making

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 5: Government Systems of the World

Different governmental systems exist throughout the world. The United States influences and is influenced by global interactions.

PO 1. Compare the United States system of politics and government to other systems of the world (e.g., monarchies, dictatorship, theocracy, oligarchy, parliamentary, unitary, proportional elections).

PO 2. Describe factors (e.g., trade, political tensions, sanctions, terrorism) that influence United States foreign policy.

PO 3. Describe world governmental and non-governmental organizations (e.g., the United Nations and its agencies, NATO, the European Union, the International Red Cross).

Strand 4: Geography

The goal of the geography strand is to provide an understanding of the human and physical characteristics of the Earth's places and regions and how people of different cultural backgrounds interact with their environment. Geographic reasoning is a way of studying human and natural features within a spatial perspective. Through the study of geography, students will be able to understand local, national, regional, and global issues. Students will interpret the arrangement and interactions of human and physical systems on the surface of the Earth. As these patterns have changed over time and are important to governments and economies, geographic reasoning will enhance students' understanding of history, civics, and economics.

Concept 1: The World in Spatial Terms

The spatial perspective and associated geographic tools are used to organize and interpret information about people, places and environments.

PO 1. Construct maps using appropriate elements (i.e., date, orientation, grid, scale, title, author, index, legend, situation).

PO 2. Interpret maps and images (e.g., political, physical, relief, thematic, Geographic Information Systems [GIS], Landsat).

PO 3. Use appropriate maps and other graphic representations to analyze geographic problems and changes over time.

PO 4. Use an atlas to access information.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Places and Regions

Places and regions have distinct physical and cultural characteristics.

PO 1. Identify the characteristics that define a region:
   a. physical processes such as climate, terrain, and resources
   b. human processes such as religion, political organization, economy, and demographics

PO 2. Describe the factors (e.g., demographics, political systems, economic systems, resources, culture) that contribute to the variations between developing and developed regions.

PO 3. Examine geographic issues (e.g., drought in Sahel, migration patterns, desertification of Aral Sea, spread of religions such as Islam, conflicts in Northern Ireland/Ireland, Jerusalem, Tibet) in places and world regions.

PO 4. Analyze the differing political, religious, economic, demographic, and historical ways of viewing places and regions.

PO 5. Examine how the geographic characteristics of a place affect the economics and culture (e.g., changing regional economy of the sunbelt, location with respect of natural hazards, location of Panama Canal, Air Force Bases in Arizona).

PO 6. Analyze how a region changes over time (e.g., U.S./Mexico border, Europe from World War I to the development of European Union, change from pre- to post-colonialism in Africa, Hong Kong).

PO 7. Analyze sides of scientific debates over how human actions (e.g., global warming, ozone decline) modify a region.

Concept 3: Physical Systems

Physical processes shape the Earth and interact with plant and animal life to create, sustain, and modify ecosystems. These processes affect the distribution of resources and economic development. Science Strands are summarized as they apply to Social Studies content in Grades K-8. In High School, the Performance Objectives are a summary of skills and content for grades 9 -12. These concepts are reinforced in Social Studies classes, but assessed through Science.

(Concept 3 High School Performance Objectives are a summary of Science Strands' skills and content for grades 9 -12. These concepts are reinforced in Social Studies classes, but assessed through Science.)

PO 1. Analyze how weather and climate (e.g., the effect of heat transfer, Earth's rotation, and severe weather systems) influence the natural character of a place. Connect with: Science Strand 6 Concepts 1, 2, 4

PO 2. Analyze different points of view on the use of renewable and non-renewable resources in Arizona. Connect with: Science Strand 3 Concept 2

PO 3. Analyze how earth's internal changes (e.g., earthquakes, volcanic activity, folding, faulting) and external changes (e.g., geochemical, water and carbon cycles, erosion, deposition) influence the character of places. Connect with: Science Strand 6 Concepts 1, 2

PO 4. Analyze how hydrology (e.g., quality, reclamation, conservation) influences the natural character of a place.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 4: Human Systems

Human cultures, their nature, and distribution affect societies and the Earth.

PO 1. Interpret population growth and demographics (e.g., birth and death rates, population growth rates, doubling time and life expectancy, carrying capacity).

PO 2. Analyze push/pull factors that contribute to human migration.

PO 3. Analyze the effects of migration on places of origin and destination, including border areas.

PO 4. Analyze issues of globalization (e.g., widespread use of English, the role of the global media, resistance to "cultural imperialism", trade, outsourcing).

PO 5. Analyze the development, growth, and changing nature of cities (e.g., urban sprawl, suburbs, city revitalization).

PO 6. Analyze factors (e.g., social, biotic, abiotic) that affect human populations.

PO 7. Predict the effect of a change in a specific factor (e.g., social, biotic, abiotic) on a human population.

PO 8. Explain how ideas, customs, and innovations (e.g., religion, language, political philosophy, technological advances, higher education, economic principles) are spread through cultural diffusion.

Concept 5: Environment and Society

Human and environmental interactions are interdependent upon one another. Humans interact with the environment- they depend upon it, they modify it; and they adapt to it. The health and well-being of all humans depends upon an understanding of the interconnections and interdependence of human and physical systems.

