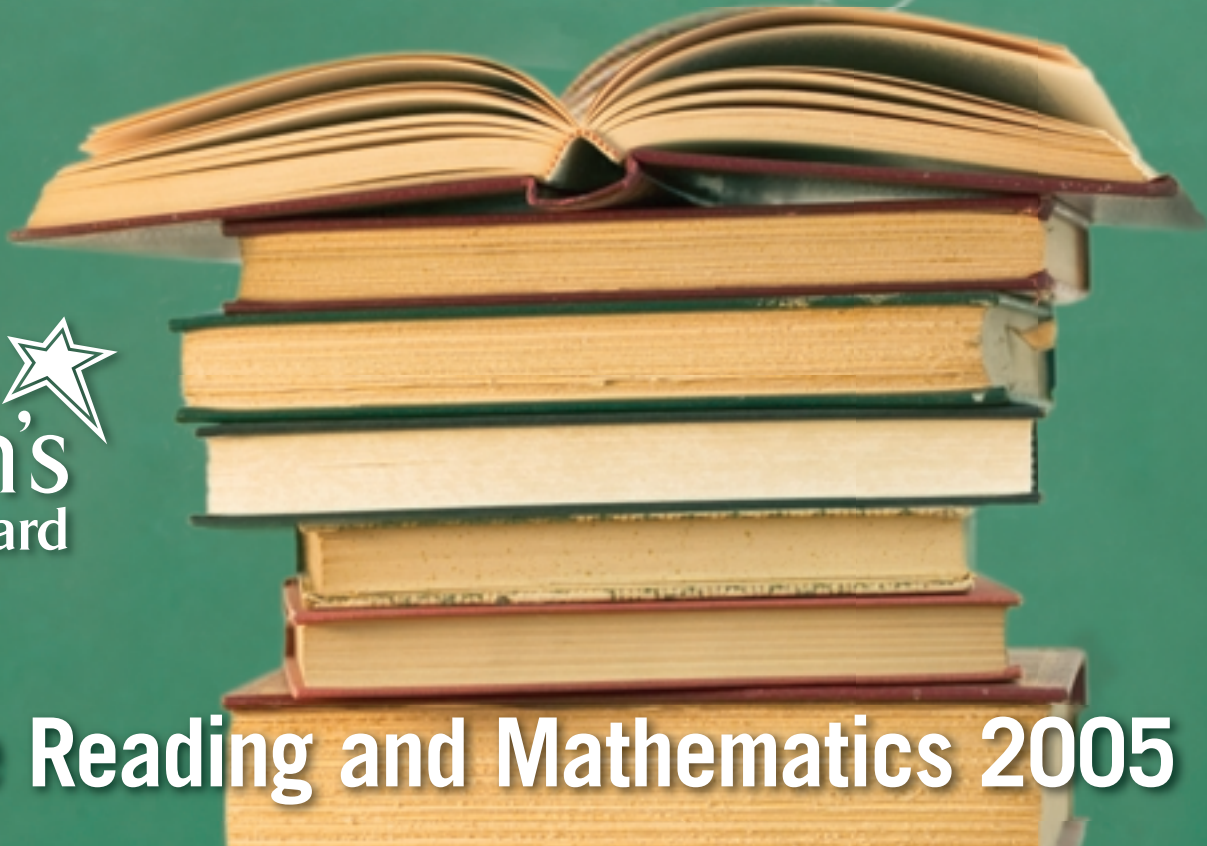


$$\sqrt{b^2 - 4ac}$$



The 
Nation's
Report Card

12th-Grade Reading and Mathematics 2005

NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS





Contents

FEBRUARY 2007

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What is The Nation's Report Card™?

The Nation's Report Card™ informs the public about the academic achievement of elementary and secondary students in the United States. Report cards communicate the findings of the National Assessment of Educational Progress (NAEP), a continuing and nationally representative measure of achievement in various subjects over time. The Nation's Report Card™ compares performance among states, urban districts, public and private schools, and student demographic groups.

For over three decades, NAEP assessments have been conducted periodically in reading, mathematics, science, writing, history, geography, and other subjects. By making objective information available on student performance at the national, state, and local levels, NAEP is an integral part of our nation's evaluation of the condition and progress of education. Only information associated with academic achievement and related variables is collected.

The privacy of individual students is protected, and the identities of participating schools are not released.

NAEP is a congressionally mandated project of the National Center for Education Statistics (NCES) within the Institute of Education Sciences of the U.S. Department of Education. The Commissioner of Education Statistics is responsible for carrying out the NAEP project. The National Assessment Governing Board oversees and sets policy for NAEP.

Executive Summary

In 2005, a representative sample of over 21,000 high school seniors from 900 schools across the country was assessed in reading and mathematics. This report presents the national results from the 1992, 1994, 1998, 2002, and 2005 reading assessments and from the 2005 mathematics assessment. It also includes sample questions to illustrate the types of skills and knowledge that were assessed in each subject.

Reading performance declines for all but top performers

In 2005, the average reading score for high school seniors was 286 on a 0–500 scale. This overall average was lower than in 1992, although it was not significantly different from the score in 2002. With the exception of the score for students performing at the 90th percentile, declines were seen across most of the performance distribution in 2005 as compared to 1992.

- The percentage of students performing at or above *Basic* decreased from 80 percent in 1992 to 73 percent in 2005, and the percentage of students performing at or above the *Proficient* level decreased from 40 to 35 percent.
- White and Black students were the only racial/ethnic groups to show a statistically significant change in reading performance, scoring lower in 2005 than in 1992.
- The score gaps between White and Black students and White and Hispanic students were relatively unchanged since 1992.

Retrieving information from a highly detailed document is an example of the knowledge and skills demonstrated by students performing at the *Basic* level. Making a critical judgment about a detailed document and explaining their reasoning is an example of the knowledge and skills associated with students' performance at the *Proficient* level.

- Both male and female students' scores declined in comparison to 1992, and the performance gap between the genders widened with female students outscoring male students.

Less than one-quarter perform at or above *Proficient* in mathematics

The 2005 mathematics assessment is based on a new framework. The assessment includes more questions on algebra, data analysis, and probability to reflect changes in high school mathematics standards and coursework. Even though many questions were repeated, results could not be placed on the old NAEP scale and could not be directly compared to previous years. The 12th-grade average in 2005 was set at 150 on a 0–300 point scale.

- Sixty-one percent of high school seniors performed at or above the *Basic* level, and 23 percent performed at or above *Proficient*.
- Asian/Pacific Islander students scored higher than students from other racial/ethnic groups, and White students scored higher than their Black and Hispanic counterparts.
- Male students scored higher on average than female students overall and in the “number properties and operations” and “measurement and geometry” content areas.

Demonstrating the ability to use the Pythagorean Theorem to determine the length of a hypotenuse is an example of the skills and knowledge associated with performance at the *Basic* level. An example of the knowledge and skills associated with the *Proficient* level is using trigonometric ratios to determine length.

For more information, visit:
<http://nationsreportcard.gov>

Understanding and Reporting the Results

The students who are selected to take the NAEP assessment are representative of all 12th-grade students across the U.S. By participating, they play an important role in helping us understand how our nation's students and schools are performing. These valuable data can only be obtained with the cooperation of schools, teachers, and students nationwide.

The results presented in this report are based on representative samples of more than 21,000 grade 12 students from 900 schools (including public schools, private schools, and Department of Defense schools). Results are reported for the nation and by region of the country. Results for states are not available at grade 12. Over 12,000 students were assessed in reading, and more than 9,000 were assessed in mathematics. Students' performance is reported in two ways: scale scores and achievement levels.

Scale scores

NAEP reading results are reported on a 0–500 scale, and mathematics results are reported on a 0–300 scale. Because NAEP score scales are developed independently for each subject, scores cannot be used to make comparisons across subjects.

In addition to reporting an overall composite score in each subject, scores are reported at different percentiles (showing trends in performance for lower-, middle-, and higher-performing students) and by subject subscales (showing performance in specific content areas).

Achievement levels

Achievement levels are performance standards showing what students should know and be able to do.

NAEP results are reported as percentages of students performing at or above three achievement levels: *Basic*, *Proficient*, and *Advanced*. Percentages below *Basic* are also reported.

The achievement levels for each subject in this report were set by the National Assessment Governing Board based on a standard-setting process that included input from a cross section of policymakers, educators, and members of the general public. The process resulted in a set of cut scores that defines the boundaries between *Basic*, *Proficient*, and *Advanced* performance, as well as descriptions of what students should know and be able to do in each subject and grade level. Abbreviated descriptions of the NAEP subject-specific achievement levels for grade 12 can be found in the reading and mathematics sections of this report. More detailed descriptions of NAEP achievement levels can be found in the subject frameworks on the Governing Board website at <http://www.nagb.org/pubs/pubs.html>.

As provided by law, NCES, upon review of congressionally mandated evaluations of NAEP, has determined that achievement levels are to be used on a trial basis and should be interpreted with caution. However, NCES and the Governing Board have affirmed the usefulness of these performance standards for understanding trends in achievement. NAEP achievement levels have been widely used by national and state officials.

The three NAEP achievement levels, from lowest to highest, are

BASIC — denotes partial mastery of the knowledge and skills that are fundamental for proficient work at a given grade.

PROFICIENT — represents solid academic performance. Students reaching this level have demonstrated competency over challenging subject matter.

ADVANCED — signifies superior performance.



A more inclusive NAEP

No testing accommodations were provided in the NAEP reading assessments prior to 1998, resulting in the exclusion of students with disabilities and English language learners who could not be meaningfully assessed without accommodations. The transition to a more inclusive NAEP began in 1998 when administration procedures were introduced that allowed the use of accommodations (e.g., extra time, individual rather than group administration) for a subsample of students in the reading assessment.

During this transition period, reading results in 1998 were reported for two separate samples—one in which accommodations were not permitted and one in which accommodations were permitted. Beginning in 2002, accommodations were permitted for all reading administrations. In 2005, accommodations were available for both reading and mathematics assessments.

Interpreting results

NAEP uses widely accepted statistical standards in analyzing data. The text of this report discusses only findings that are statistically significant at the .05 level with adjustments for multiple comparisons. In the tables and charts of this report, the symbol (*) is used to indicate that prior scores or percentages are significantly different from current scores or percentages.

