



Photo by Norma Curet, Communications Office, Puerto Rico Department of Education

Geometry

School geometry roughly mirrors the historical development of geometry, which began as a practical collection of rules for calculating lengths, areas, and volumes of common shapes. This expanded over time to include the study of the possible structures of space and ideas of symmetry and transformation.

Students at grade 4 are expected to be familiar with a library of simple figures and their attributes, both in a plane and in space. At grade 8, students are expected to be familiar with the properties of plane figures, especially parallel and perpendicular lines, angle relations in polygons, cross sections of solids, and the Pythagorean theorem.

Subtopics in the geometry content area are

- Dimension and shape
- Transformation of shapes and preservation of properties
- Relationships between geometric figures
- Position and direction
- Mathematical reasoning

Overall Results

At grade 4, the average score in geometry for students in Puerto Rico was 197. At grade 8, the average score in geometry for Puerto Rico students was 225. These scores were lower, on average, than the scores for public school students in the nation.

In Puerto Rico at grade 4, the average score in geometry was higher for female students than for male students, while the results for students

in the nation showed no significant difference in the performance of male and female students in geometry. At grade 8, the average score in geometry for male students was not significantly different from that of female students in either Puerto Rico or the nation.

The next few pages contain sample questions from the geometry content area in the 2005 NAEP mathematics assessment.

Figure 9
Average fourth-grade NAEP scores for geometry in 2005, by gender

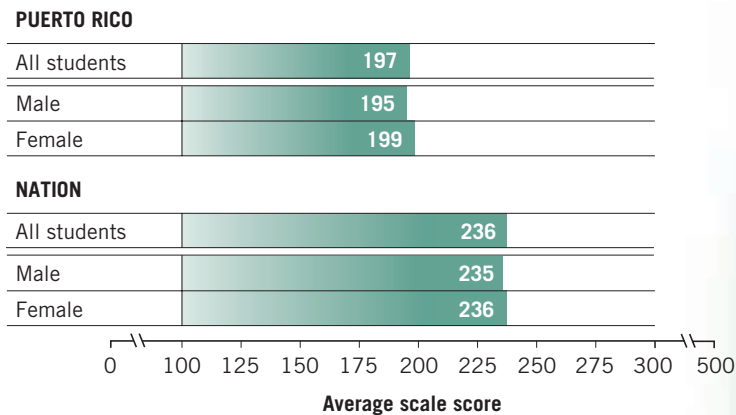
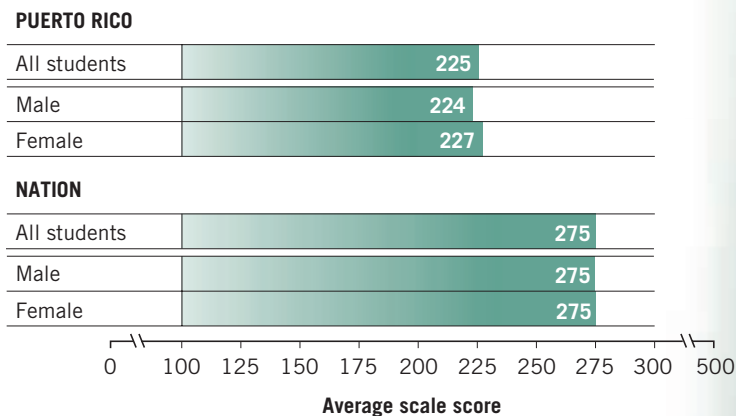
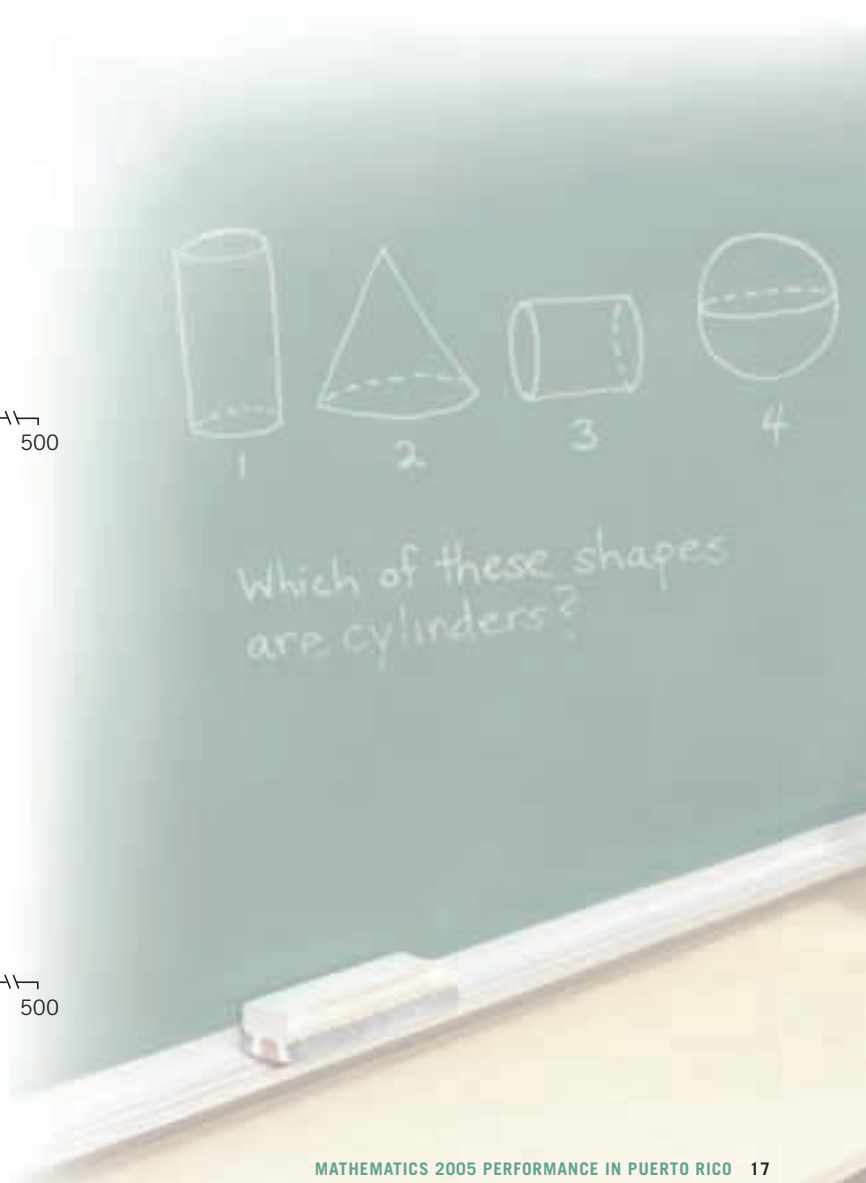