PO 1. Analyze how the Earth's natural systems (e.g., Gulf Stream permitting habitation of northern Europe, earthquakes, tsunamis, periodic droughts, river civilizations) affect humans.

PO 2. Analyze how natural hazards impact humans (e.g., differences in disaster preparation between developed and developing nations, why people continue to build in disaster-prone places).

PO 3. Analyze how changes in the natural environment can increase or diminish its capacity to support human activity (e.g., major droughts, warm and cold periods, volcanic eruptions, El Niño events, pollution).

PO 4. Analyze the environmental effects of human use of technology (e.g., irrigation, deforestation, overgrazing, global warming, atmospheric and climate changes, energy production costs and benefits, water management) on the environment.

PO 5. Analyze how humans impact the diversity and productivity of ecosystems (e.g., invading non-native plants and animals).

PO 6. Analyze policies and programs for resource use and management (e.g., the trade-off between environmental quality and economic growth in the twentieth century).

PO 7. Predict how a change in an environmental factor (e.g., extinction of species, volcanic eruptions) can affect an ecosystem.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 6: Geographic Applications

Geographic thinking (asking and answering geographic questions) is used to understand spatial patterns of the past, the present, and to plan for the future.

PO 1. Analyze how geographic knowledge, skills, and perspectives (e.g., use of Geographic Information Systems in urban planning, reapportionment of political units, locating businesses) are used to solve contemporary problems.

PO 2. Analyze how changing perceptions of places and environments (e.g., where individuals choose to live and work, Israeli settlements, role of military bases, Viking colonization and naming of Iceland) affect the choices of people and institutions.

PO 3. Analyze how geography influences historical events and movements (e.g., Trail of Tears, Cuban Missile Crisis, location of terrorist camps, pursuit of Pancho Villa, Mao's long march, Hannibal crossing the Alps, Silk Road).

Strand 5: Economics

The goal of the economics strand is to enable students to make reasoned judgments about both personal economic questions and broader questions of economic policy. Students will develop an economic way of thinking and problem solving to understand and apply basic economic principles to decisions they will make as consumers, members of the workforce, citizens, voters, and participants in a global marketplace. This will prepare students to weigh both short-term and long-term effects of decisions as well as possible unintended consequences. The study of economics explains historical developments and patterns, the results of trade, and the distribution of income and wealth in local, regional, national, and world economies. Students will be able to analyze current issues and public policies and to understand the complex relationships among economic, political, and cultural systems.

Concept 1: Foundations of Economics

The foundations of economics are the application of basic economic concepts and decision-making skills. This includes scarcity and the different methods of allocation of goods and services.

PO 1. Analyze the implications of scarcity:

a. limited resources and unlimited human wants influence choice at individual, national, and international levels
b. factors of production (e.g., natural, human, and capital resources, entrepreneurship, technology)
c. marginal analysis by producers, consumers, savers, and investors

PO 2. Analyze production possibilities curves to describe opportunity costs and trade-offs.

PO 3. Describe the characteristics of the mixed-market economy of the United States:

a. property rights
b. profit motive
c. consumer sovereignty
d. competition
e. role of the government
f. rational self-interest
g. invisible hand

PO 4. Evaluate the economic implications of current events from a variety of sources (e.g., magazine articles, newspaper articles, radio, television reports, editorials, Internet sites).

PO 5. Interpret economic information using charts, tables, graphs, equations, and diagrams.

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 2: Microeconomics

Microeconomics examines the costs and benefits of economic choices relating to individuals, markets and industries, and governmental policies.

PO 1. Describe how the interdependence of both households and firms is affected by trade, exchange, money, and banking:

a. why voluntary exchange occurs only when all participating parties expect to gain from the exchange
b. role and interdependence of households, firms, and government in the circular flow model of economic activity
c. role of entrepreneurs in a market economy and how profit is an incentive that leads entrepreneurs to accept risks of business failure
d. financial institutions and securities markets
e. importance of rule of law in a market economy for enforcement of contracts

PO 2. Describe how markets function:

a. laws of supply and demand
b. how a market price is determined
c. graphs that demonstrate changes in supply and demand
d. how price ceilings and floors cause shortages or surpluses
e. comparison of monopolistic and competitive behaviors
f. theory of production and the role of cost

PO 3. Describe how government policies influence the economy:

a. need to compare costs and benefits of government policies before taking action
b. use of federal, state, and local government spending to provide national defense; address environmental concerns; define and enforce property, consumer and worker rights; regulate markets; and provide goods and services
c. effects of progressive, proportional, and regressive taxes on different income groups
d. role of self-interest in decisions of voters, elected officials, and public employees

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 3: Macroeconomics

Macroeconomics examines the costs and benefits of economic choices made at a societal level and how those choices affect overall economic well being.

PO 1. Determine how inflation, unemployment, and gross domestic product statistics are used in policy decisions.

PO 2. Explain the effects of inflation and deflation on different groups (e.g., borrowers v. lenders, fixed income/cost of living adjustments).

PO 3. Describe the economic and non-economic consequences of unemployment.

PO 4. Analyze fiscal policy and its effects on inflation, unemployment, and economic growth.