Scales have been established for overall achievement in reading and mathematics. In addition, subscales have been established for three contexts for reading and for four content areas in mathematics. (See pages 10 and 19 for more information about the reading and mathematics frameworks.) Because subscales for each subject were developed separately, direct comparisons cannot be made from one subscale to another.

In addition to overall results, performance is presented for students categorized by different demographic characteristics (for example, by gender or highest level of parents' education). These simple breakdowns cannot be used to establish a cause-and-effect relationship between background characteristics and achievement. A complex mix of educational and socioeconomic factors may interact to affect student performance.

Not all of the results discussed in the text are presented in corresponding tables or graphics (e.g., achievement-level data for student groups), but can be found on the NAEP website at <http://nces.ed.gov/nationsreportcard/nde/>.

For additional information, see the Technical Notes on page 22 or <http://nationsreportcard.gov>.



READING



Overall Performance in Reading Declines in Comparison to 1992

Performance of the nation's 12th-graders in reading has declined in comparison to 1992; however, it has shown no significant change from the last assessment in 2002. This was seen in overall scores and in scores for literary, informational, and functional reading contexts.

In 2005, scores for both White students and Black students were lower than in 1992, and there was no significant change in the performance gap. Female students outscored male students by a wider margin than in 1992.

Scores decline in comparison to 1992 across most of the performance distribution

As seen in figure 1, students in grade 12 scored lower in 2005 than in 1992, but their score was not significantly different compared to 2002.

Examining the scores at different percentiles on the reading scale (figure 2) shows lower scores in 2005 than in 1992 across most of the performance distribution. Only the score at the 90th percentile showed no significant change in comparison to 1992. The largest decline was seen among the lower-performing students at the 10th percentile.

The decline in scores across most of the distribution is reflected in the achievement-level results. As shown in figure 3, the percentage of students performing at or above *Basic* decreased from 80 percent in 1992 to 73 percent in 2005, and the percentage of students performing at or above the *Proficient* level decreased from 40 to 35 percent over the same period of time.

Figure 1

Trend in 12th-grade average NAEP reading scores

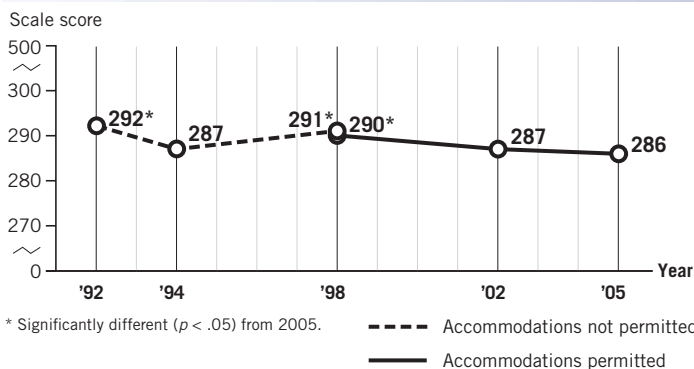


Figure 2

Trend in 12th-grade NAEP reading percentile scores

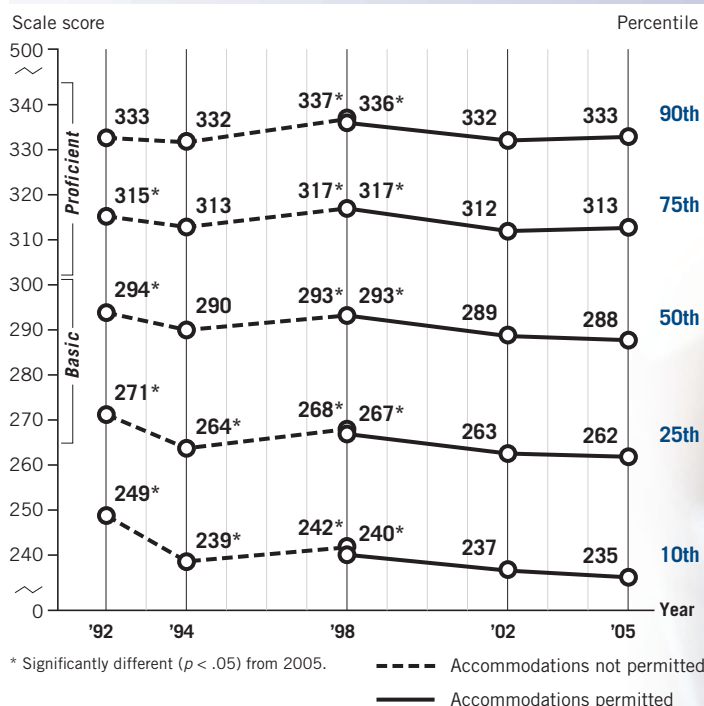
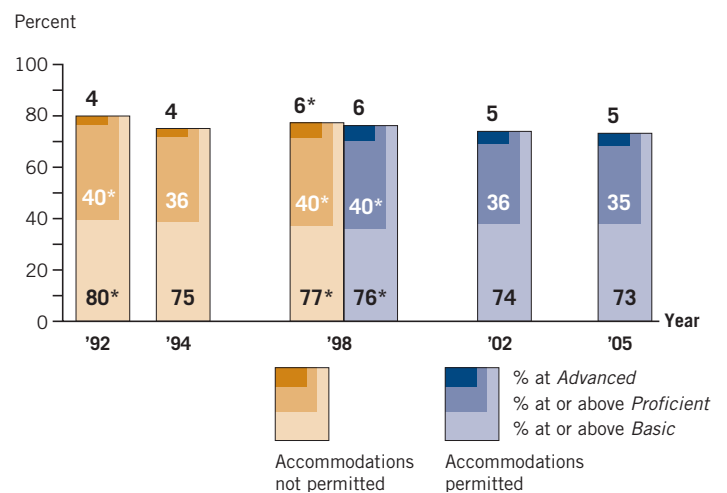


Figure 3

Trend in 12th-grade NAEP reading achievement-level results



* Significantly different ($p < .05$) from 2005.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1992–2005 Reading Assessments.

Gaps between White and minority students unchanged

As shown in figure 4, scores for both White and Black students declined in comparison to 1992. Apparent declines over the same time period for other racial/ethnic groups were not statistically significant.

Although not shown here, the percentages of students performing at or above *Proficient* were lower in 2005 than in 1992 for White students but showed no significant change for other racial/ethnic student groups.

There was no significant change in the gaps between White students and their Black or Hispanic counterparts in comparison to either 1992 or 2002 (figure 5).

Full achievement-level and gap information is available on the NAEP website at <http://nces.ed.gov/nationsreportcard/nde/>.

Figure 4

Trend in 12th-grade average NAEP reading scores, by race/ethnicity

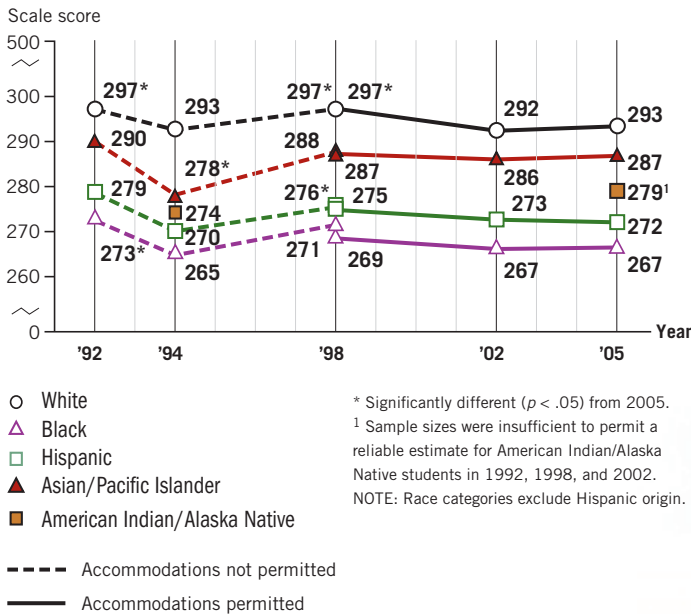
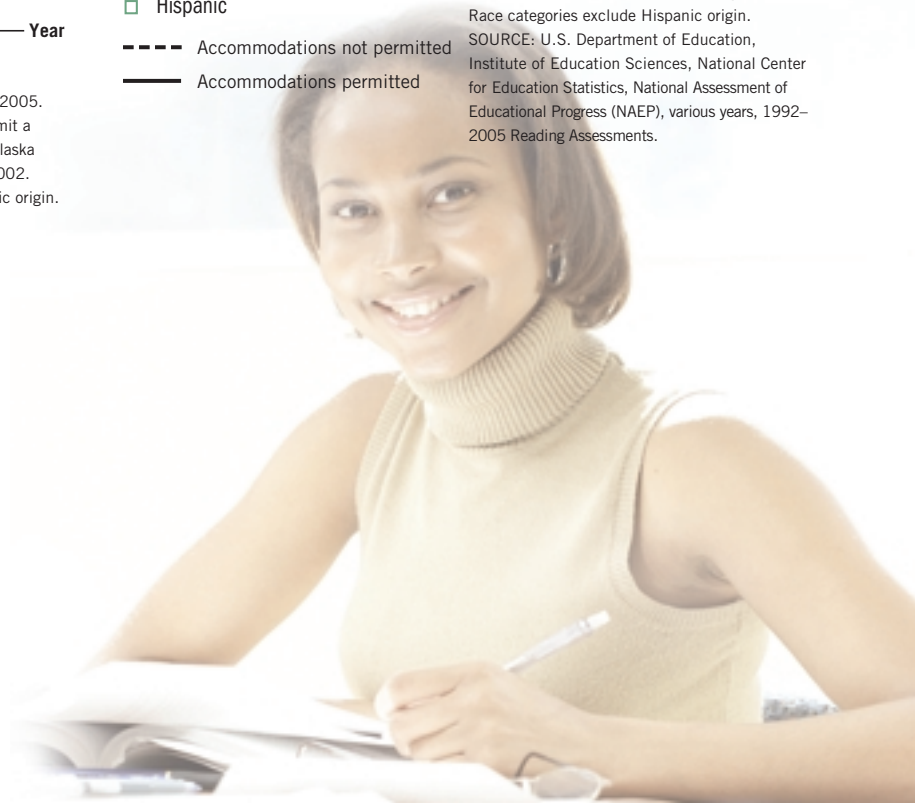
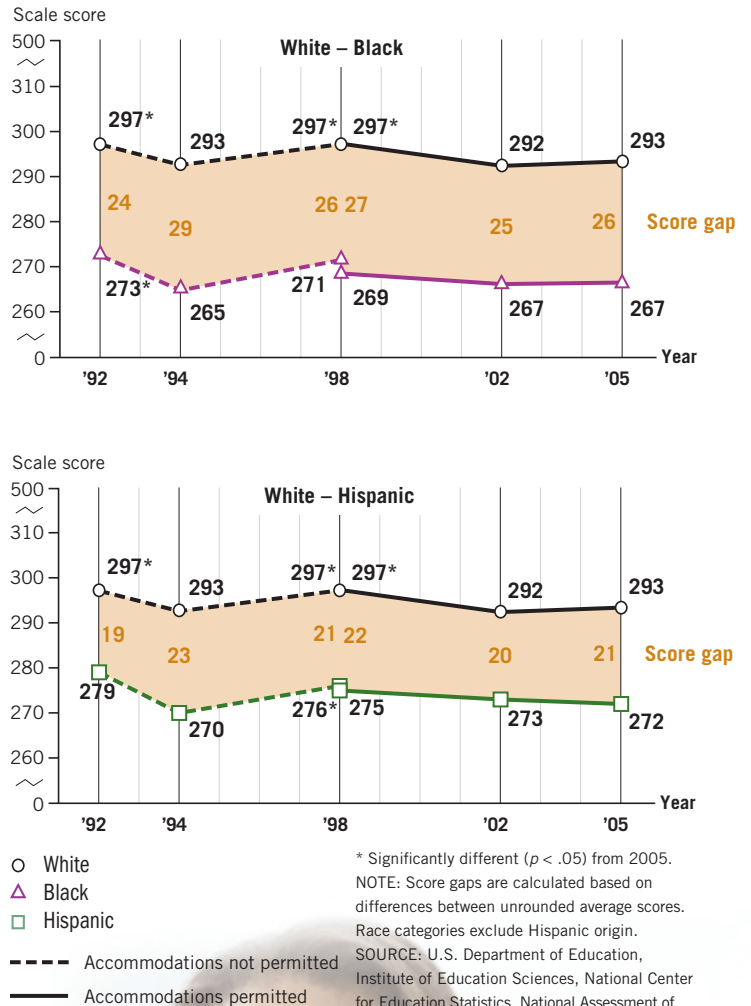


