Assessment Content at Grade 4

To interpret the results in meaningful ways, it is important to understand the content of the assessment. Content was varied to reflect differences in the skills students were expected to have at each grade. The proportion of the assessment devoted to each of the mathematics content areas in each grade can be found in table 13.

Of the 166 questions that made up the fourth-grade mathematics assessment, the largest percentage (40 percent) focused on number properties and operations. It was expected that fourth-graders should have a solid grasp of whole numbers and a beginning understanding of fractions.

In measurement, the emphasis was on length, including perimeter, distance, and height. Students were expected to demonstrate knowledge of common customary and metric units. In geometry, students were expected to be familiar with simple figures in two and three dimensions and their attributes. In data analysis and probability, students were expected to demonstrate understanding of how data are collected and organized and basic concepts of probability. In algebra at this grade, the emphasis was on recognizing, describing, and extending patterns and rules.

MATHEMATICS ACHIEVEMENT LEVELS AT GRADE 4

The following descriptions are abbreviated versions of the full achievement-level descriptions for grade 4 mathematics. The cut score depicting the lowest score representative of that level is noted in parentheses. The full descriptions can be found at http://www.nagb.org/frameworks/math_07.pdf.

Basic (214): Fourth-graders performing at the *Basic* level should be able to estimate and use basic facts to perform simple computations with whole numbers; show some understanding of fractions and decimals; and solve some simple real-world problems in all NAEP content areas. Students at this level should be able to use—though not always accurately—four-function calculators, rulers, and geometric shapes. Their written responses are often minimal and presented without supporting information.

Proficient (249): Fourth-graders performing at the *Proficient* level should be able to use whole numbers to estimate, compute, and determine whether results are reasonable. They should have a conceptual understanding of fractions and decimals; be able to solve real-world problems in all NAEP content areas; and use four-function calculators, rulers, and geometric shapes appropriately. Students performing at the *Proficient* level should employ problem-solving strategies such as identifying and using appropriate information. Their written solutions should be organized and presented both with supporting information and explanations of how they were achieved.

Advanced (282): Fourth-graders performing at the *Advanced* level should be able to solve complex nonroutine real-world problems in all NAEP content areas. They should display mastery in the use of four-function calculators, rulers, and geometric shapes. These students are expected to draw logical conclusions and justify answers and solution processes by explaining why, as well as how, they were achieved. They should go beyond the obvious in their interpretations and be able to communicate their thoughts clearly and concisely.

What Fourth-Graders Know and Can Do in Mathematics

The item map below is useful for understanding performance at different levels on the scale. The scale scores on the left represent the average scores for students who were likely to get the items correct. The lower-boundary scores at each achievement level are noted in boxes. The descriptions of selected assessment questions are listed on the right along with the corresponding mathematics content areas.

For example, the map shows that fourth-graders performing in the middle of the *Basic* range (students with an average score of 225) were likely to be able to identify a fraction modeled by a picture. Students performing in the middle of the *Proficient* range (with an average score of 267) were likely to be able to explain how to find the perimeter of a given shape.

GRADE 4 NAEP MATHEMATICS ITEM MAP

Achievement level	Scale score	Content area	Question description
	500		
Advanced	330	Data analysis and probability	Label sections in a spinner to satisfy a given condition
Advanced	318	Number properties and operations	*Add three fractions with like denominators*
Advanced	296	Algebra	*Relate input to output from a table of values*
Advanced	294	Number properties and operations	*Solve a story problem involving addition and subtraction* (shown on page 64)
Advanced	290	Measurement	*Find area of a square with inscribed triangle* (shown on page 65)
Advanced	289	Geometry	*Recognize the result of folding a given shape*
Advanced	287	Data analysis and probability	Identify color with highest chance of being chosen (shown on page 67)
	282		
Proficient	279	Number properties and operations	Solve a story problem requiring multiple operations
Proficient	279	Data analysis and probability	*Identify picture representing greatest probability*
Proficient	267	Measurement	Explain how to find the perimeter of a given shape
Proficient	264	Number properties and operations	*Solve a story problem involving money*
Proficient	263	Algebra	*Identify number that would be in a pattern*
Proficient	262	Geometry	*Determine the number of blocks used to build a figure*
Proficient	255	Number properties and operations	*Use place value to determine the amount of increase*
Proficient	250	Geometry	*Identify the 3-D shape resulting from folding paper*
Proficient	249	Data analysis and probability	*Determine probability of a specific outcome*
	249		
Basic	245	Number properties and operations	Recognize property of odd numbers
Basic	243	Number properties and operations	Multiply two decimal numbers
Basic	232	Measurement	*Determine attribute being measured from a picture*
Basic	230	Number properties and operations	*Subtract a three-digit number from a four-digit number*
Basic	227	Algebra	*Identify number sentence that models a balanced scale* (shown on page 68)
Basic	225	Number properties and operations	*Identify a fraction modeled by a picture*
Basic	220	Algebra	*Identify an expression that represents a scenario*
Basic	218	Number properties and operations	*Find a sum based on place value*
Basic	217	Geometry	*Identify congruent triangles*
	214		
	211	Data analysis and probability	Complete a bar graph
	205	Geometry	*Use reason to identify figure based on description* (shown on page 66)
	202	Measurement	*Identify appropriate unit for measuring length*
	202	Number properties and operations	*Identify place value representation of a number*
	191	Algebra	*Find unknown in whole number sentence*
	0		

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The position of a question on the scale represents the average scale score attained by students who had a 65 percent probability of successfully 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. Scale score ranges for mathematics achievement levels are referenced on the map.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Sample Multiple-Choice Question—Number Properties and Operations

This sample question measures fourth-graders' performance in the number properties and operations content area. In particular, it addresses the "Number operations" subtopic, which focuses on computation, the effects of operations on numbers, and the relationships between operations. The framework objective measured is "Solve application problems involving numbers and operations." Students were not permitted to use a calculator to solve this problem.

Thirty-one percent of AI/AN fourth-graders selected the correct answer (choice B). One way to arrive at this answer is first to use subtraction to determine that the bridge was built in 1926, and then use addition to determine that it was 50 years old in 1976. The most common incorrect choice (choice A), which was selected by 39 percent of fourth-graders, can be obtained by subtracting 50 years from 2001. The other incorrect answer choices (C and D) represent computation errors.