PO 5. Describe the functions of the Federal Reserve System (e.g., banking regulation and supervision, financial services, monetary policy) and their influences on the economy.

PO 6. Explain the effects of monetary policy on unemployment, inflation, and economic growth.

PO 7. Determine how investment in factories, machinery, new technology, and the health, education, and training of people can raise future standards of living.

Concept 4: Global Economics

Patterns of global interaction and economic development vary due to different economic systems and institutions that exist throughout the world.

PO 1. Analyze the similarities and differences among economic systems:

a. characteristics of market, command, and mixed economic systems, including roles of production, distribution, and consumption of goods and services
b. benefits and costs of market and command economies
c. characteristics of the mixed-market economy of the United States, including such concepts as private ownership, profit motive, consumer sovereignty, competition, and government regulation
d. role of private property in conserving scarce resources and providing incentives in a market economy

PO 2. Describe the effects of international trade on the United States and other nations:

a. how people and nations gain through trade
b. how the law of comparative advantage leads to specialization and trade
c. effects of protectionism, including tariffs and quotas on international trade and on a nation's standard of living
d. how exchange rates work and how they affect international trade
e. how the concepts of balance of trade and balance of payments are used to measure international trade
f. factors that influence the major world patterns of economic activity including the differing costs of production between developed and developing countries
g. economic connections among different regions, including changing alignments in world trade partners
h. identify the effects of trade agreements (e.g., North American Free Trade Agreement)

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SOCIAL STUDIES STANDARD ARTICULATED BY GRADE LEVEL
HIGH SCHOOL

Concept 5: Personal Finance

Decision-making skills foster a person's individual standard of living. Using information wisely leads to better informed decisions as consumers, workers, investors and effective participants in society.

PO 1. Explain how education, career choices, and family obligations affect future income.

PO 2. Analyze how advertising influences consumer choices.

PO 3. Determine short- and long-term financial goals and plans, including income, spending, saving, and investing.

PO 4. Compare the advantages and disadvantages of using various forms of credit and the determinants of credit history.

PO 5. Explain the risk, return, and liquidity of short- and long-term saving and investment vehicles.

PO 6. Identify investment options, (e.g., stocks, bonds, mutual funds) available to individuals and households.

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Technology Standards 2000

Proficiency and Distinction (Grades 9-12)

Technology Education Standards Rationale

Technology encompasses the tools and strategies for solving problems, using information, increasing productivity and enhancing personal growth. The word *technology* summons an image of a variety of tools ranging from shovels to gene splitters. When asked to develop the original Technology Standards, adopted in 1997, the Committee did so without the benefit of seeing the integration of various technologies into other curricular standards. Over the past four years, significant advances in technology have occurred. These changes have caused many national organizations to review what students need to know and be able to do in relation to technology. Therefore, when asked to review the current standards, the Revision Committee examined national standards (National Educational Technology Standards, Information Power, Information Technology in Education and Technology for All Americans), along with current Arizona standards. The Revision Committee also analyzed current research on technology skills important to business and industry. The Revision Committee reviewed technology that is currently integrated into other content area standards with the vision that as other standards are revised, technology will be seamlessly integrated.

The goal is to help students live, learn and work successfully and responsibly in an increasingly complex, technology-driven society. These Technology Standards are designed to provide foundational skills and processes that students need in order to work productively and creatively in their studies, at work and at home. Research on the transfer of learning strongly supports the position that instruction and educational activities should closely parallel the final desired behavior. It is essential that technology instruction be an integral part of a student's educational experience. Education's role is to help students meet the challenge of the future. Arizona must encourage, assist and provide all students with the required tools and instruction to enable them to acquire knowledge, develop skills and apply these tools successfully in our world.

The following definition of technology is supported in this document:

Technology is the application of tools to solve problems that extend human potential for the benefit of society

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 1: FUNDAMENTAL OPERATIONS AND CONCEPTS

Students understand the operations and function of technology systems and are proficient in the use of technology.

PROFICIENCY (Grades 9-12)

- **1T-P1. Use the appropriate technology device to complete a task**
  See: Mathematics (3M-P1 and P3, 4M-P2)

  PO 1. Given a task, select the appropriate technology device(s) (e.g., reporting a news story using digital and video camera and online editing to publish on the Web; gathering data using scientific probes and graphing calculators)

- **1T-P2. Make informed choices among technology systems, resources and services**
  See: Arts {Music} (1AM-P10) and Language Arts (VP-P)

  PO 1. Create criteria to compare and contrast technology systems, resources and services (e.g., which Internet service provider, music system, Web browser or graphics package meets criteria)

DISTINCTION (Honors)

- **1T-D1. Manage a complex technology system such as a local area network, video distribution of a school, or lighting for a production**
  See: Arts {Theatre} (1AT-D4, D8-9)

- **IT-D2. Set up and manage a homework hotline, tutoring site, discussion group, threaded discussion and/or e-mail system for students and parents**

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 2: SOCIAL, ETHICAL AND HUMAN ISSUES

Students understand the social, ethical and human issues related to using technology in their daily lives and demonstrate responsible use of technology systems, information and software.