Figure 5

Trend in 12th-grade NAEP reading score gaps for White – Black and for White – Hispanic students



Changing student population

During the 13 years since the first reading assessment was administered, there have been significant shifts in the student population. As shown in table 1, White students made up a smaller proportion of the population in 2005 (67 percent) than they did in 1992 (74 percent). At the same time, the percentage of Hispanic students increased from 7 percent in 1992 to 14 percent in 2005.

Table 1

Percentage of 12th-grade students in the population, by race/ethnicity

	1992	1994	1998	2002	2005
○ White	74*	75*	72*	71*	67
△ Black	15*	13	14	12	13
□ Hispanic	7*	7*	10*	10*	14
▲ Asian/Pacific Islander	3*	4*	4*	5	5
■ American Indian/Alaska Native	#*	1	#*	‡	1

The estimate rounds to zero.

‡ Reporting standards not met. Sample size was insufficient to permit a reliable estimate for American Indian/Alaska Native students in 2002.

* Significantly different ($p < .05$) from 2005.

NOTE: Percentages for the unclassified race/ethnicity category are not included in this table. Race categories exclude Hispanic origin.

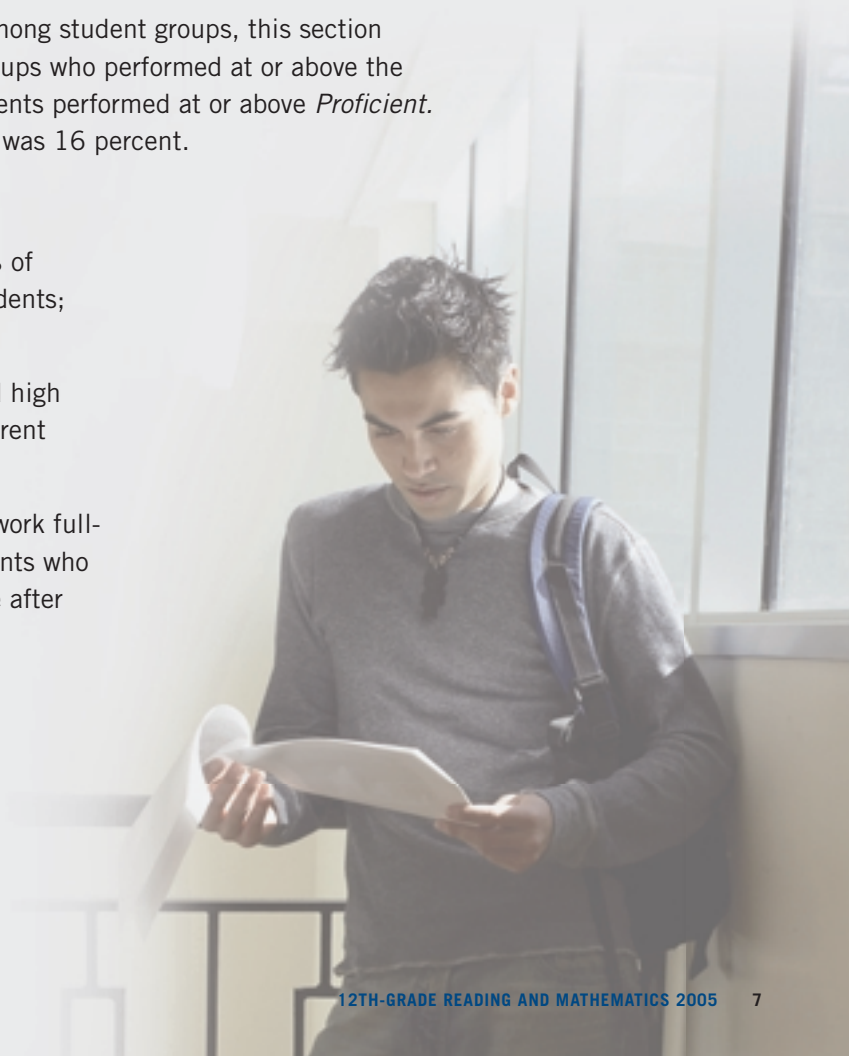
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1992–2005 Reading Assessments.

Achievement-level profiles

To help in understanding differences in performance among student groups, this section shows the percentage of students in each of several groups who performed at or above the *Proficient* level. For example, 43 percent of White students performed at or above *Proficient*. The percentage of Black students at or above this level was 16 percent.

Percentage of students at or above *Proficient*

- 43% of White students; 16% of Black students; 20% of Hispanic students; 36% of Asian/Pacific Islander students; 26% of American Indian/Alaska Native students
- 17% of students who reported neither parent finished high school; 47% of students who reported at least one parent graduated from college
- 15% of students who reported that they expected to work full-time after graduating from high school; 48% of students who reported that they expected to attend a 4-year college after graduating from high school



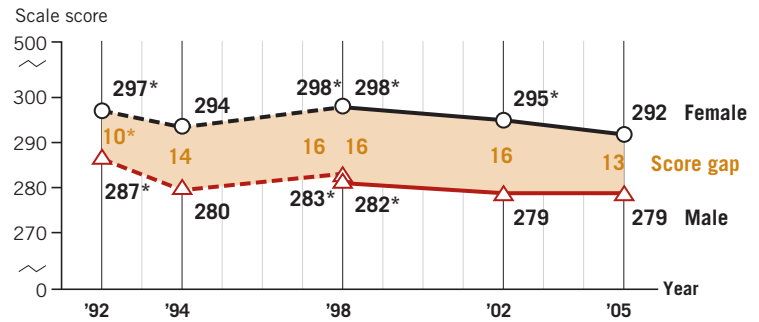
Female students outperform male students by a wider margin in 2005 than in 1992

In 2005, female students scored 13 points higher on average in reading than male students, as shown in figure 6. The average reading score for female students was lower in 2005 than in either 1992 or 2002. The score for male students, while lower than in 1992, was unchanged from 2002. The score for female students was 5 points lower in 2005 than in 1992, and the score for male students was 8 points lower, resulting in a widening of the gap between the two groups.

Though not shown here, female students outperformed male students in all three contexts for reading (reading for literary experience, for information, and to perform a task). Scores for male students showed declines in comparison to 1992 in all three contexts, while declines for female students were only significant in reading for literary experience. See the section on the reading framework on page 10 for more information on the contexts for reading.

Figure 6

Trend in 12th-grade average NAEP reading scores, by gender



* Significantly different ($p < .05$) from 2005.
NOTE: Score gaps are calculated based on differences between unrounded average scores.

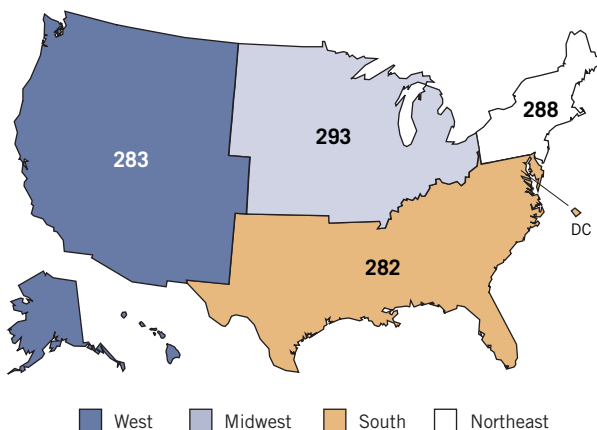
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Higher average reading scores in the Midwest

Average scores in 2005 by region show a higher score for students in the Midwest than in the Northeast and higher scores for both regions than for students in the South and West (figure 7). See page 23 for more information on how the regions were defined.

Figure 7

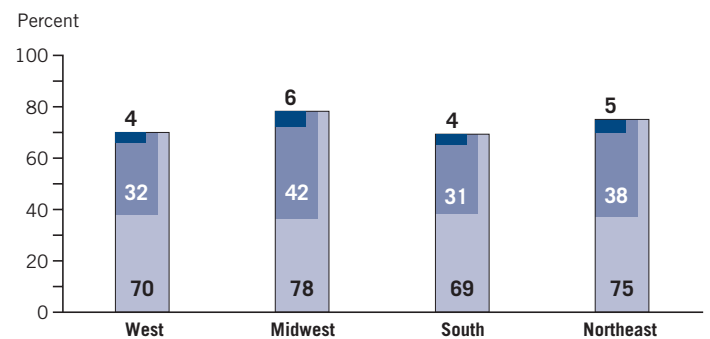
Twelfth-grade average NAEP reading scores in 2005, by region



Achievement-level results in figure 8 show similar patterns. The percentages of students both at or above *Basic* and at or above *Proficient* in the Midwest and Northeast were higher than in the West and South.