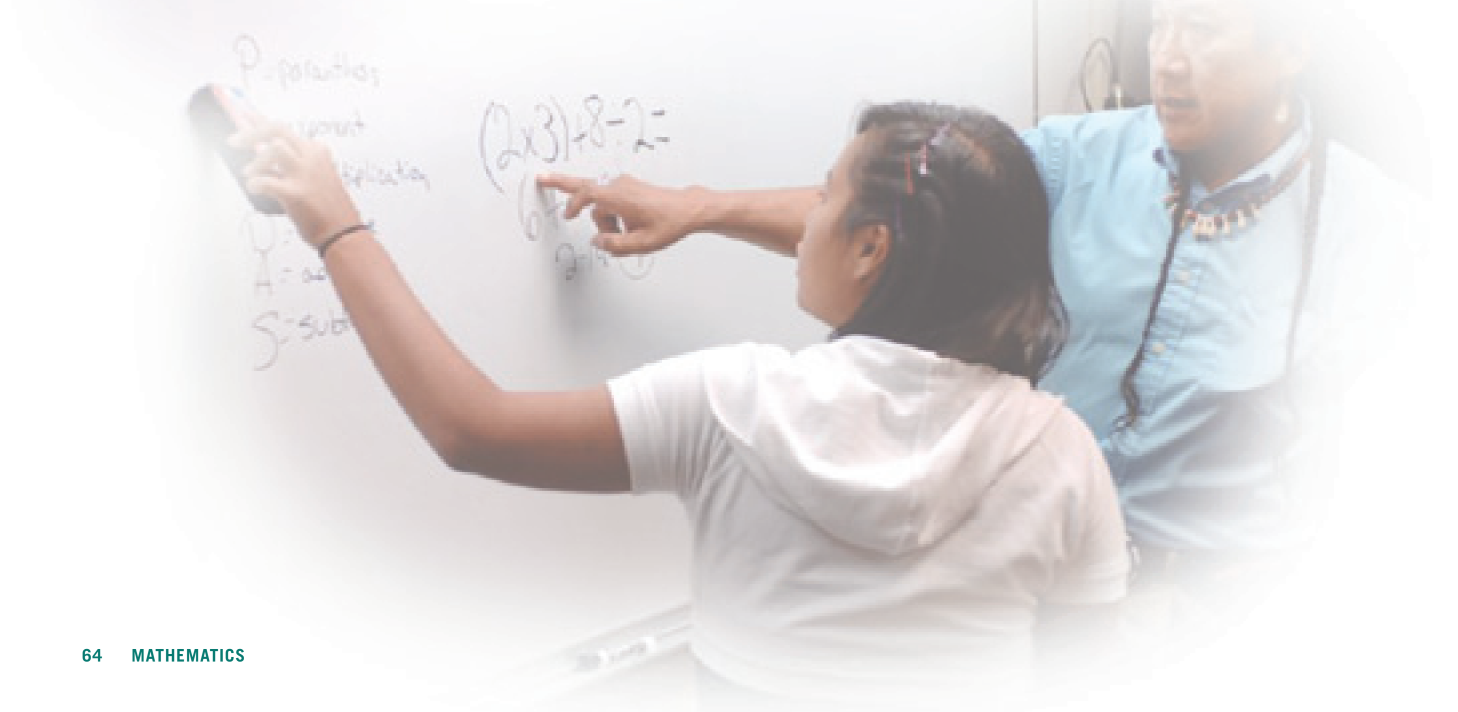
The Ben Franklin Bridge was 75 years old in 2001. In what year was the bridge 50 years old?

- Ⓐ 1951
- Ⓑ 1976
- Ⓒ 1984
- Ⓓ 1986

Percentage of fourth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Omitted
Nation (all students)	39	**36**	10	14	1
AI/AN students	39	**31**	11	17	3

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



Sample Multiple-Choice Question—Measurement

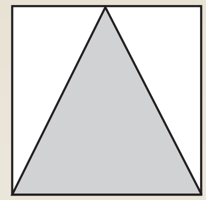
This sample question measures fourth-graders' performance in the measurement content area. This question addresses the "Measuring physical attributes" subtopic, which focuses on identifying attributes that can be measured, comparing objects or estimating the size of an object, using measurement instruments, and solving problems involving perimeter and area of simple plane figures. The framework objective measured by this question is "Compare objects with respect to a given attribute, such as length, area, volume, time, or temperature." A calculator was not available for this question.

Forty-three percent of AI/AN fourth-graders selected the correct answer (choice C). To answer this question, the student could reason that the area of the triangle, which is equal to "½ × base × height," is also equal to "½ × base of the square × height of the square," or equivalent to ½ times the area of the square. Since the area of the triangle is equal to 4, the area of the square is equal to twice the area of the triangle, which is 2 × 4 = 8 square inches. Incorrect answer choices are 4 (choice B), which is the area of the triangle, one-half of 4 (choice A), and 4^2 (choice D).

Percentage of fourth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Omitted
Nation (all students)	12	17	**48**	22	1
AI/AN students	15	22	**43**	19	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



If the area of the shaded triangle is 4 square inches, what is the area of the entire square?

Ⓐ 2 square inches

Ⓑ 4 square inches

Ⓒ 8 square inches

Ⓓ 16 square inches

Sample Multiple-Choice Question—Geometry

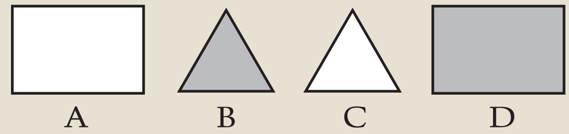
This sample question measures fourth-graders' performance in the geometry content area. This question addresses the "Mathematical reasoning" subtopic, which focuses on reasoning about geometric figures and their properties. The framework objective measured by this question is "Distinguish which objects in a collection satisfy a given geometric definition and explain choices." A calculator was not available for this question.

Eighty-seven percent of AI/AN fourth-graders selected the correct answer (choice D), the shaded rectangle.

Percentage of fourth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Omitted
Nation (all students)	5	3	1	**90**	1
AI/AN students	6	3	3	**87**	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



Melissa chose one of the figures above.

- **The figure she chose was shaded.**
- **The figure she chose was not a triangle.**

Which figure did she choose?

Ⓐ **A**

Ⓑ **B**

Ⓒ **C**

Ⓓ **D**

Sample Constructed-Response Question—Data Analysis and Probability

This sample question measures fourth-graders' performance in the data analysis and probability content area. It addresses the "Probability" subtopic, which focuses on simple probability and counting or representing the outcomes of a given event. The framework objective measured by this question is "Use informal probabilistic thinking to describe chance events." A calculator was not available for this question.

Student responses for this question were rated using the following three-level scoring guide:

Correct—Response indicates that a red cube is most likely to be picked <u>and</u> indicates that the probability is 3 out of 6 (or equivalent).

Partial—Response indicates that a red cube is most likely to be picked <u>or</u> indicates that the probability is 3 out of 6 (or equivalent).

Incorrect—All incorrect responses.

The student response on the right was rated as "Correct" because both parts of the question were answered correctly. Eleven percent of AI/AN fourth-graders gave a response that was rated "Correct" for this question. Seventy percent of AI/AN fourth-graders provided a response rated as "Partial."

Percentage of fourth-grade students in each response category in 2007

Student group	Correct	Partial	Incorrect	Omitted
Nation (all students)	22	67	10	1
AI/AN students	11	70	18	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because a small percentage of responses that did not address the assessment task are not shown.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

There are 6 cubes of the same size in a jar.

2 cubes are yellow.

3 cubes are red.

1 cube is blue.

Chuck is going to pick one cube without looking. Which color is he most likely to pick?

red

What is the probability of this color being picked?

3 out of 6

Sample Multiple-Choice Question—Algebra

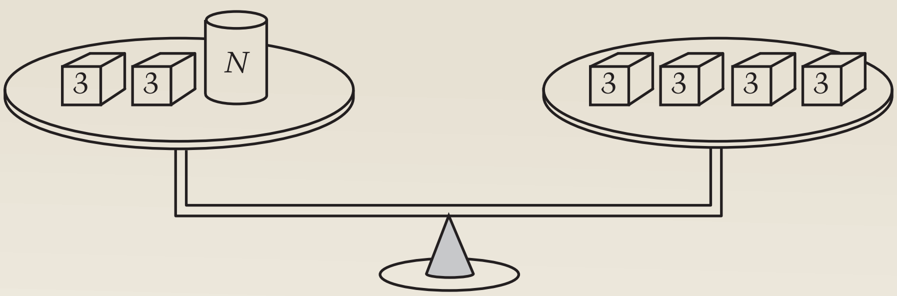
This sample question measures fourth-graders' performance in the algebra content area. This question addresses the "Variables, expressions, and operations" subtopic, which focuses on representing unknown quantities and expressing simple mathematical relationships with symbols. The framework objective measured by this question is "Express simple mathematical relationships using number sentences." A calculator was available for this question.

Seventy-two percent of AI/AN fourth-graders selected the correct answer (choice A). Answering this question correctly requires recognizing that each block on the scale represents the quantity "three," and the cylinder represents a specific, but unknown, quantity. The incorrect answer choices are obtained by using the number of blocks instead of the weight of the blocks on the right side of the scale (choice B), the left side of the scale (choice C), or both (choice D).