PROFICIENCY (Grades 9 – 12)

- **2T-P1. Identify capabilities and limitations of contemporary and emerging technology resources and assess the potential of these systems and services**
  See: Arts {Music} (2AM-P3) and Social Studies (1SS-P1, PO2)

  PO 1. Make informed choices among technology systems, resources and services in a variety of contexts
  PO 2. Explain the impact computer networking has on an organization (e.g., cost, allocation of resources, security, productivity, communications, and organizational or societal change)
  PO 3. Predict future technological advances and the impact of them for individuals and the workplace (e.g., given the current "instant access," what's next?)

- **2T-P2. Analyze advantages and disadvantages of widespread use and reliance on technology in the workplace and in society as a whole**
  See: Comprehensive Health (4CH-P2), Science (3SC-P3), Social Studies (1SS-P1, PO1-2) and Workplace Skills (7WP-P2)

  PO 1. Explain the cost of maintaining technology in terms of money and manpower
  PO 2. Describe the effect on an organization when technology fails (e.g., power outage)
  PO 3. Analyze the long-term impact of technologies and their obsolescence (e.g., on the preservation of, and access to, older technologies; responsible disposal of old technologies; retraining of workforce)

- **2T-P3. Demonstrate legal and ethical behaviors among peers, family, and community regarding the use of technology and information**
  See: Social Studies (2SS-P8, PO2 and PO4-6)

  PO 1. State personal liability issues related to security systems to protect technologies (e.g., use of passwords and the importance of protecting them; use of encryption software)
  PO 2. Discuss individual privacy issues versus First Amendment protection (e.g., federal and state filtering and access legislation)
  PO 3. Explain the impact of unauthorized intrusions (i.e., hacking, spamming, manipulating or deleting data) on society
  PO 4. Describe computer viruses and ways to protect computers from them

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

DISTINCTION (Honors)

- **2T-D1. Analyze current changes in technologies and predict the effect those changes have on the workplace and society**
  See: Comprehensive Health (4CH-D1) and Science (3SC-D1)

- **2T-D2. Advocate for legal and ethical behaviors among peers, family, and community regarding the use of technology and information**
  See: Comprehensive Health (4CH-D1, 5CH-D1) and Science (4SC-D1 and D2)

STANDARD 3: TECHNOLOGY PRODUCTIVITY TOOLS

Students use technology tools to enhance learning, to increase productivity and creativity, and to construct technology-enhanced models, prepare publications and produce other creative works.

PROFICIENCY (Grades 9-12)

- **3T-P1. Communicate to a variety of audiences using professional level technology tools**
  See: Mathematics (2M-P2), Science (5SC-P3-4) and Social Studies (4SS-P2, PO1-2)

  PO 1. Create documents using professional format (e.g., résumé, letter of application, electronic portfolio, research paper)
  PO 2. Merge information from one document to another (e.g., mail merge, publish and subscribe)
  PO 3. Create a document that utilizes hyperlinks (e.g., Web link in documents, linking a word to a glossary, creating an interactive index)

- **3T-P2. Use a variety of technology tools for data collection and analysis to support a decision**
  See: Arts {Theatre}(1AT-P6), Mathematics (2M-P2, 3M-P3) and Social Studies (1SS-P1, PO2)

  PO 1. Select appropriate technology devices to collect and record data (e.g., science probe, graphing calculator, PDA {personal digital assistant}, alternative keyboard, webcam, GPS and Internet)
  PO 2. Create and use a spreadsheet to analyze variables (e.g., 12-month budget, loan rates, science and math experiments, and investment portfolios)
  PO 3. Analyze data and create a database report from information manipulated in a variety of ways to support decisions (e.g., census data, polls and surveys, annual report)

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **3T-P3. Use technology tools to publish and present information with interactive features**
  See: Mathematics (2M-P7, 4M-P2) and Science (5SC-P2 and P6, 6SC-P1)

  PO 1. Design and create a multimedia presentation or Web site with interactive features (e.g., animation, sound, action buttons to play, video, control devices, open other applications, link to a Web site)

- **3T-P4. Use technology tools to support modeling and system analysis**
  See: Science (3SC-P2) and Workplace Skills (6WP-P3)

  PO 1. Manipulate several variables in a computer simulation to reach a desired outcome (e.g., simulation software, Web-based simulation, textbook support software)

DISTINCTION (Honors)

- **3T-D1. Demonstrate technical standards, practices and techniques in videography by creating a product**
  See: Arts {Theatre} (1AT-D4-6)

STANDARD 4: TECHNOLOGY COMMUNICATIONS TOOLS

Building on productivity tools, students will collaborate, publish, and interact with peers, experts and other audiences using telecommunications and media.