Figure 8

Twelfth-grade NAEP reading achievement-level results in 2005, by region



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1992–2005 Reading Assessments.

■ % at Advanced
■ % at or above Proficient
■ % at or above Basic

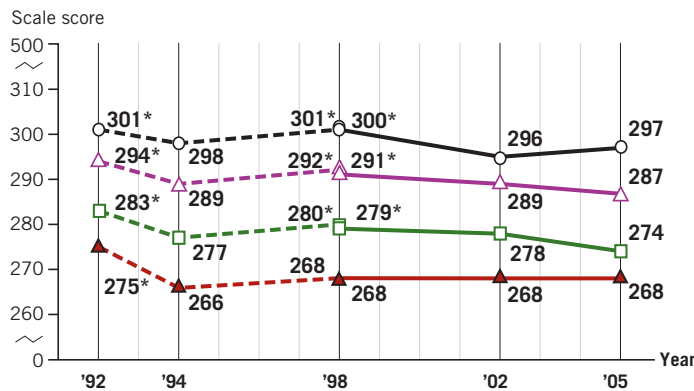
Average reading scores decline across all parental education levels

The reading results presented in figure 9 show that higher average reading scores were generally associated with higher levels of parental education. Students who reported that at least one parent graduated from college scored higher than students who reported lower levels of parental education.

Average reading scores were lower in 2005 than in 1992 regardless of the level of parental education students reported.

Figure 9

Trend in 12th-grade average NAEP reading scores, by highest level of parental education



- Graduated from college
- △ Some education after high school
- Graduated from high school
- ▲ Did not finish high school
- Accommodations not permitted
- Accommodations permitted

* Significantly different ($p < .05$) from 2005.

Percentage of students with parents graduating from college increasing

As shown in table 2, the percentage of students who reported that high school graduation was their parents' highest level of education was lower in 2005 than in 1992, while the percentage reporting that at least one parent graduated from college was higher in 2005 than in 1992.

Table 2

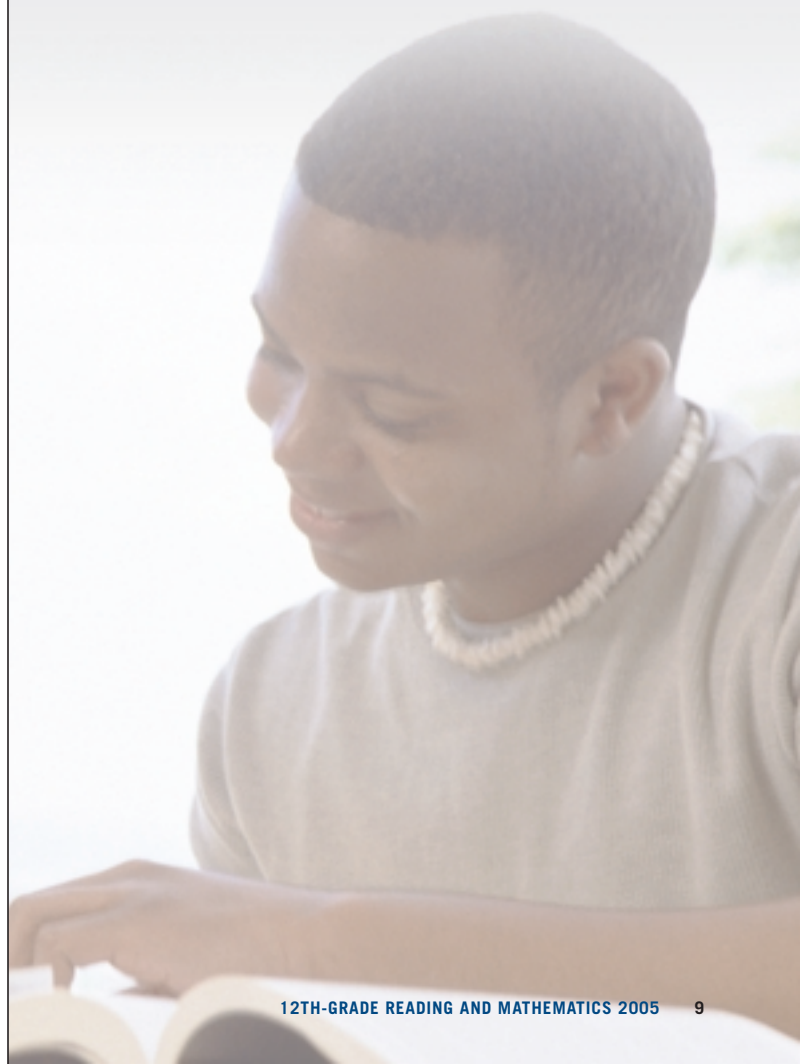
Percentage of 12th-grade students in the population, by highest level of parental education

	1992	1994	1998	2002	2005
Did not finish high school	8	7	7	7	8
Graduated from high school	22*	21*	19	18	18
Some education after high school	27*	26	25	24	24
Graduated from college	41*	44*	46	48	47

* Significantly different ($p < .05$) from 2005.

NOTE: Results are not shown for students who did not know the highest education level for either of their parents.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1992–2005 Reading Assessments.



Reading Framework

The current NAEP reading framework describes in detail how reading should be assessed at grade 12, and has been the basis for developing the assessment content since 1992. It reflects current definitions of literacy by differentiating among three contexts for reading.

The contexts for reading provide guidance for the types of texts to be included in the assessment. The framework specifies that 35 percent of the assessment be devoted to reading for literary experience, 45 percent to reading for information, and 20 percent to reading to perform a task.

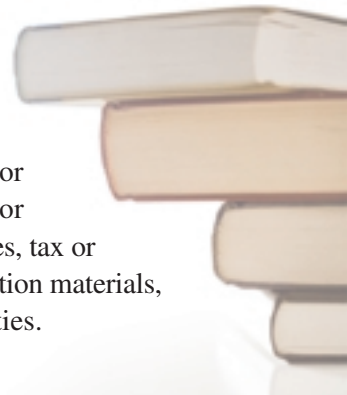
Twelfth-grade students who participated in the NAEP reading assessment were asked to read passages and answer a series of comprehension questions. At least one-half of the questions required written answers. The reading passages used in the NAEP assessment were drawn from the types of books and publications that students might encounter in school, in the library, or at home. Selections ranged from 500 to 1,500 words.

Contexts for reading

Reading for literary experience involves the reader in exploring themes, events, characters, settings, and the language of literary works. Various types of texts are associated with reading for literary experience, including short stories, poems, legends, myths, folktales, and biographies.

Reading for information engages the reader with aspects of the real world. Reading for information is most commonly associated with textbooks, primary and secondary sources, newspaper and magazine articles, essays, and speeches.

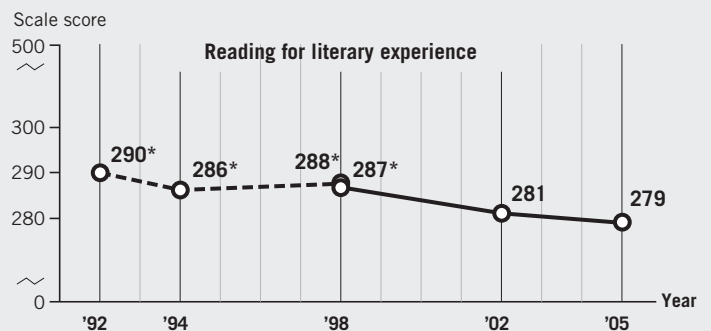
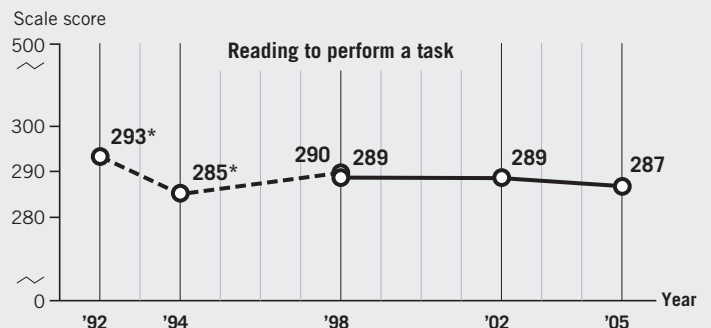
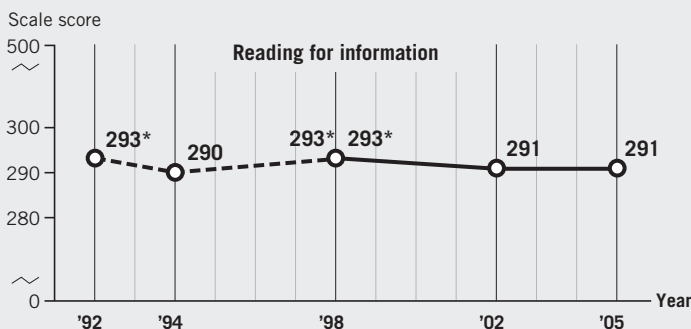
Reading to perform a task involves reading to accomplish something. Practical texts may include charts, bus or train schedules, directions for games or repairs, classroom or library procedures, tax or insurance forms, recipes, voter registration materials, maps, referenda, or consumer warranties.



Declines evident in all reading contexts

Scores declined from 1992 to 2005 in each of the three reading contexts. There was a 2-point decrease in reading for information, a 6-point decrease in reading to perform a task, and a 12-point decrease in reading for literary experience over the same time period. (Note that these score point differences are calculated based on the difference between unrounded average scores rather than on the rounded scores shown in the figure.)

Figure 10
Trend in 12th-grade average NAEP reading scores, by context for reading



--- Accommodations not permitted
— Accommodations permitted

* Significantly different ($p < .05$) from 2005.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1992–2005 Reading Assessments.

Reading achievement levels at grade 12

The reading achievement levels represent what 12th-graders should know and be able to do in reading at each level. The following are excerpts of the reading achievement-level descriptions with the corresponding minimum cut scores noted in parentheses. The full descriptions can be found at <http://www.nagb.org/pubs/pubs.html>.