Percentage of fourth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Omitted
Nation (all students)	**79**	5	9	5	2
AI/AN students	**72**	9	9	8	2

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



The weights on the scale above are balanced. Each cube weighs 3 pounds. The cylinder weighs *N* pounds. Which number sentence best describes this situation?

- (A) $6 + N = 12$
- (B) $6 + N = 4$
- (C) $2 + N = 12$
- (D) $2 + N = 4$

Assessment Content at Grade 8

Of the 168 questions that made up the eighth-grade mathematics assessment, the largest percentage (approximately 30 percent) focused on algebra. The emphasis was on students' understanding of algebraic representations, patterns, and functions; linearity; and algebraic expressions, equations, and inequalities. The knowledge and skills expected at grade 8 in number properties and operations include computing with rational numbers, common irrational numbers, and numbers in scientific notation, and using numbers to solve problems involving proportionality and rates. In the measurement content area, students were expected to be familiar with area, volume, angles, and rates. In geometry, eighth-graders were expected to be familiar with parallel and perpendicular lines, angle relations in polygons, cross sections of solids, and the Pythagorean theorem. In data analysis and probability, students were expected to use a variety of techniques for organizing and summarizing data, analyzing statistical claims, and demonstrating an understanding of the terminology and concepts of probability.

MATHEMATICS ACHIEVEMENT LEVELS AT GRADE 8

The following descriptions are abbreviated versions of the full achievement-level descriptions for grade 8 mathematics. The cut score depicting the lowest score representative of that level is noted in parentheses. The full descriptions can be found at http://www.nagb.org/frameworks/math_07.pdf.

Basic (262): Eighth-graders performing at the *Basic* level should complete problems correctly with the help of structural prompts such as diagrams, charts, and graphs. They should be able to solve problems in all NAEP content areas through the appropriate selection and use of strategies and technological tools, including calculators, computers, and geometric shapes. Students at this level also should be able to use fundamental algebraic and informal geometric concepts in problem solving. As they approach the *Proficient* level, students at the *Basic* level should be able to determine which of the available data are necessary and sufficient for correct solutions and use them in problem solving. However, these eighth-graders show limited skill in communicating mathematically.

Proficient (299): Eighth-graders performing at the *Proficient* level should be able to conjecture, defend their ideas, and give supporting examples. They should understand the connections among fractions, percents, decimals, and other mathematical topics such as algebra and functions. Students at this level are expected to have a thorough understanding of *Basic* level arithmetic operations—an understanding sufficient for problem solving in practical situations. Quantity and spatial relationships in problem solving and reasoning should be familiar to them, and they should be able to convey underlying reasoning skills beyond the level of arithmetic. They should be able to compare and contrast mathematical ideas and generate their own examples. These students should make inferences from data and graphs, apply properties of informal geometry, and accurately use the tools of technology. Students at this level should understand the process of gathering and organizing data and be able to calculate, evaluate, and communicate results within the domain of statistics and probability.

Advanced (333): Eighth-graders performing at the *Advanced* level should be able to probe examples and counterexamples in order to shape generalizations from which they can develop models. Eighth-graders performing at the *Advanced* level should use number sense and geometric awareness to consider the reasonableness of an answer. They are expected to use abstract thinking to create unique problem-solving techniques and explain the reasoning processes underlying their conclusions.

What Eighth-Graders Know and Can Do in Mathematics

The item map below illustrates the range of mathematical knowledge and skills demonstrated by eighth-graders. For example, students performing near the middle of the *Basic* range (with an average score of 278) were likely to be able to estimate time given a rate and a distance. Students performing near the top of the *Proficient* range (with an average score of 325) were likely to be able to complete a table and write an algebraic expression.

GRADE 8 NAEP MATHEMATICS ITEM MAP

Achievement level	Scale score	Content area	Question description
	500		
Advanced	364	**Geometry**	Model a geometrical situation given specific conditions
Advanced	355	**Measurement**	*Estimate side length of a square given area*
Advanced	342	**Algebra**	*Identify the graph of a linear equation*
Advanced	340	**Number properties and operations**	*Interpret a number expressed in scientific notation*
Advanced	337	**Geometry**	Find container height given dimensions of contents (shown on page 73)
Advanced	334	**Data analysis and probability**	Identify best method for selecting a sample
	333		
Proficient	329	**Algebra**	*Convert a temperature from Fahrenheit to Celsius*
Proficient	328	**Data analysis and probability**	*Identify which statistic is represented by a response*
Proficient	325	**Algebra**	Complete a table and write an algebraic expression
Proficient	320	**Number properties and operations**	*Determine distance given rate and time*
Proficient	317	**Number properties and operations**	Analyze a mathematical relationship (shown on page 71)
Proficient	314	**Algebra**	*Use a formula to solve a problem*
Proficient	311	**Number properties and operations**	*Divide large numbers in a given context*
Proficient	308	**Measurement**	Determine value of marks on a scale
Proficient	306	**Geometry**	*Determine measure of an angle in a figure*
Proficient	304	**Number properties and operations**	*Identify fractions listed in ascending order*
Proficient	301	**Algebra**	*Determine an equation relating sales and profit* (shown on page 75)
	299		
Basic	296	**Data analysis and probability**	*Identify relationship in a scatterplot* (shown on page 74)
Basic	296	**Number properties and operations**	*Convert raw points to a percentage*
Basic	287	**Data analysis and probability**	Explain which survey is better
Basic	278	**Number properties and operations**	*Estimate time given a rate and a distance*
Basic	276	**Algebra**	*Determine an expression to model a scenario*
Basic	268	**Measurement**	*Determine width after proportional enlargement*
Basic	265	**Algebra**	*Identify point on a graph with specified coordinates*
	262		
	261	**Algebra**	*Evaluate an expression for a specific value*
	259	**Data analysis and probability**	*Recognize misrepresented data*
	258	**Measurement**	*Determine dimensions that give the greatest volume* (shown on page 72)
	258	**Geometry**	*Identify the result of combining two shapes*
	257	**Algebra**	*Solve an algebraic equation*
	254	**Number properties and operations**	*Use place value to write a number*
	0		

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The position of a question on the scale represents the average scale score attained by students who had a 65 percent probability of successfully answering a constructed-response question, a 74 percent probability of correctly answering a four-option multiple-choice 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. Scale score ranges for mathematics achievement levels are referenced on the map.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Sample Constructed-Response Question—Number Properties and Operations

This sample question measures eighth-graders' performance in the number properties and operations content area. It addresses the "Properties of number and operations" subtopic, which focuses on recognizing, describing, and explaining properties of integers and operations. The framework objective measured by this question is "Explain or justify a mathematical concept or relationship." A calculator was available for this question.