PROFICIENCY (Grades 9-12)

- **4T-P1. Routinely and efficiently use online information resources to meet needs for collaboration and communications**
  See: Language Arts (W-P2-6) and Workplace Skills (1WP-P5)

  PO 1. Using criteria for research in Standard 5, create an end product (e.g., multimedia presentation, publication, Web page) to disseminate the information

- **4T-P2. Manage and communicate personal and professional information utilizing technology tools and resources**
  See: Language Arts (W-P2-6) and Workplace Skills (7WP-P1, 1WP-P3)

  PO 1. Plan and present a product appropriate to the task

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **4T-P3. Using technology, collaborate with peers, experts, and others to contribute to a content-related knowledge base**
  See: Workplace Skills (1WP-P3-6 and P9, 4WP-P1)

  PO 1. Contribute digitized material (e.g., video interviews, scanned pictures, text, and graphic information) to a project archive and create links to resource material
  PO 2. Conduct e-mail interviews with content experts
  PO 3. Consider several methods and choose the best for building group collaboration in research, communication and presentation among students in physically separated schools

DISTINCTION (Honors)

- **4T-D1. Use technology to compile, synthesize, produce, and disseminate information, models, and other creative works**
  See: Language Arts (LS-D) and Workplace Skills (1WP-D4)

- **4T-D2. Participate in a student think-tank simulation to solve a technology-based problem**
  See: Workplace Skills (1WP-D5, 4WP-D1)

STANDARD 5: TECHNOLOGY RESEARCH TOOLS

Students will utilize technology-based research tools to locate and collect information pertinent to the task as well as evaluate and analyze information from a variety of sources.

Note: The performance objectives described in Standard 5 rely upon the mastery of skills and understanding of concepts from Standards 1-4 of this document

PROFICIENCY (Grades 9-12)

- **5T-P1. Develop a research strategy to find accurate, relevant, appropriate electronic information sources**
  See: Arts {Theatre} (2AT-P1), Language Arts (W-P4), Mathematics (2M-E1, PO 1), Social Studies (1SS-P2, PO1 and PO3) and Workplace Skills (7WP-P1)

  PO 1. Explain the difference between Internet searching using directories and search engines
  PO 2. Construct online or electronic database searches using Boolean logic (AND, OR, NOT)
  PO 3. Independently select appropriate electronic resources from school, community and the world (via online) to be used to locate information needed when presented with a problem to solve

PO 4. Evaluate the appropriateness and effectiveness of electronic resources (e.g., purpose, credibility of author)

- **5T-P2. Investigate and apply expert systems (e.g., search engines and intelligent agents)**
  See: Arts {Theatre} (2AT-P1) and Workplace Skills (1WP-P9, P10)

  PO 1. Given a concept, use online search engines as well as resource-specific search features (e.g., CD-ROMs) to find relevant information
  PO 2. Adapt software for personal efficiency by setting preferences for effective use of the software
  PO 3. Use advanced features (e.g., preferences, advanced searching, filtering) in Internet browser and information software

- **5T-P3. Present research findings from electronic resources using academic models for citations and format**
  See: Workplace Skills (1WP-P10, 2WP-P2)

  PO 1. Utilize evaluation criteria (authority, accuracy, relevancy, timeliness) for information found on the Internet to present research findings
  PO 2. Create citations for resources used following an academic model to present research findings

DISTINCTION (Honors)

- **5T-D1. Design a research project using a variety of technologies to solve a real-world problem**
  See: Language Arts (W-D1)

- **5T-D2. Evaluate the accuracy, relevance, appropriateness, comprehensiveness and bias of electronic information sources**
  See: Arts {Theatre} (2AT-D2)

  PO 1. Compare and contrast bias in electronic information resources
  PO 2. Create a presentation on bias found in electronic information resources to present to a younger audience (*See Technology 5T-E2, PO4)*

TECHNOLOGY EDUCATION STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 6: TECHNOLOGY AS A TOOL FOR PROBLEM SOLVING AND DECISION-MAKING

Students use technology to make and support decisions in the process of solving real-world problems.

Note: Problem solving is inherent in all disciplines. Technology Standard 6 is designed to provide a cumulative (capstone) experience See: Science 3SC in its entirety and Workplace Skills 3WP in its entirety

PROFICIENCY (Grades 9-12)

- **6T-P1. Investigate technology-based options, including distance and distributed education for lifelong learning**
  See: Workplace Skills (1WP-P9)

  PO 1. Locate and use an online tutorial and discuss the benefits and disadvantages of this method of learning
  PO 2. Research a career and predict the advanced training needed to maintain success in the career
  PO 3. Design and implement a personal learning plan that utilizes technology (e.g., identify a topic such as an academic interest, personal hobby, health issue, or potential job sources, and utilize research skills from Standard 5 to support lifelong learning)

- **6T-P2. Routinely and ethically use productivity tools, communication tools and research skills to solve a problem**
  See: Mathematics (2M-P7-8)

  PO 1. As a capstone experience in a content area, solve a problem using appropriate technology tools to:
  a) identify the problem and formulate the strategy to solve the problem (e.g., brainstorming tools, flowcharting, online resources)
  b) collect data (e.g., using GPS, PDA {personal digital assistant}, Internet, probeware, recordings)
  c) interpret data (e.g., visualization, simulation, or modeling software)
  d) develop a solution to the problem
  e) present findings (e.g., electronic presentation, Web page, professionally formatted document, computer model, audio or video presentation, Web streaming)

DISTINCTION (Honors)

- **6T-D1. Collaborate with peers, experts and others to compile, synthesize, produce and disseminate information and models for the purpose of suggesting solutions to a complex problem**
  See: Science (1SC-D1)

Workplace Skills Standards 1997

Proficiency and Distinction (Grades 9-12)

Workplace Skills Standards Rationale

Most students will spend more than a third of their lives in a diverse and constantly changing workplace. Regardless of personal, career, or educational plans, students must demonstrate proficiency both in academics and the following workplace standards.