Basic (265): Twelfth-grade students performing at the *Basic* level should be able to demonstrate an overall understanding and make some interpretations of the text. When reading text appropriate to twelfth grade, they should be able to identify and relate aspects of the text to its overall meaning, extend the ideas in the text by making simple inferences, recognize interpretations, make connections among and relate ideas in the text to their personal experiences, and draw conclusions. They should be able to identify elements of an author's style.

Proficient (302): Twelfth-grade students performing at the *Proficient* level should be able to show an overall understanding of the text, which includes inferential as well as literal information. When reading text appropriate to twelfth grade, they should be able to extend the ideas of the

text by making inferences, drawing conclusions, and making connections to their own personal experiences and other readings. Connections between inferences and the text should be clear, even when implicit. These students should be able to analyze the author's use of literary devices.

Advanced (346): Twelfth-grade students performing at the *Advanced* level should be able to describe more abstract themes and ideas in the overall text. When reading text appropriate to twelfth grade, they should be able to analyze both the meaning and the form of the text and explicitly support their analyses with specific examples from the text. They should be able to extend the information from the text by relating it to their experiences and to the world. Their responses should be thorough, thoughtful, and extensive.

Sample Multiple-Choice Reading Question

As part of the 2005 reading assessment, 12th-graders were presented with a Metro Guide to a city's transit system.



The multiple-choice question presented below required students to make a simple inference based on explicit information in the Metro Guide.

According to the guide, at which of the following times of day would the reduced Metrorail fare be in effect?

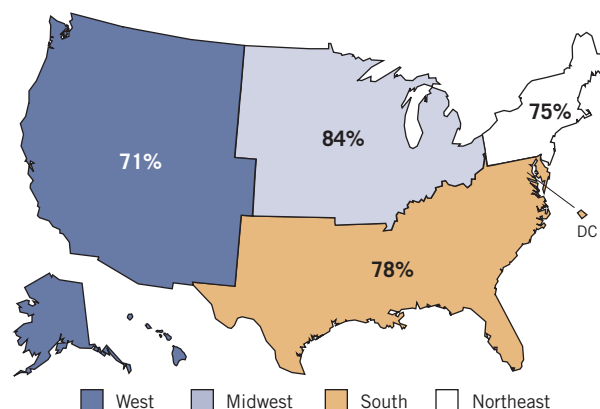
- (A) 5:30 a.m. (C) 3:00 p.m.
 (B) 6:00 a.m. (D) 7:30 p.m.

In addition to the overall percentage of students who answered the question correctly, the percentage of students at each achievement level who answered correctly is presented.

Percentage correct overall and at achievement levels in 2005

Overall	Below <i>Basic</i>	At <i>Basic</i>	At <i>Proficient</i>	At <i>Advanced</i>
77	48	81	93	98

Percentage of correct 12th-grade student responses in 2005, by region



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Reading Assessment.

Full information, including reading passages, is available for NAEP reading questions of various types and difficulty levels at <http://nces.ed.gov/nationsreportcard/itmrls>.

Sample Short Constructed-Response Reading Question

The following is a short constructed-response question which asked students to interpret document information in relation to a real-life situation. Responses to this task were rated according to a three-level scoring guide:

“Evidence of full comprehension” for responses that selected a place where Metro passes could be purchased and described both a convenience and an inconvenience of buying passes at that location.

“Evidence of partial comprehension” for responses that selected a place where Metro passes could be purchased but described only a convenience or only an inconvenience of buying passes at that location.

“Evidence of little or no comprehension” for responses that selected a place where Metro passes could be purchased but described neither a convenience nor an inconvenience of buying passes at that location.

The sample student response below was rated as “Evidence of full comprehension.” Examples of partial responses to this question and other information about NAEP questions can be found at <http://nces.ed.gov/nationsreportcard/itmrls>.

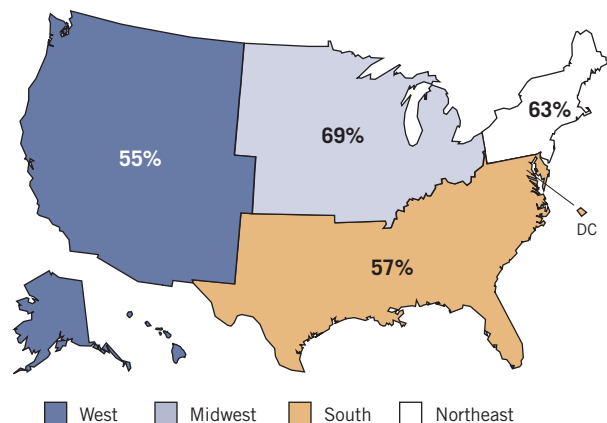
Choose one of the locations listed in the guide where Metro passes can be purchased. Describe one convenience and one inconvenience of buying passes at that location.

Metro passes can be purchased online with smartlink. It is a convenient way to purchase passes in the comfort of your own home. You don't have to leave your house or wait in line. However you do have to have a credit card and charge the passes.

Percentage rated as “Evidence of full comprehension” overall and at achievement levels in 2005

Overall	Below Basic	At Basic	At Proficient	At Advanced
60	24	62	84	92

Percentage of 12th-grade student responses rated “Evidence of full comprehension” in 2005, by region



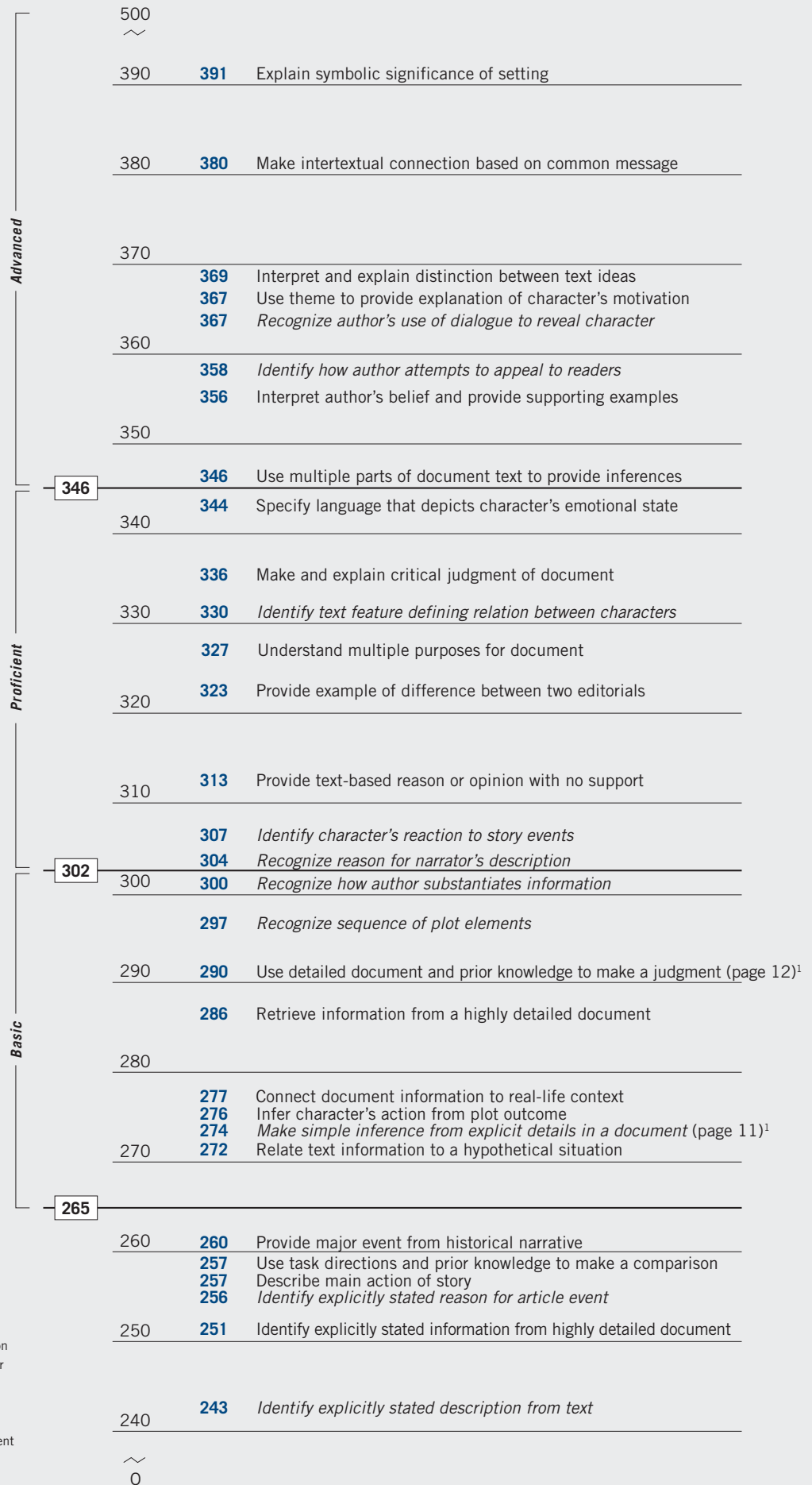
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Reading Assessment.



Range of Reading Performance

The item map is a useful tool for better understanding what it means to perform at different levels on the reading scale. The left side of the map shows the scores that define the lower boundaries of the *Basic*, *Proficient*, and *Advanced* achievement levels. The right side lists descriptions of some selected assessment questions that fall at various levels on the 0–500 scale. Retrieving information from a highly detailed document (286 on the scale) is an example of the knowledge and skills associated with performance at the *Basic* achievement level. Making a critical judgment about a detailed document and explaining their reasoning (336) is an example of the skills and knowledge demonstrated by students performing at the *Proficient* level. Note that several examples of performance below the *Basic* level are included. For example, students who perform below *Basic* are likely to be able to identify explicitly stated information from a highly detailed document (251) and to describe the main action of a story (257).

NAEP Reading Item Map



¹ Page numbers refer to the location in the report where the question described is presented.

NOTE: The position of a question on the scale represents the average scale score attained by students who had a 65 percent probability of correctly answering a constructed-response question, or a 74 percent probability of correctly answering a four-option multiple-choice question. For constructed-response questions, the question description represents students' performance rated as completely correct. Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Reading Assessment.