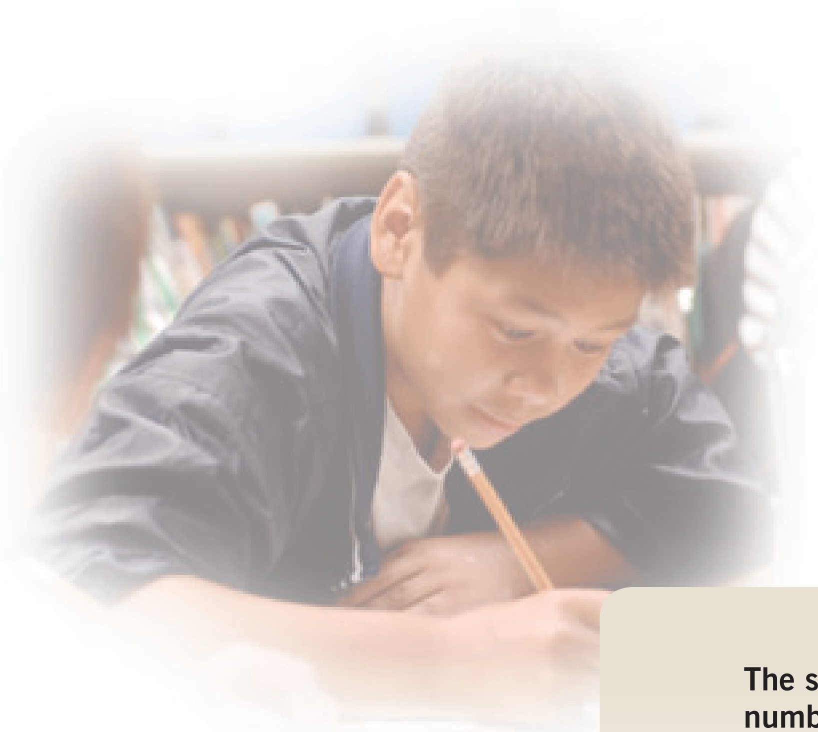
Student responses for this question were rated using a two-level scoring guide, rating responses as "Correct" or "Incorrect."

Twenty-nine percent of grade 8 AI/AN students correctly responded to this question. The student response below was rated as "Correct." It showed that if two of the three numbers are 23 and 62, then the third number must be 88, and therefore, 62 cannot be the largest of the three numbers.

Percentage of eighth-grade students in each response category in 2007

Student group	Correct	Incorrect	Omitted
Nation (all students)	**42**	55	2
AI/AN students	**29**	69	2

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because a small percentage of responses that did not address the assessment task are not shown.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



The sum of three numbers is 173. If the smallest number is 23, could the largest number be 62?

○ **Yes** ● **No**

Explain your answer in the space below.

62 + 23 = 85 and 173 - 85 = 88. 88 would have to be the third number and 88 is larger than 62.

Sample Multiple-Choice Question—Measurement

This sample question measures eighth-graders' performance in the measurement content area. It addresses the "Measuring physical attributes" subtopic, which focuses on comparing objects or estimating the size of an object with respect to a measurement attribute (such as length), using appropriate measurement instruments, solving problems involving the perimeter or area of plane figures, and solving problems involving the volume or surface area of solids. The framework objective measured by this question is "Compare objects with respect to length, area, volume, angle measurement, weight, or mass." A calculator was not available for this question.

Sixty-seven percent of AI/AN eighth-graders selected the correct answer (choice A). By comparing the refrigerator dimensions, it is possible to identify the refrigerator with the largest capacity without computing the volumes. For example, the refrigerator in choice A has one dimension that is equal to a dimension of the refrigerators in choices B and C, and two dimensions that are both greater than the other two dimensions in these refrigerators. Therefore, choices B and C do not have the largest capacity. Similarly, the refrigerator in choice A has a larger capacity than either of the refrigerators in choices D and E.

Mr. Elkins plans to buy a refrigerator. He can choose from five different refrigerators whose interior dimensions, in inches, are given below. Which refrigerator has the greatest capacity (volume)?

- (A) $42 \times 34 \times 30$
- (B) $42 \times 30 \times 32$
- (C) $42 \times 28 \times 32$
- (D) $40 \times 34 \times 30$
- (E) $40 \times 30 \times 28$

Percentage of eighth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Choice E	Omitted
Nation (all students)	**76**	9	6	6	2	1
AI/AN students	**67**	15	7	7	3	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Sample Constructed-Response Question—Geometry

This sample question measures eighth-graders' performance in the geometry content area. It addresses the "Relationships between geometric figures" subtopic, which focuses on applying geometric properties, solving problems, representing and analyzing situations in two and three dimensions, and solving problems using the Pythagorean theorem. The framework objective measured by this question is "Represent problem situations with simple geometric models to solve mathematical or real-world problems." A calculator was available for this question.

Student responses for this question were rated using the following three-level scoring guide:

Correct—Response indicates that the minimum height of the can is 18 centimeters and gives a correct diagram or a complete explanation.

Partial—Response indicates that the minimum height of the can is 18 centimeters without supporting work, or the response gives a correct diagram or explanation without indicating that the height is 18, or the response gives an incorrect height with work supporting the height that is given.

Incorrect—All incorrect responses.

Nine percent of grade 8 AI/AN students correctly responded to this question. The first response below was rated as "Correct," explaining that since the radius of each ball is 3 centimeters, the diameter of each ball is 6 centimeters, and therefore the height is 6 × 3 = 18 centimeters. The second response shows a common response that was rated "Partial," giving a correct diagram supporting an incorrect answer of 9 centimeters. This answer was obtained by computing the minimum height of a can holding three balls each with a diameter of 3 centimeters (instead of a radius of 3 centimeters).

Percentage of eighth-grade students in each response category in 2007

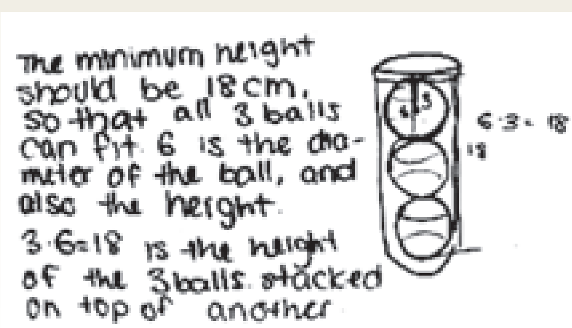
Student group	Correct	Partial	Incorrect	Omitted
Nation (all students)	**18**	20	48	13
AI/AN students	**9**	16	59	13

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because a small percentage of responses that did not address the assessment task are not shown.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

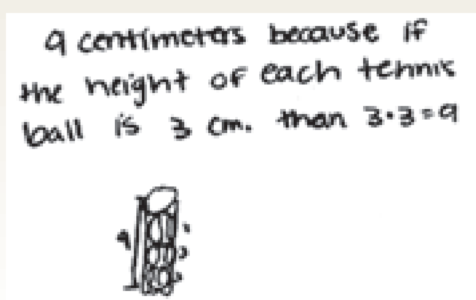
Three tennis balls are to be stacked one on top of another in a cylindrical can. The radius of each tennis ball is 3 centimeters. To the nearest whole centimeter, what should be the minimum height of the can?

Explain why you chose the height that you did. Your explanation should include a diagram.

Student Response—Correct



Student Response—Partial



Sample Multiple-Choice Question—Data Analysis and Probability

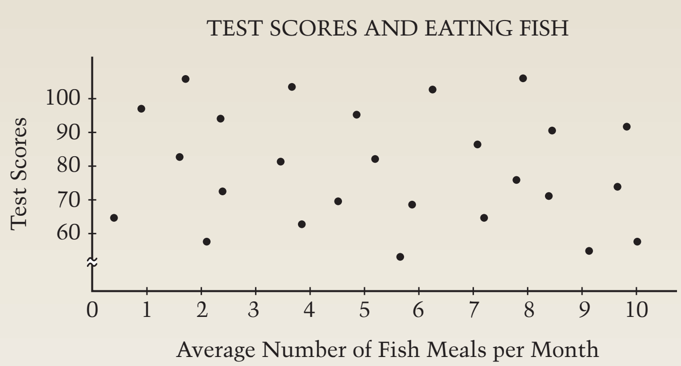
This sample question measures eighth-graders' performance in the data analysis and probability content area. It addresses the "Data representation" subtopic, which focuses on reading and interpreting data, solving problems by estimating and computing with data, and comparing different representations of data. The framework objective measured by this question is "Read or interpret data, including interpolating or extrapolating from data." A calculator was available for this question.

Fifty-three percent of eighth-grade AI/AN students selected the correct answer for this question (choice A). The incorrect answer choices for this question represent various misinterpretations of the relationship between test scores and the average number of fish meals per month.