The Workplace Skills Standards are designed to be integrated into the traditional curriculum taught in schools at all levels and are most effectively learned in the context of an integrated effort involving parents, educators, business partners and members of the community. Student acquisition of critical workplace skills, with an emphasis on application, is a developmental process which encompasses an individual's entire lifetime. The demonstration of these skills is essential for individuals and contributes to the foundation of an educated citizenry.

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

STANDARD 1
Students use principles of effective oral, written and listening communication skills to make decisions and solve workplace problems.

PROFICIENCY (Grades 9-12)

- **1WP-P1. Exhibit interviewing skills (e.g., responding effectively to questions; using language that conveys maturity, sensitivity and respect; dressing appropriately; and using appropriate body language)**

  PO 1. Respond effectively to interview questions
  PO 2. Employ suitable interview language
  PO 3. Describe appropriate dress/dress appropriately
  PO 4. Exhibit appropriate body language

- **1WP-P2. Respond to verbal and nonverbal messages in ways that demonstrate understanding**

  PO 1. Respond appropriately to verbal messages
  PO 2. Respond appropriately to nonverbal message

- **1WP-P3. Communicate a clear message and respond to listener feedback**

  PO 1. Formulate a clear message using acceptable format
  PO 2. Respond appropriately to listener feedback

- **1WP-P4. Participate in conversation, discussion and/or group presentations using verbal and nonverbal communication with appropriate style and tone for audience and occasion**

  PO 1. Apply group interaction skills (verbal and nonverbal)
  PO 2. Adapt style and tone to audience and occasion (verbal and nonverbal)

- **1WP-P5. Maintain records and information completely and accurately**

  PO 1. Identify basic record keeping skills
  PO 2. Select method of record keeping
  PO 3. Maintain a complete and accurate system

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **1WP-P6. Create documents (e.g., letters, memos, manuals, graphs, flowcharts, directions, reports and proposals) that are clear, appropriate to the audience, subject matter and purpose, and exhibit the writer's use of correct grammar, spelling and punctuation**

  PO 1. Select style and format
  PO 2. Establish clear purpose for a specific audience
  PO 3. Use correct grammar, spelling and punctuation
  PO 4. Create an acceptable document

- **1WP-P7. Respond to informal and formal speeches using illustrations, statistics, comparisons and analogies to critique the effectiveness of presentations**

  Note: The P.O.'s were developed to evaluate the effectiveness of the presentation and then formulate the response.

  PO 1. Evaluate the effectiveness of presentation
  PO 2. Formulate a response
  PO 3. Select style and medium
  PO 4. Utilize appropriate tools (e.g., flow charts and illustrations)

- **1WP-P8. Summarize information from reading material, clearly and succinctly articulating its major points and proposals**

  PO 1. Identify major points from written materials
  PO 2. Summarize major points clearly and concisely

- **1WP-P9. Infer and locate the meaning of unknown or technical vocabulary**

  PO 1. Using available resources, determine the meaning of unknown or technical vocabulary

- **1WP-P10. Research and synthesize information and develop a written document to convey that information which is appropriate to the audience**

  PO 1. Judge the accuracy, appropriateness, style and plausibility of reports, proposals, and/or theories
  PO 2. Determine audience needs and interests
  PO 3. Develop accurate and appropriate documents that synthesize the information using accurate grammar, mechanics, and vocabulary

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

DISTINCTION (Honors)

- **1WP-D1. Deliver a polished or impromptu speech that is organized and well suited to the audience, using effective body language and voice inflection to clarify and defend positions**

- **1WP-D2. Conduct a thoughtful interview, taking appropriate notes and summarizing the information learned**

- **1WP-D3. Use clear, concise and cogent language when presenting analytical responses to workplace literature, conveying technical information, and explaining complex concepts and procedures**

- **1WP-D4. Plan and produce an effective visual technical report or display**

- **1WP-D5. Draw conclusions and make predictions from technical information and data**

- **1WP-D6. Identify a problem, conduct research, and summarize the findings and solutions, using sources such as technical journals and government publications to support the original thesis**

- **1WP-D7. Express and defend their points of view by formulating sound, rational arguments and applying the art of persuasion and debate**

STANDARD 2

Students apply computation skills and data analysis techniques to make decisions and solve workplace problems.