MATHEMATICS



New Mathematics Assessment

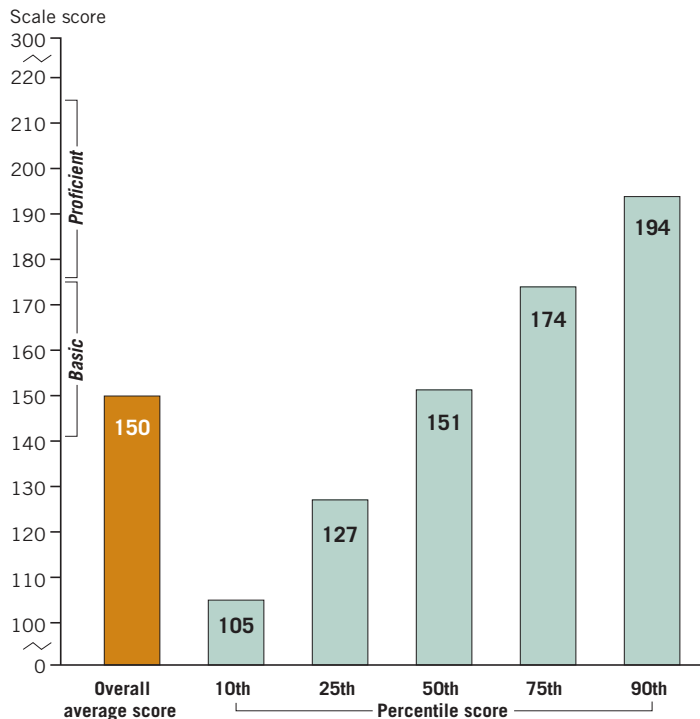
Sixty-one percent of students nationwide performed at or above the *Basic* achievement level in 2005, and 23 percent performed at or above *Proficient* on the new 12th-grade mathematics assessment. Asian/Pacific Islander students outperformed those in all other racial/ethnic groups. The average for White students was 31 points higher than for Black students and 24 points higher than for Hispanic students. Overall, male students scored higher on average than female students, but in two of the four content areas measured, there was no significant difference by gender in average scores.

Because of changes in assessment content and administration, the results for 2005 could not be directly compared to those from previous years.

Less than one-quarter of 12th-graders perform at the *Proficient* level or higher

Figure 11

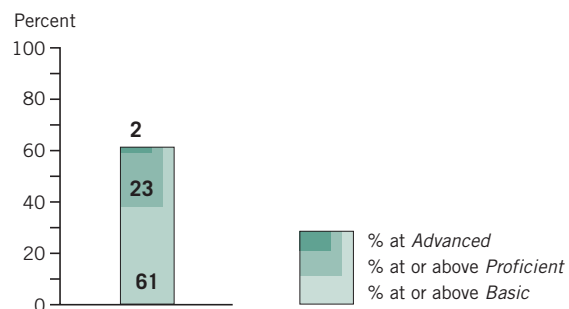
Average 12th-grade NAEP mathematics score and percentile scores in 2005



While the overall average mathematics score in 2005 was set at 150, students in grade 12 exhibited a wide range of performance as shown in figure 11. Scores ranged from 105 for lower-performing students at the 10th percentile, to 194 for higher-performing students at the 90th percentile. Sixty-one percent of 12th-graders performed at or above the *Basic* level in 2005, and 23 percent performed at or above the *Proficient* level (figure 12).

Figure 12

Twelfth-grade NAEP mathematics achievement-level results in 2005



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Changes to the NAEP mathematics assessment in 2005

For 2005, the National Assessment Governing Board adopted a new mathematics framework for grade 12 to reflect changes in high school standards and coursework. In addition, changes were made in booklet design and calculator-use policy for the one-third of the assessment in which calculators were allowed. Major differences from previous assessments are highlighted in the table. As a result of these changes, the 2005 results could not be placed on the previous NAEP scale and are not compared to results from previous years in this report. There were, however, some questions from the 2000 assessment that fit the requirements in the new framework and were used again in 2005. A special analysis was done to see how students' performance on this set of items differed between the two years. More information about this analysis can be found at <http://nces.ed.gov/nationsreportcard/mathematics/interpret-results.asp>.

2005 mathematics assessment	Previous mathematics assessments
Content areas	
Four content areas, with measurement and geometry combined into one because the majority of 12th-grade measurement topics are geometric in nature	Five content areas, with measurement and geometry represented as separate areas
Distribution of questions across content areas	
10% Number properties & operations	20% Number sense, properties, & operations
30% Measurement & geometry	15%; 20% Measurement; geometry & spatial sense
25% Data analysis & probability	20% Data analysis, statistics, & probability
35% Algebra	25% Algebra & functions
Reporting scale	
0–300 single-grade scale	0–500 cross-grade scale
Calculators	
Students given the option to bring their own graphing or scientific calculator, or are provided with a scientific calculator	Students provided with standard model scientific calculator
Booklet design	
Two 25-minute blocks	Three 15-minute blocks

Male students score higher than female students overall, but not in every content area

In 2005, male students scored higher on average than female students as shown in figure 13. When the results were examined by each of the four content areas, the scores for male students were only higher than the scores for female students in two content areas: the number properties and operations and the measurement and geometry content areas (table 3). Apparent differences in the other content areas were not statistically significant.

Figure 13

Average 12th-grade NAEP mathematics scores in 2005, by gender

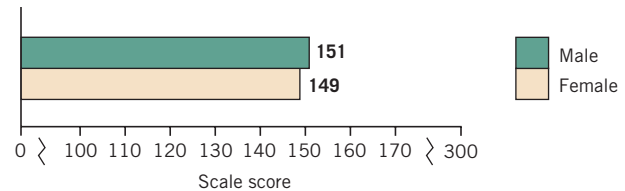


Table 3

Average 12th-grade NAEP mathematics scores in 2005, by gender and content area

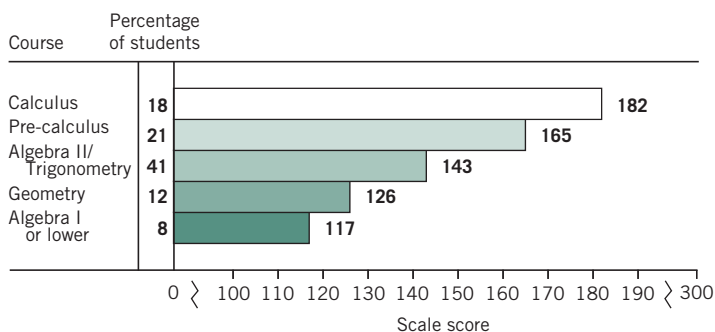
Content area	Male	Female
Number properties and operations	152	148
Measurement and geometry	152	148
Data analysis and probability	151	149
Algebra	151	150

Higher scores associated with advanced mathematics courses

Figure 14 shows the percentages of students and their average scores by the highest level mathematics course they reported having taken. The five categories, from highest to lowest level, were calculus, pre-calculus, algebra II/trigonometry, geometry, and algebra I or lower. The results show that taking higher level mathematics courses was associated with higher mathematics scores.

Figure 14

Percentages of 12th-grade students and average NAEP mathematics scores in 2005, by highest reported mathematics course



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.



Asian/Pacific Islander students outperform students in other racial/ethnic groups

As shown in figure 15, Asian/Pacific Islander students scored higher on average in 2005 than the other four racial/ethnic groups. The average score for White students was higher than the scores for Black, Hispanic, and American Indian/Alaska Native students. Hispanic students scored higher on average than Black students.

Generally, the comparisons between groups were similar in each of the four content areas (table 4). Scores for Asian/Pacific Islander students and White students were not significantly different in the number properties and operations and the data analysis and probability content areas. While there was no significant difference in scores for Black and American Indian/Alaska Native students overall, American Indian/Alaska Native students scored higher on average than Black students in measurement and geometry.

Figure 15

Average 12th-grade NAEP mathematics scores in 2005, by race/ethnicity

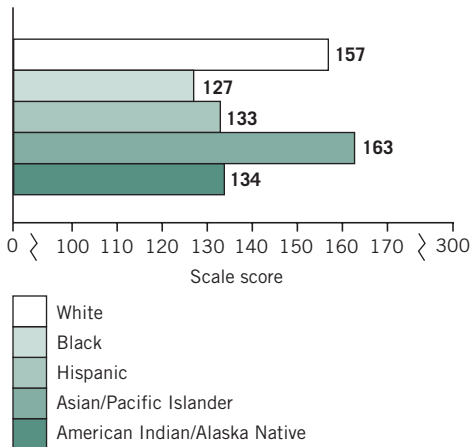


Table 4

Average 12th-grade NAEP mathematics scores in 2005, by race/ethnicity and content area

Content area	White	Black	Hispanic	Asian/Pacific Islander	American Indian/Alaska Native
Number properties and operations	158	126	132	160	132
Measurement and geometry	158	124	134	163	141
Data analysis and probability	158	126	132	157	134
Algebra	157	130	134	167	129

NOTE: Race categories exclude Hispanic origin.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Achievement-level profiles

To help in understanding differences in performance among student groups, this section shows the percentage of students in each of several groups who performed at or above the *Proficient* level. For example, 29 percent of White students performed at or above *Proficient*. The percentage of Black students at or above this level was 6 percent.

Percentage of students at or above *Proficient*

- 29% of White students; 6% of Black students; 8% of Hispanic students; 36% of Asian/Pacific Islander students; 6% of American Indian/Alaska Native students
- 7% of students who reported neither parent finished high school; 34% of students who reported at least one parent graduated from college
- 15% of students who reported never taking a mathematics Advanced Placement course; 55% of students who reported taking a mathematics Advanced Placement course



Mathematics achievement levels at grade 12

The following mathematics achievement levels describe what 12th-graders should know and be able to do in mathematics at each level. The cut score indicating the lower end of the score range for each level is noted in parentheses.

Basic (141): Twelfth-grade students performing at the *Basic* level should be able to solve mathematical problems that require the direct application of concepts and procedures in familiar situations. For example, they should be able to perform computations with real numbers and estimate the results of numerical calculations. These students should also be able to estimate, calculate, and compare measures and identify and compare properties of two- and three-dimensional figures, and solve simple problems using two-dimensional coordinate geometry. At this level, students should be able to identify the source of bias in a sample and make inferences from sample results, calculate, interpret, and use measures of central tendency and compute simple probabilities. They should understand the use of variables, expressions, and equations to represent unknown quantities and relationships among unknown quantities. They should be able to solve problems involving linear relations using tables, graphs, or symbols; and solve linear equations involving one variable.