Figure 10
Average eighth-grade NAEP scores for geometry in 2005, by gender



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



Grade 4

Sample question 9 addresses the transformation of shapes and preservation of properties subtopic, which includes questions about symmetry, reflections, translations, and rotations, and how shapes change or remain the same under transformations. Sample question 10 addresses the relationships between geometric figures subtopic, which includes questions about patterns of geometric figures, properties of simple and compound figures, and two-dimensional faces of three-dimensional shapes.

Sample Multiple-Choice Question

Sample question 9 involves visualizing the result of folding a two-dimensional figure into a three-dimensional form. The framework objective measured in this question is “Recognize which attributes (such as shape and area) change or don’t change when plane figures are cut up and rearranged.”

Sixteen percent of the grade 4 students in Puerto Rico answered this question correctly. The incorrect answer choices for this question represent misconceptions about the preservation of length and the relationship between the dimensions in the two figures. These incorrect choices reflect the following misconceptions and errors:

- Selecting other dimensions shown in one of the figures (choice A and choice D)
- Finding the difference in the lengths of the sides in the original rectangle (choice C)

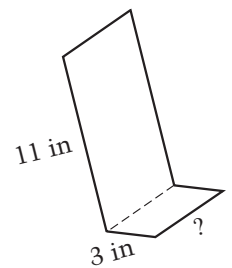
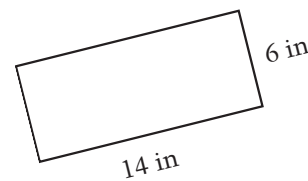
Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Choice A	32	22
Choice B	16	53
Choice C	11	9
Choice D	41	15
Omit	1	1

NOTE: 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), 2005 Mathematics Assessment.