Percentage of eighth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Choice E	Omitted
Nation (all students)	**62**	11	9	12	5	1
AI/AN students	**53**	18	11	12	5	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.



For a science project, Marsha made the scatterplot above that gives the test scores for the students in her math class and the corresponding average number of fish meals per month. According to the scatterplot, what is the relationship between test scores and the average number of fish meals per month?

Ⓐ **There appears to be no relationship.**

Ⓑ **Students who eat fish more often score higher on tests.**

Ⓒ **Students who eat fish more often score lower on tests.**

Ⓓ **Students who eat fish 4–6 times per month score higher on tests than those who do not eat fish that often.**

Ⓔ **Students who eat fish 7 times per month score lower on tests than those who do not eat fish that often.**

Sample Multiple-Choice Question—Algebra

This sample question measures eighth-graders' performance in the algebra content area. It addresses the "Algebraic representations" subtopic, which focuses on analyzing, interpreting, and translating among different representations of linear relationships; representing points in a rectangular coordinate system; and recognizing common nonlinear relationships in meaningful contexts. The framework objective measured by this question is "Translate between different representations of linear expressions using symbols, graphs, tables, diagrams, or written descriptions." A calculator was available for this question.

Forty-three percent of AI/AN eighth-graders selected the correct answer (choice B). The most common incorrect answer selected by AI/AN students (choice D), which was selected by 18 percent of the students, is an alternate way to represent the relationship between the number of cards sold and the profit on Monday, but it does not represent the relationship on the other days. Choice C is another way to represent the relationship on Monday only. Choice A results from interchanging the variables for the number of cards sold and the amount of profit, and choice E can be obtained by interchanging the variables and considering Thursday only.

Percentage of eighth-grade students in each response category in 2007

Student group	Choice A	Choice B	Choice C	Choice D	Choice E	Omitted
Nation (all students)	17	**54**	13	9	6	1
AI/AN students	17	**43**	17	18	5	1

NOTE: AI/AN = American Indian/Alaska Native. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Number Sold, *n*	4	0	5	2	3	6
Profit, *p*	\$2.00	\$0.00	\$2.50	\$1.00	\$1.50	\$3.00

Angela makes and sells special-occasion greeting cards. The table above shows the relationship between the number of cards sold and her profit. Based on the data in the table, which of the following equations shows how the number of cards sold and profit (in dollars) are related?

Ⓐ $p = 2n$

Ⓑ $p = 0.5n$

Ⓒ $p = n - 2$

Ⓓ $p = 6 - n$

Ⓔ $p = n + 1$

Technical Notes

Sampling and Weighting

The schools and students participating in NAEP assessments are selected to be representative both nationally and for public schools at the state level. While national and regional results reflect the performance of students in public schools, Bureau of Indian Education (BIE) schools[1], Department of Defense schools, and private schools, state-level results presented in this report reflect the performance of public and BIE school students only. For comparison purposes within the state results section, the national sample is composed of public and BIE school students only.

The samples of American Indian/Alaska Native students participating in the 2007 NAEP reading and mathematics assessments represent augmentations of the sample of American Indian/Alaska Native students who would usually be selected by NAEP. This allows more detailed reporting of performance for this group. Prior to 2005, BIE schools were identified as part of the national sample, and the resulting number of participating schools was usually small, fewer than five per grade. In 2005, BIE schools were sampled as a part of each state sample, at the same rate as public schools in a given state. That means, roughly speaking, that a BIE student had the same probability of selection as a public school student in the same state. As a result, about 30 BIE schools were included per grade, thereby increasing the number of American Indian/Alaska Native students in the sample. In 2007, there were even larger samples of BIE schools than in 2005. All BIE schools and students were included in the sample. The BIE population represents approximately 135 schools at grade 4 and 115 schools at grade 8. In terms of the number of students, the BIE population represents approximately 3,000 students at grade 4 and 3,100 students at grade 8.

In 2005, seven states had sufficient samples of AI/AN students to report state-level data. In 2007, a total of 11 states had sufficiently large samples, with Minnesota, North Carolina, Oregon, and Washington being added to the original 7 selected states from 2005. While 6 of the 11 selected states had sufficient AI/AN students without oversampling, schools in 5 of the selected states were oversampled in 2007: Arizona, Minnesota, North Carolina, Oregon, and Washington. Schools with relatively large percentages (at least 10%) of AI/AN students were oversampled by factors ranging from 2 to 6 based on state and grade. When AI/AN students are widely dispersed among schools, school oversampling is not effective.

The basic approach taken was to create a new stratum in each state that contains schools with a "high" percentage of AI/AN students, and then to increase the "measure of size" of these schools by an oversampling factor, thereby increasing their probability of selection. The increase in the expected sample size of AI/AN students was then calculated.

Using different sampling rates for different subgroups of the population, and consequently applying different weights, is generally not as efficient as a sampling scheme which gives each unit in the population an equal chance of selection. The precision achieved by a sample selected in this way could be achieved by a smaller sample size (typically called the "effective" sample size) if sampling rates were the same for each subgroup.

Table TN-1. **Number of participating schools with AI/AN students and number of participating AI/AN students, by grade, subject, and type of school: 2007**

	Grade 4				Grade 8			
	Reading		Mathematics		Reading		Mathematics	
Type of school	Schools	Students	Schools	Students	Schools	Students	Schools	Students
Public	1,330	4,300	1,300	4,500	1,150	3,700	1,150	3,600
BIE	120	1,000	120	1,100	100	1,000	100	1,000

NOTE: AI/AN = American Indian/Alaska Native. BIE = Bureau of Indian Education. The numbers of schools are rounded to the nearest ten, and the numbers of students are rounded to the nearest hundred. Numbers are not shown for Department of Defense and private schools.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

[1] In 2005, referred to as Bureau of Indian Affairs (BIA) schools.

In the process of identifying viable options for oversampling AI/AN students, it was necessary to make some assumptions:

- that a maximum of 50, but ideally no more than 25–30, schools be added to the state sample for each grade;
- that an effective student sample size of about 100 is required per subject per grade in each state; and
- that there is no substantial increase in the design effect resulting from the increased clustering of sampled AI/AN students.

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

School and Student Participation Rates

To ensure unbiased samples, NCES and the Governing Board established participation rate standards that states were required to meet in order for their results to be reported. The required participation rate of at least 85 percent was met by the populations for which results are presented in this report. In both reading and mathematics, the national school participation rates were 98 percent for grade 4 and 97 percent for grade 8; and the student participation rates were 95 percent for grade 4 and 92 percent for grade 8. Student participation rates for American Indian/Alaska Native students were 93 percent for grade 4 in reading and mathematics, 91 percent in grade 8 mathematics, and 92 percent in grade 8 reading. School participation rates for BIE schools were 87 percent in grade 4 and 86 percent in grade 8 in both reading and mathematics.

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 entire population.

When an estimate 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 estimates. For example, a 2-point gain between 2005 and 2007 for non-AI/AN students may be statistically significant, while a 2-point gain for AI/AN students may not be.

Race/Ethnicity

In all NAEP assessments, data about student race/ethnicity are collected from two sources: school records and student self-reports. Prior to 2002, NAEP used students' self-reported race as the primary race/ethnicity reporting variable. Beginning in 2002, the race/ethnicity variable presented in NAEP reports has been based on the race reported by the school. When school-recorded information is missing, student-reported data are used to determine race/ethnicity.

Schools sampled for NAEP are asked to provide lists of all students in the target grade(s) along with basic demographic information, including race/ethnicity. Students are categorized into one of five mutually exclusive categories plus "other." Administration Schedules—also referred to as student rosters—are created that include the list of sampled students along with their basic demographic information. These data are checked and updated during data collection. This race/ethnicity information is available for all sampled students: those who participated and those who were absent or excluded.