Proficient (176): Students in the twelfth grade performing at the *Proficient* level should be able to select strategies to solve problems and integrate concepts and procedures. These students should be able to interpret an argument, justify a mathematical process, and make comparisons dealing with a wide variety of mathematical tasks. They should also be able to perform calculations involving similar figures including right triangle trigonometry. They should understand and apply properties of geometric figures and relationships between figures in two and three dimensions. Students at this level should select and use appropriate units of measure as they apply formulas to solve problems. Students performing at this level should be able to use measures of central tendency and variability of distributions to make decisions and predictions; calculate combinations and permutations to solve problems, and understand the use of the normal distribution to describe real-world situations. Students performing at the *Proficient* level should be able to identify, manipulate, graph, and apply linear, quadratic, exponential, and inverse proportionality ($y = k/x$) functions; solve routine and non-routine problems involving functions expressed in algebraic, verbal, tabular, and graphical forms; and solve quadratic and rational equations in one variable and solve systems of linear equations.

Advanced (216): Twelfth-grade students performing at the *Advanced* level should demonstrate in-depth knowledge of the mathematical concepts and procedures represented in the framework. They can integrate knowledge to solve complex problems and justify and explain their thinking. These students should be able to analyze, make and justify mathematical arguments, and communicate their ideas clearly. *Advanced* level students should be able to describe the intersections of geometric figures in two and three dimensions, and use vectors to represent velocity and direction. They should also be able to describe the impact of linear transformations and outliers on measures of central tendency and variability; analyze predictions based on multiple data sets; and apply probability and statistical reasoning in more complex problems. Students performing at the *Advanced* level should be able to solve or interpret systems of inequalities; and formulate a model for a complex situation (e.g., exponential growth and decay) and make inferences or predictions using the mathematical model.



Mathematics Framework

The framework calls for the assessment of mathematics within four content areas and at different levels of complexity. The framework specifies that 10 percent of assessment questions should be devoted to number properties and operations, 30 percent to measurement and geometry, 25 percent to data analysis and probability, and 35 percent to algebra.

The level of complexity of a question is determined by the demands it places on students. According to the framework, the ideal balance for the assessment is that one-half of the score is based on items of moderate complexity, with the remainder of the score based equally on items of low and high complexity.

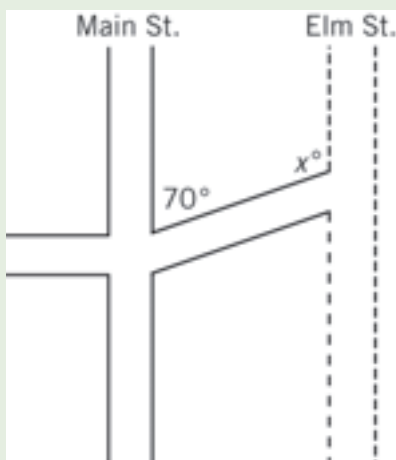
Assessment design

Each student received a booklet containing two 25-minute sections of 17 to 21 mathematics questions. Multiple-choice questions required students to select an answer from five options, while constructed-response questions required students to write either short or extended answers.

Calculators could be used for approximately one-third of the assessment. Students were permitted to bring whatever calculator they were accustomed to using in the classroom (including a graphing calculator) or were provided with scientific calculators. Graphing calculators were not needed to complete any question on the assessment.

Sample Multiple-Choice Mathematics Question

The following multiple-choice question comes from the measurement and geometry content area. The question required students to determine an angle formed by a cross street between two parallel streets.



In the figure above, Elm Street is to be constructed parallel to Main Street. What is the value of x ?

- (A) 70 (C) 120 (E) 140
 (B) 110 (D) 130

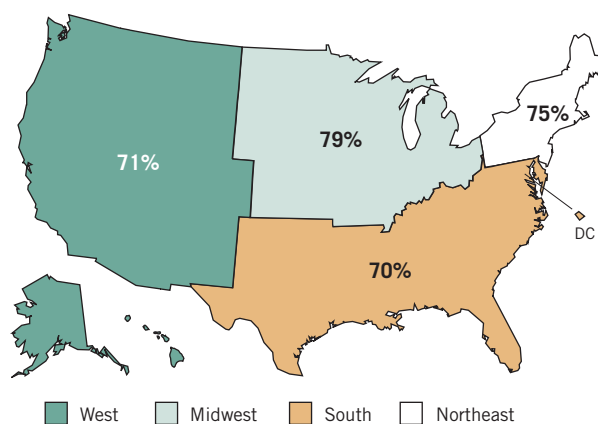
In addition to the overall percentage of students who answered the question correctly, the percentage of students at each achievement level who answered correctly is presented.

Percentage correct overall and at achievement levels in 2005

Overall	Below Basic	At Basic	At Proficient	At Advanced
73	49	83	96	‡

‡ Reporting standards not met. Sample size was insufficient to permit a reliable estimate.

Percentage of correct 12th-grade student responses in 2005, by region



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Full information is available for NAEP mathematics questions of various types and difficulty levels at <http://nces.ed.gov/nationsreportcard/itmrls>.



Sample Short Constructed-Response Mathematics Question

The following is a short constructed-response question from the algebra content area. The question asked students to determine the composition $f \circ g$ of a quadratic function f and a linear function g . Responses were rated as “Correct,” “Partial,” or “Incorrect.” The sample student response below was rated “Correct.”

If $f(x) = x^2 + x$ and $g(x) = 2x + 7$, what is an expression for $f(g(x))$?

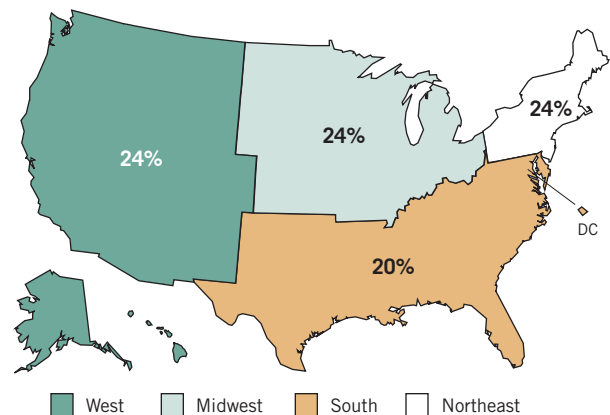
$$f(2x+7) = (2x+7)^2 + (2x+7)$$

Percentage “Correct” overall and at achievement levels in 2005

Overall	Below Basic	At Basic	At Proficient	At Advanced
23	1	16	60	†

† Reporting standards not met. Sample size was insufficient to permit a reliable estimate.

Percentage of “Correct” 12th-grade student responses in 2005, by region

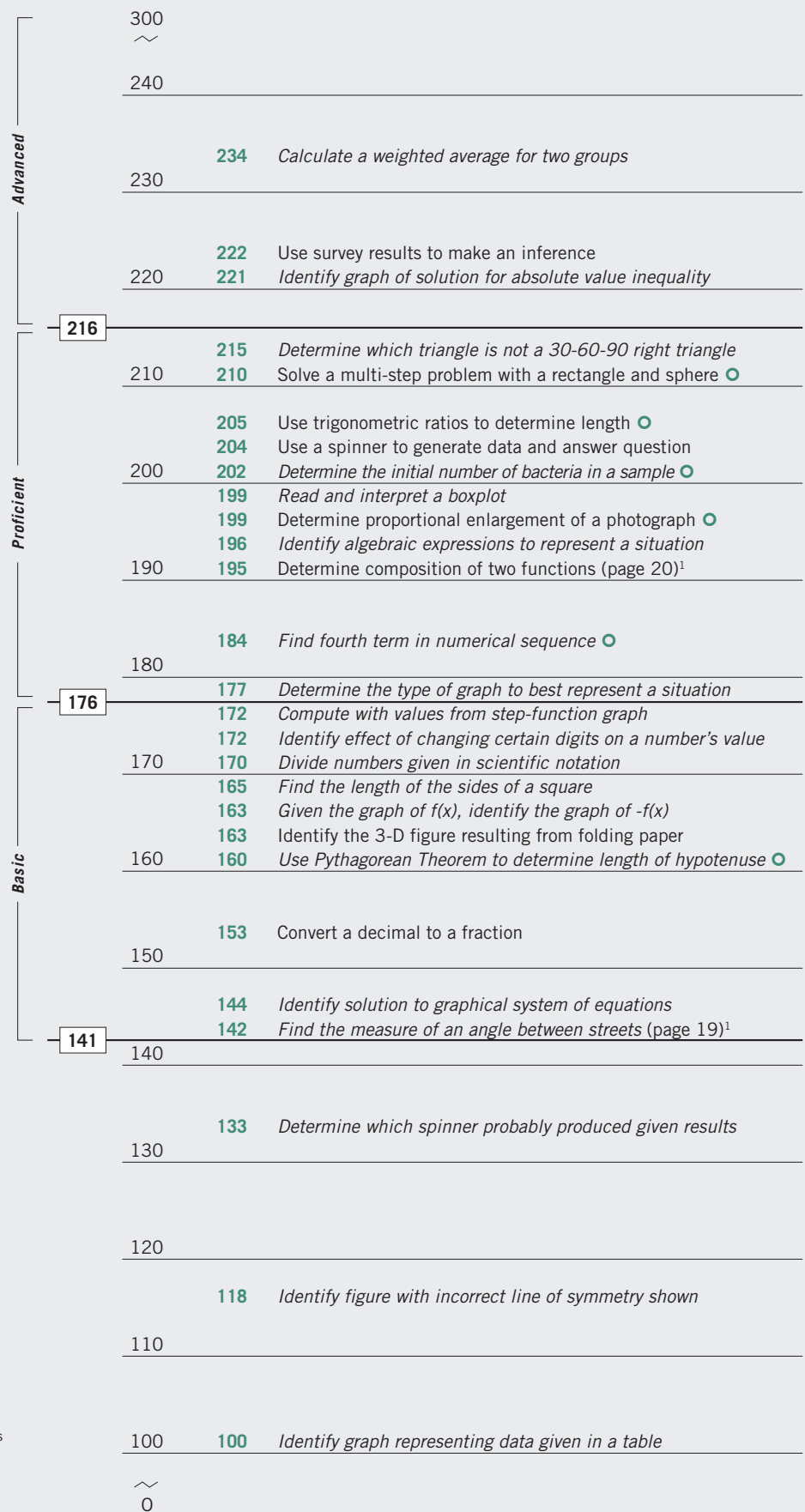


SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Range of Mathematics Performance

The item map is a useful tool for better understanding what it means to perform at different levels on the mathematics scale. The left side of the map shows the scores that define the lower boundaries of the *Basic*, *Proficient*, and *Advanced* achievement levels. The right side lists descriptions of some selected assessment questions that fall at various levels on the 0–300 scale. Using the Pythagorean Theorem to determine the length of a hypotenuse (160 on the scale) is an example of the knowledge and skills demonstrated by students performing at the *Basic* achievement level. An example of the knowledge and skills demonstrated by students performing at the *Proficient* level is using trigonometric ratios to determine length (205). Note that several examples of performance below the *Basic* level are included. For example, students who perform below *Basic* are likely to be able to identify a graph representing data given in a table (100) and to determine which spinner probably produced given results (133).