Sample question 9



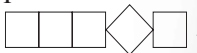
A piece of metal in the shape of a rectangle was folded as shown above. In the figure on the right, the “?” symbol represents what length?

- (A) 3 inches
- (B) 6 inches
- (C) 8 inches
- (D) 11 inches

Sample Extended Constructed-Response Question

Sample question 10 is an extended constructed-response question that asks students to arrange five squares according to specified criteria. Students are provided with 10 paper squares to aid them in answering this question. The framework objective measured in this question is “Analyze or describe patterns of geometric figures by increasing number of sides, or changing size or orientation (e.g., polygons with more and more sides).”

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

- Extended** Responses were those in which students drew three correct arrangements with lines shown separating the squares.
- Satisfactory** Responses were those in which students drew two correct arrangements with lines shown separating the squares.
- Partial** Responses were those in which students drew one correct arrangement with lines shown separating the squares or drew two of the figures given with a translation (must be translations or flips of two different figures).
- Minimal** Responses were those in which students made an attempt with five squares but showed no examples of a different way to arrange the squares (e.g., repeated one or more of the examples) or drew an arrangement with five squares that failed to meet criteria, such as .
- Incorrect** All incorrect responses.

In Puerto Rico, 2 percent of grade 4 student responses were rated “Extended.”

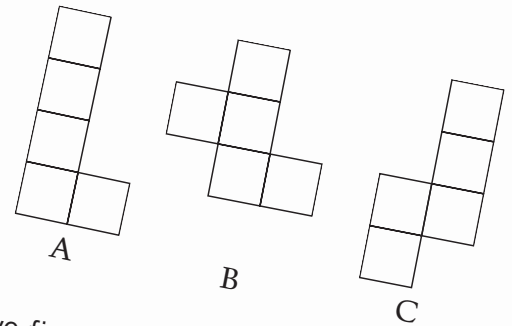
Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Extended	2	11
Satisfactory	3	13
Partial	13	20
Minimal	23	19
Incorrect	24	19
Omit	36	17

NOTE: 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), 2005 Mathematics Assessment.

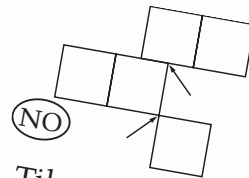
Sample question 10

It is possible to arrange 5 tiles so that at least one side of each tile completely shares one side of another tile. Here are 3 different ways to do this.

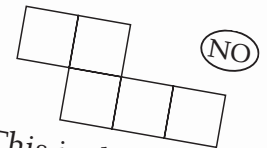


Two figures are not considered different if one figure can be turned or flipped to match the other.

The figures below are not examples of proper arrangements or new arrangements.



Tiles do not share whole sides.



This is the same as C turned.

Using 5 of your tiles, show 3 other different ways to arrange the tiles. Trace the tiles to show each figure. **Show the lines separating the individual squares.**



Grade 8

Sample question 11 addresses the position and direction subtopic, which includes questions about relative positions of points and lines including midpoints, parallel and perpendicular lines, and points of intersection; cross sections of solids; and the representation of geometric figures in a rectangular coordinate plane. Sample question 12 addresses the dimension and shape subtopic, which includes questions about identifying, describing, and drawing two- and three-dimensional geometric objects.

Sample Multiple-Choice Question

Sample question 11 asks students to find the midpoint of a line segment in the coordinate plane. The x -coordinate of the midpoint is the average of the x -coordinates of the endpoints, and the y -coordinate of the midpoint is the average of the y -coordinates of the endpoints. One way to find the average of two numbers is to find one-half of the sum of the two numbers. The framework objective measured in this question is “Describe relative positions of points and lines using the geometric ideas of midpoint, points on common line through a common point, parallelism, or perpendicularity.”