All students who take a NAEP assessment complete a section of general student background questions, including questions about their race/ethnicity. Separate questions are asked about students' Hispanic ethnic background and about students' race. This race/ethnicity information is available only for students who participated in the assessment and not for those who were absent or excluded.

The mutually exclusive racial/ethnic categories are White (non-Hispanic), Black (non-Hispanic), Hispanic, Asian/Pacific Islander, American Indian (including Alaska Native), and Unclassified. Unclassified students are those whose school-reported race was "other," "unavailable," or missing, or who self-reported more than one race category (i.e., "multi-racial") or none. Hispanic students may be of any race. Information based on student self-reported race/ethnicity is available on the NAEP Data Explorer (http://nces.ed.gov/nationsreportcard/nde).

National School Lunch Program

NAEP first began collecting data in 1996 on student eligibility for the National School Lunch Program (NSLP) as an indicator of poverty. Under the guidelines of NSLP, children from families with incomes below 130 percent of the poverty level are eligible for free meals. Those from families with incomes between 130 and 185 percent of the poverty level are eligible for reduced-price meals. (For the period July 1, 2006 through June 30, 2007, for a family of four, 130 percent of the poverty level was $26,000, and 185 percent was $37,000.) For more information on NSLP, visit http://www.fns.usda.gov/cnd/lunch/.

School Density

School density indicates the proportion of AI/AN students enrolled in a given school. High density schools are defined by the Office of Indian Education (OIE) as schools in which at least 25 percent of the students are American Indian or Alaska Native. All other schools are classified as low density. This concept has been used by educational researchers for many years and is the basis for the terms "low Indian enrollment" and "high Indian enrollment" schools.

Bureau of Indian Education Schools

There are 184 BIE schools and dormitories located on or near 63 reservations that serve approximately 47,000 students in 23 states. Schools funded by the BIE are either operated by the BIE or by tribes under contracts or grants. BIE-operated schools are under the direct auspices of the BIE, and tribally operated schools are managed by individual federally recognized tribes with grants or contracts from the BIE. The BIE, formerly the Office of Indian Education Programs, in the Department of the Interior, oversees the BIE elementary and secondary school programs.

Type of Location

NAEP results are reported for four mutually exclusive categories of school locations: city, suburb, town, and rural. The categories are based on standard definitions established by the Federal Office of Management and Budget using population and geographic information from the U.S. Census Bureau. Schools are assigned to these categories in the NCES Common Core of Data (CCD) based on their physical address. The classification system was revised for 2007; therefore, trend comparisons to previous years are not available. The new categories ("locale codes") are based on a school's proximity to an urbanized area (a densely settled core with densely settled surrounding areas). This is a change from the original system based on metropolitan statistical areas. To distinguish the two systems, the new system is referred to as "urban-centric locale codes." More detail on the locale codes is available at http://nces.ed.gov/ccd/rural_locales.asp.

The urban-centric locale code system classifies territory into four major types: city, suburban, town, and rural. Each type has three subcategories. For city and suburb, these are gradations of size—large, midsize, and small. Towns and rural areas are further distinguished by their distance from an urbanized area. They can be characterized as fringe, distant, or remote.

One of the primary advantages of the locale framework is the use of explicit distance measures to identify town and rural subtypes. Unlike the previous CCD framework that differentiates towns on the basis of population size, the new typology classifies towns according to their proximity to larger urban cores. This approach considers potential spatial relationships and acknowledges the likely interaction between urban cores based on their relative locations. Rural subtypes are similar in that they identify rural territory relative to urban cores. This distinction avoids the often-misleading distance proxy based on county metro status. More importantly, the explicit distance indicators offer the opportunity to identify and differentiate rural schools and school systems in relatively remote areas, from those that may be located just outside an urban core.

Table TN-2. **Definitions of the 12 urban-centric locale code categories: 2006**

City	
City, Large:	Territory inside an urbanized area and inside a principal city with population of 250,000 or more.
City, Midsize:	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.
City, Small:	Territory inside an urbanized area and inside a principal city with population less than 100,000.
Suburb	
Suburb, Large:	Territory outside a principal city and inside an urbanized area with population of 250,000 or more.
Suburb, Midsize:	Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.
Suburb, Small:	Territory outside a principal city and inside an urbanized area with population less than 100,000.
Town	
Town, Fringe:	Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area.
Town, Distant:	Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.
Town, Remote:	Territory inside an urban cluster that is more than 35 miles from an urbanized area.
Rural	
Rural, Fringe:	Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.
Rural, Distant:	Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.
Rural, Remote:	Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Documentation to the NCES Common Core of Data Public Elementary/Secondary School Locale Code File: School Year 2003–04," (NCES 2006–332).

Drawing Inferences From the Results

The reported statistics are estimates and are therefore subject to a measure of uncertainty. There are two sources of such uncertainty. First, NAEP uses a sample of students rather than testing all students. Second, all assessments have some amount of uncertainty related to the fact that they cannot ask all questions that might be asked in a content area. The magnitude of this uncertainty is reflected in the standard error of each of the estimates. When the percentages or average scale scores of certain groups are compared, the estimated standard error should be taken into account. Therefore, the comparisons are based on statistical tests that consider the estimated standard errors of the statistics being compared and the magnitude of the difference between the averages or percentages.

The differences between statistics—such as comparisons of two groups of students' average scale scores and percentages of students at various achievement levels—that are discussed in this report are determined by using standard errors. Comparisons are based on statistical tests that consider both the size of the differences and the standard errors of the two statistics being compared. Estimates based on smaller groups are likely to have relatively large standard errors. As a consequence, a numerical difference that seems large may not be statistically significant. Furthermore, 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 2-point gain between 2005 and 2007 for non-AI/AN students may be statistically significant, while a 2-point gain for AI/AN students may not be. The differences described in this report have been determined to be statistically significant at the .05 level with appropriate adjustments for part-to-whole and multiple comparisons (Benjamini and Hochberg 1995).

Any difference between scores or percentages that is identified as higher, lower, larger, or smaller in this report, including within-group differences not marked in tables and charts, meets the requirements for statistical significance.

While the standard error reflects the precision of the sample mean, the standard deviation reflects the variability of scores within a group in the original scale of measurement. Thus, standard deviations for two groups can be used to understand both the variability of NAEP reading and mathematics scores among AI/AN students, and among all other students at each grade level. Table TN-3 shows the standard deviations of the scores of AI/AN students and of all other students for each subject and grade.

Table TN-3. **Standard deviations of NAEP average scores, by student group, grade, and subject: 2007**

Grade and subject	Standard deviation	
	AI/AN students	Non-AI/AN students
Grade 4		
Reading	40.2	35.6
Mathematics	30.1	28.6
Grade 8		
Reading	38.5	34.8
Mathematics	36.4	36.0

NOTE: AI/AN = American Indian/Alaska Native.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

The standard deviation measures how widely spread the values in a data set are. If many data points are close to the mean, then the standard deviation is small; if many data points are far from the mean, then the standard deviation is large.

Weighting and Variance Estimation

A complex sample design was used to select the students who were assessed. The properties of a sample selected through such a design could be very different from those of a simple random sample, in which every student in the target population has an equal chance of selection and in which the observations from different sampled students can be considered to be statistically independent of one another. Therefore, the properties of the sample for the data collection design were taken into account during the analysis of the assessment data.

One way that the properties of the sample design were addressed was by using sampling weights to account for the fact that the probabilities of selection were not identical for all students. All population and subpopulation characteristics based on the assessment data were estimated using sampling weights. These weights included adjustments for school and student nonresponse.

Not only must appropriate estimates of population characteristics be derived, but appropriate measures of the degree of uncertainty must be obtained for those statistics. Two components of uncertainty are accounted for in the variability of statistics based on student ability: (1) the uncertainty due to sampling only a relatively small number of students, and (2) the uncertainty due to sampling only a relatively small number of cognitive questions. The first component accounts for the variability associated with the estimated percentages of students who had certain background characteristics or who had a certain rating for their responses to a task.