NAEP Mathematics Item Map



○ Calculator available

¹ Page numbers refer to the location in the report where the question described is presented.

NOTE: The position of a question on the scale represents the average scale score attained by students who had a 65 percent probability of correctly answering a constructed-response question, or a 72 percent probability of correctly answering a five-option multiple-choice question. For constructed-response questions, the question description represents students' performance rated as completely correct. Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

Technical Notes

Sampling and weighting

The schools and students participating in NAEP assessments are chosen to be nationally representative. The sample was chosen using a two-stage design that involved sampling students from selected schools (public and nonpublic) across the country. More information on sampling can be found at <http://nces.ed.gov/nationsreportcard/about/nathow.asp>.

Each school that participated in the assessment, and each student assessed, represents a portion of the population of interest. Results are weighted to make valid inferences between the student samples and the respective populations from which they are drawn. Sampling weights account for disproportionate representation due to the oversampling of students who attend schools with high concentrations of minority students and students who attend nonpublic schools, and also account for lower sampling rates for very small schools.

Accommodations

Prior to 1998, no testing accommodations were provided in the reading assessment to students with disabilities and English language learners. In 1998, administration procedures were introduced that allowed the use of accommodations, such as extra testing time or individual rather than group administration, for a subsample of students in the reading assessment. In 1998, two samples of students were assessed in reading: one in which accommodations were permitted and one in which they were not permitted. This made it possible to report trends in students' reading achievement across all the assessment years and, at the same time, examine how including students assessed with accommodations affected overall assessment results. Based on analysis of the results, it was decided that, beginning with the 2002 reading assessment, NAEP would permit the use of accommodations for all assessments. In this report, the 1998 reading results are presented for both samples. For subsequent years, only results from the accommodated sample are shown.

The results for the 2005 mathematics assessment are based on administration procedures that allowed accommodations. Some accommodations allowed in the mathematics assessment were not allowed for reading, including read aloud and bilingual booklets.

Introducing accommodations in the NAEP program appears to have had little impact on the percentage of students excluded in the reading assessment at grade 12. The exclusion rate for reading was 5 percent in 1992 and 4 percent in 2005. The exclusion rate for mathematics was 3 percent in 2005. The results presented in this report reflect the performance of students who could be assessed. No attempt was made to infer or include performance estimates for students who could not be assessed due to a disability or because they were still learning English. Additional information on exclusion can be found at [http://nces.ed.gov/nationsreportcard/nrc/reading_math_2005/s0093.asp?printver=.](http://nces.ed.gov/nationsreportcard/nrc/reading_math_2005/s0093.asp?printver=)



School and student participation rates

To ensure unbiased samples, school participation rates need to be at least 85 percent before substitute schools are added to meet reporting requirements established by NCES and the Governing Board. While participation standards were met for public schools at grade 12, they were not met for private schools.

At the student level, response rates at grade 12 fell below 85 percent for students in both public and private schools. A nonresponse bias analysis showed significant differences between responding and nonresponding public school students in terms of gender, race/ethnicity, age, and English language learner identification. Although the differences are quite small, it is unlikely that nonresponse weighting adjustments completely accounted for these differences.

Results by region of the country

NAEP analyses and reports use the U.S. Census Bureau’s definition of “region.” The four regions defined by the U.S. Census Bureau are West, Midwest, South, and Northeast. The table to the right shows how the 50 states and District of Columbia are subdivided into these Census regions.

The percentages of 12th-graders vary by region. For example, of the 12th-graders assessed in 2005 in reading and mathematics, 34 percent were in the South, 23 percent in the Midwest, 23 percent in the West, and 20 percent in the Northeast.

West	Midwest	South	Northeast
Alaska	Illinois	Alabama	Connecticut
Arizona	Indiana	Arkansas	Maine
California	Iowa	Delaware	Massachusetts
Colorado	Kansas	District of Columbia	New Hampshire
Hawaii	Michigan	Florida	New Jersey
Idaho	Minnesota	Georgia	New York
Montana	Missouri	Kentucky	Pennsylvania
Nevada	Nebraska	Louisiana	Rhode Island
New Mexico	North Dakota	Maryland	Vermont
Oregon	Ohio	Mississippi	
Utah	South Dakota	North Carolina	
Washington	Wisconsin	Oklahoma	
Wyoming		South Carolina	
		Tennessee	
		Texas	
		Virginia	
		West Virginia	

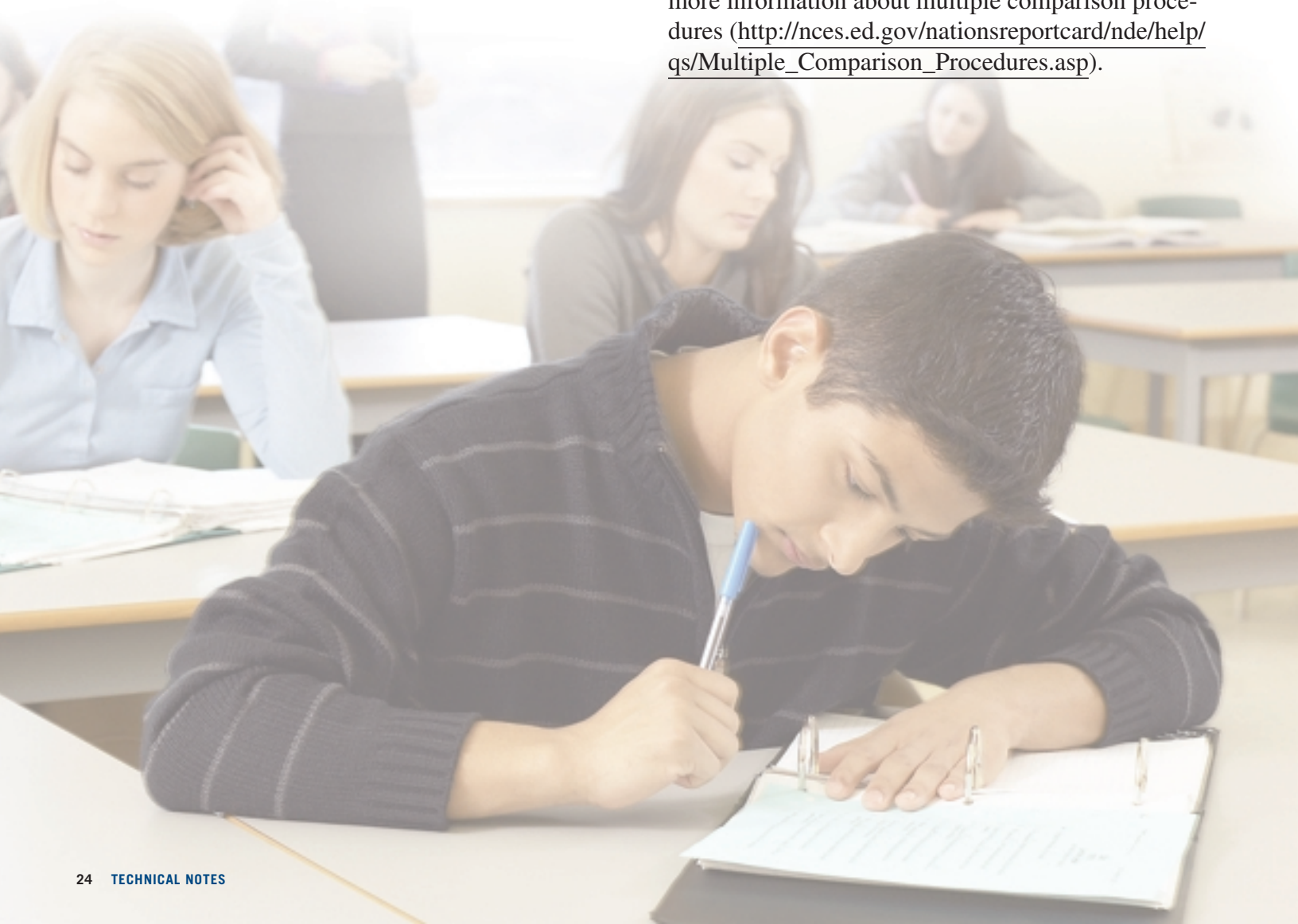
SOURCE: U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau.



Interpreting statistical significance

Comparisons over time or between groups are based on statistical tests that consider both the size of the differences and the standard errors of the two statistics being compared. Standard errors are margins of error, and estimates based on smaller groups are likely to have larger margins of error. The size of the standard errors may also be influenced by other factors such as how representative the students assessed are of the population as a whole. When an estimate—such as an average score—has a large standard error, a numerical difference that seems large may not be statistically significant. Differences of the same magnitude may or may not be statistically significant depending upon the size of the standard errors of the statistics. For example, a 3-point difference between male and female students may be statistically significant, while

a 3-point difference between White and Hispanic students may not be. Standard errors for the NAEP scores and percentages presented in this report are available on the NAEP website (<http://nces.ed.gov/nationsreportcard/nde/>). In the tables and charts of this report, the symbol (*) is used to indicate that a score or percentage in a previous assessment year is significantly different from the comparable measure in 2005. Statistically significant differences between groups of students—for example, between White students and Black students—are not identified in the tables and charts, but they were tested in the same way. Any difference between scores or percentages that is identified as higher, lower, larger, or smaller in this report has been determined to be statistically significant at the .05 level with appropriate adjustments for multiple comparisons. See the NAEP website for more information about multiple comparison procedures (http://nces.ed.gov/nationsreportcard/nde/help/qs/Multiple_Comparison_Procedures.asp).



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THE NATION'S REPORT CARD

12th GRADE READING AND MATHEMATICS 2005

February 2007

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