> *Note: The Essentials Level is central to preparation for the workplace and is adequately covered in the Mathematics Standards document. The Proficiency and Distinction Levels include additional references to what students need to know and do as it relates to the workplace.*

PROFICIENCY (Grades 9-12)

- **2WP-P1. Select and use appropriate computation techniques (i.e., mental, paper and pencil, and technology) to solve problems and determine the accuracy of results**

  PO 1. Select appropriate computation techniques, such as averaging, estimation, statistical techniques, and appropriate electronic calculations
  PO 2. Apply selected technique to solve problems
  PO 3. Evaluate accuracy of results

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **2WP-P2. Construct projections and trends from raw data, charts, tables and graphs that summarize data from real-world situations**

  PO 1. Evaluate data from real-world situations
  PO 2. Construct projections and trends

DISTINCTION (Honors)

- **2WP-D1. Analyze inferences from charts, tables and graphs that summarize data**

- **2WP-D2. Use appropriate technology to display and analyze workplace data**

- **2WP-D3. Evaluate data for interpretation and prediction**

- **2WP-D4. Test possible solutions using appropriate statistics**

STANDARD 3

Students apply critical and creative thinking skills to make decisions and solve workplace problems.

PROFICIENCY (Grades 9-12)

- **3WP-P1. Develop a plan to solve complex problems by gathering, selecting and analyzing data; include determining the history and politics of the situation**

  PO 1. Identify the problem
  PO 2. Select needed data
  PO 3. Analyze data
  PO 4. Develop a plan within the context of the workplace to solve problem

- **3WP-P2. Identify and allocate available resources (e.g., time, money, materials, facilities and human)**

  PO 1. Identify available resources
  PO 2. Allocate resources

- **3WP-P3. Design and justify solutions by tracking and evaluating the results**

  PO 1. Design justifiable solution
  PO 2. Monitor results
  PO 3. Evaluate results

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **3WP-P4. Demonstrate the ability to adapt new information to changing situations and requirements**

  PO 1. Demonstrate the ability to apply new information to changing situations and requirements

  - **3WP-P5.Combine ideas or information in new ways, make connections between seemingly unrelated ideas and reshape goals in ways that reveal new possibilities to solve problems**

  PO 1. Integrate existing ideas and information in new ways to solve a problem

- **3WP-P6. Develop an inventory record keeping system to maintain data and information in a systematic fashion**

  PO 1. Determine record keeping needs based on the nature of data
  PO 2. Develop an appropriate record keeping system

DISTINCTION (Honors)

- **3WP-D1. Apply a continuous improvement process to an existing business**

- **3WP-D2. Conduct a comprehensive workplace needs assessment, communicate their findings to the employer, and develop and defend a set of proposed solutions to address the needs**

STANDARD 4

Students work individually and collaboratively within team settings to accomplish objectives.

PROFICIENCY (Grades 9-12)

- **4WP-P1. Demonstrate ability to work with others from diverse backgrounds, including identifying individual interests, aptitudes and skills; teach others new skills**

- **4WP-P2. Understand group dynamics**

  PO 1. Identify personal qualities
  PO 2. Demonstrate an understanding of group dynamics
  PO 3. Work well with others
  PO 4. Teach others new skills

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **4WP-P3. Work toward consensus by exchanging resources and resolving divergent interests**

  PO 1. Demonstrate the ability to reach consensus by resolving divergent interests

- **4WP-P4. Monitor individual performance and team effectiveness**

  PO 1. Conduct periodic checks of individual team member's contributions and the team's progress in obtaining goals

- **4WP-P5. Provide constructive feedback**

  PO 1. Define feedback criteria
  PO 2. Give constructive feedback to team participants that strengthens individual and group performance

- **4WP-P6. Assume leadership roles in team settings to accomplish tasks**

  PO 1. Communicate thoughts and ideas to clarify roles and responsibilities
  PO 2. Delegate tasks and responsibilities effectively
  PO 3. Motivate team to accomplish tasks
  PO 4. Evaluate team effectiveness

- **4WP-P7. Demonstrate punctuality, trustworthiness, civility and initiative on school projects**

  PO 1. Complete school projects on time, with integrity, while displaying conduct befitting a citizen of the class

- **4WP- P8. Negotiate solutions to identified conflicts by separating people from the problem; focusing on interests, not positions; inventing options for mutual gain; and insisting on the use of objective criteria**

  PO 1. Apply negotiation skills to solve conflicts

- **4WP-P9. Work and communicate with diverse clients, customers and community to satisfy their expectations**

  PO 1. Identify/define expectations of clients, customers and community
  PO 2. Develop a plan to meet those expectations
  PO 3. Implement plan
  PO 4. Evaluate plan

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

DISTINCTION (Honors)

- **4WP-D1. Demonstrate teamwork and negotiation skills in innovative and effective ways to accomplish tasks**

- **4WP-D2. Pursue difficult and challenging leadership roles**

STANDARD 5

Students will demonstrate a set of marketable skills that enhance career options.