Because NAEP uses complex sampling procedures, conventional formulas for estimating sampling variability that assume simple random sampling are inappropriate. NAEP uses a jackknife replication procedure to estimate standard errors. The jackknife standard error provides a reasonable measure of uncertainty for any student information that can be observed without error. However, because each student typically responds to only a few questions within a content area, the scale score for any single student would be imprecise. In this case, NAEP's marginal estimation methodology can be used to describe the performance of groups and subgroups of students. The estimate of the variance of the students' posterior scale score distributions (which reflect the imprecision due to lack of measurement accuracy) is computed. This component of variability is then included in the standard errors of NAEP scale scores.

Analyzing Group Differences in Averages and Percentages

Statistical tests determine whether, based on the data from the groups in the sample, there is strong enough evidence to conclude that the averages or percentages are actually different for those groups in the population. If the evidence is strong (i.e., the difference is statistically significant), the report describes the group averages or percentages as being different (e.g., one group performed higher or lower than another group), regardless of whether the sample averages or percentages appear to be approximately the same. The reader is cautioned to rely on the results of the statistical tests rather than on the apparent magnitude of the difference between sample averages or percentages when determining whether the sample differences are likely to represent actual differences among the groups in the population.

To determine whether a real difference exists between the average scale scores (or percentages of a certain attribute) for two groups in the population, one needs to obtain an estimate of the degree of uncertainty associated with the difference between the averages (or percentages) of these groups for the sample. This estimate of the degree of uncertainty, called the "standard error of the difference" between the groups, is obtained by taking the square of each group's standard error, summing the squared standard errors, and taking the square root of that sum.

$$SE_{A\text{-}B} = \sqrt{(SE_A^2 + SE_B^2)}$$

The standard error of the difference can be used, just like the standard error for an individual group average or percentage, to help determine whether differences among groups in the population are real. The difference between the averages or percentages of the two groups plus or minus 1.96 standard errors of the difference represents an approximately 95 percent confidence interval. If the resulting interval includes zero, there is insufficient evidence to claim a real difference between the groups in the population. If the interval does not contain zero, the difference between the groups is statistically significant at the .05 level.

The following example of comparing groups addresses the problem of determining whether the average mathematics scale score of group A is higher than that of group B. The sample estimates of the average scale scores and estimated standard errors are as follows:

Group	Average scale score	Standard error
A	218	0.9
B	216	1.1

The difference between the estimates of the average scale scores of groups A and B is 2 points (218 – 216). The standard error of this difference is

$$\sqrt{(0.9^2 + 1.1^2)} = 1.4$$

Thus, an approximately 95 percent confidence interval for this difference is plus or minus 1.96 standard errors of the difference:

$$2 \pm 1.96 \times 1.4$$
$$2 \pm 2.7$$
$$(-0.7, 4.7)$$

The value zero is within the confidence interval; therefore, there is insufficient evidence to conclude that group A's performance is statistically different from group B.
The procedure above is appropriate to use when it is reasonable to assume that the groups being compared have been independently sampled for the assessment. Such an assumption is clearly warranted when comparing results for one state with another. This is the approach used for NAEP reports when comparisons involving independent groups are made. The assumption of independence is violated to some degree when comparing group results for the nation or a particular state (e.g., comparing national 2005 results for male and female students), since these samples of students have been drawn from the same schools.

When the groups being compared do not share students (as is the case, for example, of comparing male and female students), the impact of this violation of the independence assumption on the outcome of the statistical tests is assumed to be small, and NAEP, by convention, has, for computational convenience, routinely applied the procedures described above to those cases as well.

When making comparisons of results for groups that share a considerable proportion of students in common, it is not appropriate to ignore such dependencies. In such cases, NAEP has used procedures appropriate to comparing dependent groups. When the dependence in group results is due to the overlap in samples (e.g., when a subgroup is being compared to a total group), a simple modification of the usual standard error of the difference formula can be used. The formula for such cases is

$$SE_{\text{Total-Subgroup}} = \sqrt{(SE^2_{\text{Total}} + SE^2_{\text{Subgroup}} - 2pSE^2_{\text{Subgroup}})}$$

where p is the proportion of the total group contained in the subgroup. This formula was used for this report when a state was compared to the aggregate nation.

Conducting Multiple Tests

The procedures used to determine whether group differences in the samples represent actual differences among the groups in the population and the certainty ascribed to intervals (e.g., a 95 percent confidence interval) are based on statistical theory that assumes that only one confidence interval or test of statistical significance is being performed. However, there are times when many different groups are being compared (i.e., multiple sets of confidence intervals are being analyzed). For multiple comparisons, statistical theory indicates that the certainty associated with the entire set of comparisons is less than that attributable to each individual comparison from the set. To hold the significance level for the set of comparisons at a particular level (e.g., .05), the standard methods must be adjusted by multiple comparison procedures (Miller 1981). The procedure used by NAEP is the Benjamini-Hochberg False Discovery Rate (FDR) procedure (Benjamini and Hochberg 1995).

Unlike other multiple comparison procedures that control the familywise error rate (i.e., the probability of making even one false rejection in the set of comparisons), the FDR procedure controls the expected proportion of falsely rejected hypotheses. (A "family" in this context is the number of categories to be compared for a given variable. This might be 6 within the race/ethnicity variable or 50 when considering states.) Furthermore, the FDR procedure used in NAEP is considered appropriately less conservative than familywise procedures for large families of comparisons (Williams, Jones, and Tukey 1999). Therefore, the FDR procedure is more suitable for multiple comparisons in NAEP than are other procedures.

Cautions in Interpretation

It is possible to examine NAEP performance results for groups of students defined by various background factors measured by NAEP, such as whether their teachers use certain instructional techniques or how much reading material is available in their homes. However, a relationship that exists between achievement and another variable does not reveal its underlying cause, which may be influenced by a number of other variables. Similarly, the assessments do not reflect the influence of unmeasured variables. The results are most useful when they are considered in combination with other knowledge about the student population and the educational system, such as trends in instruction, changes in the school-age population, and societal demands and expectations.

Accommodations and Exclusions in NAEP

Testing accommodations, such as extra testing time or individual rather than group administration, are provided for students with disabilities or English language learners who could not fairly and accurately demonstrate their abilities without modified test administration procedures.

Even with the availability of accommodations, there still remains a portion of students excluded from the NAEP assessment. Variations in exclusion and accommodation rates, due to differences in policies and practices regarding the identification and inclusion of students with disabilities and English

Table TN-4. **AI/AN students with disabilities and English language learners identified, excluded, and assessed in NAEP reading, as a percentage of all AI/AN students, by grade and selected states: 2007**

	Students with disabilities				English language learners			
Grade and state	Identified	Excluded	Assessed with accommodations	Assessed without accommodations	Identified	Excluded	Assessed with accommodations	Assessed without accommodations
Grade 4								
Nation	17	6	6	4	10	1	2	7
Alaska	18	4	8	7	28	4	6	17
Arizona	14	5	7	3	22	3	2	17
Minnesota	22	8	7	7	3	#	1	1
Montana	15	5	8	2	28	3	11	14
New Mexico	14	6	4	4	41	6	6	30
North Carolina	21	5	11	5	#	#	#	#
North Dakota	26	14	4	8	8	3	1	4
Oklahoma	19	9	6	4	1	1	#	#
Oregon	21	3	3	14	11	#	#	11
South Dakota	19	9	3	7	12	2	1	9
Washington	19	8	4	7	1	#	#	1
Grade 8								
Nation	17	5	8	4	9	1	2	6
Alaska	16	2	10	4	37	1	13	23
Arizona	14	6	5	2	13	2	3	8
Minnesota	22	8	9	5	#	#	#	#
Montana	22	6	12	4	31	4	12	16
New Mexico	15	6	4	5	33	4	4	25
North Carolina	11	2	8	1	#	#	#	#
North Dakota	24	14	4	6	15	5	2	8
Oklahoma	16	6	7	4	1	#	#	1
Oregon	15	4	8	3	5	#	1	4
South Dakota	17	7	5	5	6	1	1	4
Washington	15	3	9	2	2	#	#	1

Rounds to zero.
NOTE: AI/AN = American Indian/Alaska Native. The national and state results reported here include only public and Bureau of Indian Education (BIE) schools.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

language learners, should be taken into consideration when comparing students' performance over time and across states. While the effect of exclusion is not precisely known, comparisons of performance results could be affected if exclusion rates are comparatively high or vary widely over time. More information about NAEP's policy on inclusion of special-needs students is available at http://nces.ed.gov/nationsreportcard/about/inclusion.asp.

Tables TN-4 and TN-5 show the percentages of AI/AN students identified as students with disabilities or English language learners, excluded, and assessed with accommodations for the nation and selected states for 2007.

Table TN-5. **AI/AN students with disabilities and English language learners identified, excluded, and assessed in NAEP mathematics, as a percentage of all AI/AN students, by grade and selected states: 2007**

Grade and state	Students with disabilities				English language learners			
	Identified	Excluded	Assessed with accommodations	Assessed without accommodations	Identified	Excluded	Assessed with accommodations	Assessed without accommodations
Grade 4								
Nation	17	3	10	4	9	#	3	6
Alaska	19	2	12	5	28	#	9	18
Arizona	13	2	8	3	20	#	6	14
Minnesota	19	4	12	4	1	#	#	1
Montana	15	3	10	2	26	2	9	14
New Mexico	12	4	6	3	38	2	11	25
North Carolina	17	2	11	4	#	#	#	#
North Dakota	23	6	13	4	9	2	3	4
Oklahoma	17	6	7	4	1	#	#	1
Oregon	22	2	13	7	6	#	2	4
South Dakota	17	1	9	7	14	#	3	11
Washington	21	5	13	3	1	#	#	1
Grade 8								
Nation	16	4	8	4	9	1	2	6
Alaska	18	4	9	4	36	1	11	24
Arizona	13	3	4	6	14	2	2	10
Minnesota	27	3	19	5	#	#	#	#
Montana	21	6	12	3	33	3	11	19
New Mexico	12	2	6	4	35	1	9	26
North Carolina	22	1	16	5	#	#	#	#
North Dakota	24	8	13	3	16	3	5	8
Oklahoma	17	8	6	2	3	#	1	2
Oregon	20	7	8	5	5	1	#	4
South Dakota	17	3	9	5	6	#	1	5
Washington	17	6	9	2	2	#	#	2

Rounds to zero.
NOTE: AI/AN = American Indian/Alaska Native. The national and state results reported here include only public and Bureau of Indian Education (BIE) schools.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

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Data Appendix

Additional data tables (including standard errors) to support the findings in this report can be found at http://nces.ed.gov/nationsreportcard/nies/.

Table A-1. **Average scores and achievement-level results (with standard errors) in NAEP reading, by grade and race/ethnicity: 2007**

Grade and race/ethnicity	Average scale score	Percentage of students	
		At or above *Basic*	At or above *Proficient*
Grade 4			
AI/AN	203 (1.2)	49 (1.4)	18 (1.1)
Black	203 (0.4)	46 (0.6)	14* (0.4)
Hispanic	205 (0.5)	50 (0.6)	17 (0.6)
White	231* (0.2)	78* (0.3)	43* (0.4)
Asian/Pacific Islander	232* (1.0)	77* (1.0)	46* (1.4)
Grade 8			
AI/AN	247 (1.2)	56 (1.9)	18 (1.3)
Black	245 (0.4)	55 (0.6)	13* (0.4)
Hispanic	247 (0.4)	58 (0.5)	15 (0.4)
White	272* (0.2)	84* (0.3)	40* (0.3)
Asian/Pacific Islander	271* (1.1)	80* (1.1)	41* (1.1)

* Significantly different ($p < .05$) from AI/AN students.
NOTE: AI/AN = American Indian/Alaska Native. Black includes African American, Hispanic includes Latino, and Pacific Islander includes Native Hawaiian. Race categories exclude Hispanic origin. Standard errors of the estimates appear in parentheses.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

Table A-2. **Average scores and achievement-level results (with standard errors) in NAEP mathematics, by grade and race/ethnicity: 2007**

Grade and race/ethnicity	Average scale score	Percentage of students	
		At or above *Basic*	At or above *Proficient*
Grade 4			
AI/AN	228 (0.7)	70 (1.2)	25 (1.1)
Black	222* (0.3)	64* (0.6)	15* (0.4)
Hispanic	227 (0.3)	70 (0.5)	22* (0.4)
White	248* (0.2)	91* (0.2)	51* (0.4)
Asian/Pacific Islander	253* (0.8)	91* (0.7)	58* (1.3)
Grade 8			
AI/AN	264 (1.2)	53 (1.8)	16 (1.2)
Black	260* (0.4)	47* (0.7)	11* (0.3)
Hispanic	265 (0.4)	55 (0.7)	15 (0.4)
White	291* (0.3)	82* (0.3)	42* (0.3)
Asian/Pacific Islander	297* (0.9)	83* (0.8)	50* (1.1)

* Significantly different ($p < .05$) from AI/AN students.
NOTE: AI/AN = American Indian/Alaska Native. Black includes African American, Hispanic includes Latino, and Pacific Islander includes Native Hawaiian. Race categories exclude Hispanic origin. Standard errors of the estimates appear in parentheses.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

Table A-3. **Percentage of students (with standard errors) in NAEP reading, by type of school location, grade, and selected race/ethnicity categories: 2007**

Grade and race/ethnicity	City	Suburb	Town	Rural
Grade 4				
AI/AN	19 (1.3)	14 (1.3)	20 (1.5)	47 (2.0)
Black	49* (0.8)	31* (0.8)	8* (0.5)	12* (0.5)
Hispanic	46* (1.0)	36* (1.1)	9* (0.8)	9* (0.6)
Grade 8				
AI/AN	17 (1.4)	15 (1.4)	19 (1.8)	49 (2.1)
Black	46* (1.0)	32* (1.0)	8* (0.5)	14* (0.6)
Hispanic	45* (1.2)	36* (1.1)	8* (0.7)	10* (0.8)

* Significantly different ($p < .05$) from AI/AN students.
NOTE: AI/AN = American Indian/Alaska Native. Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Standard errors of the estimates appear in parentheses.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

Table A-4. **Percentage of students (with standard errors) in NAEP mathematics, by type of school location, grade, and selected race/ethnicity categories: 2007**

Grade and race/ethnicity	City	Suburb	Town	Rural
Grade 4				
AI/AN	18 (1.3)	14 (1.3)	20 (1.5)	48 (1.9)
Black	49* (0.8)	30* (0.8)	8* (0.6)	12* (0.5)
Hispanic	46* (1.0)	36* (1.1)	9* (0.7)	9* (0.7)
Grade 8				
AI/AN	17 (1.6)	14 (1.6)	21 (1.8)	48 (2.1)
Black	46* (1.1)	32* (1.0)	8* (0.5)	14* (0.7)
Hispanic	45* (1.1)	37* (1.1)	8* (0.7)	10* (0.8)

* Significantly different ($p < .05$) from AI/AN students.
NOTE: AI/AN = American Indian/Alaska Native. Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Standard errors of the estimates appear in parentheses.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 National Indian Education Study.

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Student Artwork: *Untitled* by Michael Curley; tribal affiliation: Zuni

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