PROFICIENCY (Grades 9-12)

- **5WP-P1. Write, evaluate and revise a career plan consistent with occupational interests, aptitudes and abilities**

  PO 1. Assess career interests, aptitudes and abilities
  PO 2. Develop a career pathway plan
  PO 3. Evaluate and revise plan, as needed

- **5WP-P2. Demonstrate job acquisition skills by completing resume and job applications and by demonstrating interviewing techniques**

  PO 1. Demonstrate job acquisition skills as defined by the instructor

- **5WP-P3. Exhibit work ethics and behaviors essential for success in all areas of life**

  PO 1. Define ethics and effective workplace behaviors
  PO 2. Use appropriate behaviors (time management, communications, interpersonal skills, life balance) that display success in life

- **5WP-P4. Demonstrate marketable occupational skills for an entry-level job based on career interests**

  Note: *This is an observational concept as opposed to a testable concept. This concept becomes the culmination of the previous three concepts. Demonstration of marketable occupational skills will be unique to each individual based on career interests and through and with the coordination of the counselors, teachers, parents and students.*

DISTINCTION (Honors)

- **5WP-D1. Evaluate goals and career options and adjust their career plans accordingly**

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **5WP-D2. Increase academic and occupational skills to become more marketable**

- **5WP-D3. Evaluate career plans on a continuous basis to determine appropriate educational strategies**

STANDARD 6

Students illustrate how social, organizational and technological systems function.

Definition: A system equals an organized framework made up of interrelated components acting together as a whole, in which a change in one component may affect the entire operation. Examples of systems are social (e.g., family, school) and technological (e.g., local area network, telephone).

PROFICIENCY (Grades 9-12)

- **6WP-P1. Draft and interpret an organizational chart**

  PO 1. Design an organizational chart
  PO 2. Interpret an organizational structure

- **6WP-P2. Evaluate the quality and performance of workplace systems, distinguish trends, and recommend improvements and modifications to an existing system to improve products or services**

  PO 1. Describe alternate workplace systems
  PO 2. Evaluate the quality and performance of workplace systems
  PO 3. Distinguish trends in workplace systems
  PO 4. Generate recommendations for improvements/modifications to existing workplace systems

- **6WP-P3. Understand how changing a component of a system (e.g., changing how employees are assigned to work shifts, using the Internet) impacts the whole system**

  PO 1. Analyze the cause and effect relationships within a real world setting

DISTINCTION (Honors)

- **6WP-D1. Predict the impact of actions on system operations, diagnose deviations in the function of systems/organizations, and take necessary action to correct performance**

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **6WP-D2. Anticipate and project potential modification of systems to meet the needs of a changing society**

STANDARD 7
Students demonstrate technological literacy for productivity in the workplace.

PROFICIENCY (Grades 9-12)

- **7WP-P1. Select and use appropriate technology to organize, send and receive information**

  PO 1. Identify available technological tools
  PO 2. Employ appropriate tools to organize, send, and receive information

- **7WP-P2. Analyze the impact of technological changes on tasks, people and society**

  PO 1. Define technology as it relates to tasks, people, society, and careers
  PO 2. Analyze the impact

DISTINCTION (Honors)

- **7WP-D1. Demonstrate computer operation skills such as computer-aided drafting and computer-integrated manufacturing with other technologies in a variety of applications within a workplace setting**

- **7WP-D2. Design technologies which go beyond any existing technology**

- **7WP-D3. Adapt technology use to expand academic and personal growth**

- **7WP-D4. Identify or solve problems with computers and other technologies**

STANDARD 8
Students apply principles of resource management and develop skills that promote personal and professional well-being.

PROFICIENCY (Grades 9-12)

- **8WP-P1. Set and prioritize their goals, estimate the time required to complete each assigned task, and prepare and follow the timeline/schedule**

  PO 1. Develop a written personal/professional plan

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **8WP-P2. Prepare a short- and long-term personal budget; make expenditure, revenue and savings forecasts; maintain proper records**

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PO 1. Implement a written personal financial plan

- **8WP-P3. Evaluate the impact of health choices (e.g., smoking, substance abuse, exercise) on personal and professional well-being**

PO 1. Describe the effects of health choices on a person's well being and his/her ability to complete work tasks
PO 2. Analyze and evaluate the impacts of health choices

- **8WP-P4. Identify strategies for balancing self, family, work, leisure and citizenship; ways to reduce the impact of stress; and how both relate to personal and career satisfaction**

PO 1. Develop written strategies for personal and career satisfaction

DISTINCTION (Honors)

- **8WP-D1. Design a Request for Proposal process**
- **8WP-D2. Maintain a personal management system by setting goals, managing resources, and balancing life choices to accomplish career and life satisfaction**
- **8WP-D3. Select relevant goals, prioritize them, allocate time to each, and prepare and follow schedules when solving workplace or school projects**
- **8WP-D4. Organize and efficiently allocate material, facilities, supplies, parts and equipment to optimize their use in personal and professional goal attainment**
- **8WP-D5. Prepare budgets and make cost and revenue forecasts in a business, reconciling differences between inventory and financial records, and projecting resource needs over time**
- **8WP-D6. Design a task analysis flow chart**
- **8WP-D7. Assess knowledge and skills, delegate work accordingly, evaluate performance and provide feedback on human resources when working on a team project**
- **8WP-D8. Design a computer-generated workplace document with narrative and graphics, using desktop publishing software**

WORKPLACE SKILLS STANDARDS
PROFICIENCY AND DISTINCTION (GRADES 9-12)

- **8WP-D9. Demonstrate an understanding of First-In First-Out (FIFO), Last-In First-Out (LIFO) and Just-in-Time inventory systems**
- **8WP-D10. Develop a workplace staffing plan and write job descriptions**
- **8WP-D11. Develop a bill processing system**