In Puerto Rico, 17 percent of the grade 8 students answered this question correctly. Some misconceptions represented by the incorrect answer choices in this question are given below:

- Finding one-half of the x -coordinate of the second point (4) and subtracting the x -coordinate of the first point (2), which is 2; similarly, finding one-half of the y -coordinate of the second point ($4\frac{1}{2}$) and subtracting the x -coordinate of the first point (1), which is $3\frac{1}{2}$ (choice A)
- Finding one-half of the positive difference of the x -coordinates and one-half of the positive difference of the y -coordinates (choice B)
- Finding the average of 1 and 8 for the x -coordinate of the midpoint, and finding the average of 2 and 9 for the y -coordinate of the midpoint (choice D)
- Finding the sum of the x -coordinates and the y -coordinates (choice E)

Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Choice A	25	7
Choice B	21	28
Choice C	17	38
Choice D	21	16
Choice E	15	8
Omit	2	3

NOTE: 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), 2005 Mathematics Assessment.

Sample question 11

The endpoints of a line segment are the points with coordinates (2, 1) and (8, 9). What are the coordinates of the midpoint of this line segment?

- (A) $(2, 3\frac{1}{2})$
- (B) (3, 4)
- (C) (5, 5)
- (D) $(4\frac{1}{2}, 5\frac{1}{2})$
- (E) (10, 10)

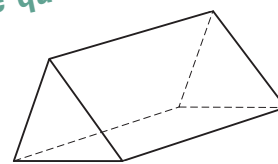
Sample Multiple-Choice Question

Sample question 12 asks students to identify which of the given figures could be folded into a triangular prism. The framework objective measured in this question is “Demonstrate an understanding about the two- and three-dimensional shapes in our world through identifying, drawing, modeling, building, or taking apart.”

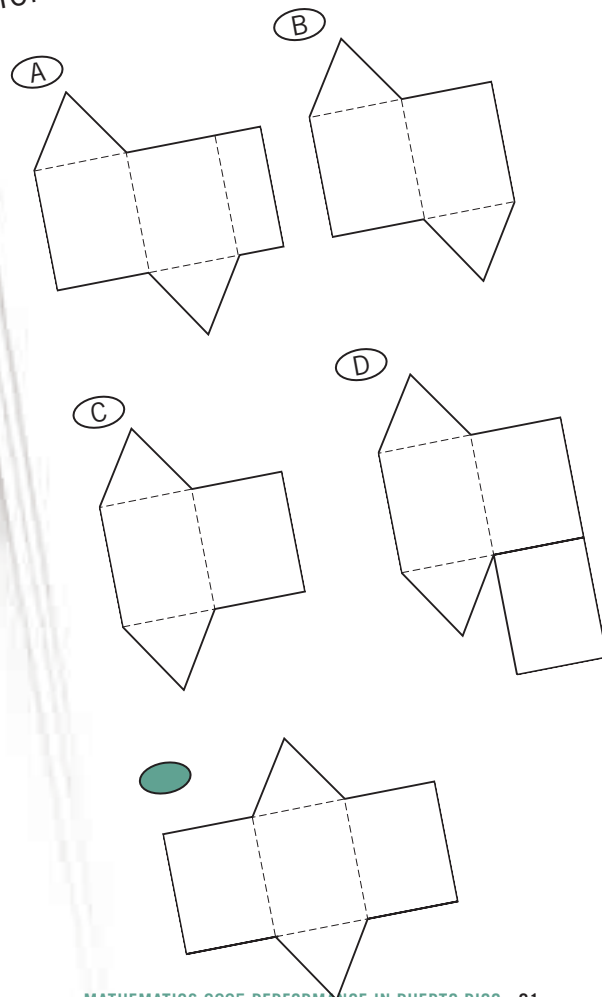
In Puerto Rico, 79 percent of the grade 8 students answered this question correctly. Some misconceptions represented by the incorrect answer choices in this question are given below:

- Not taking into account the scale of the figure when visualizing how it folds; one of the rectangular faces is not wide enough to completely meet all of its adjoining edges when folded (choice A)
- Not taking into account the total number of faces in the prism; in these instances, there are only four, instead of five, faces (choice B and choice C)
- Not taking into account the manner in which the faces need to be connected to fold up into the prism that is shown (choice D)

Sample question 12



Which of the following can be folded to form the prism above?



Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Choice A	5	4
Choice B	5	4
Choice C	6	2
Choice D	3	2
Choice E	79	87
Omit	2	#

The estimate rounds to zero.

NOTE: 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), 2005 Mathematics Assessment.



Photo by Norma Curet, Communications Office, Puerto Rico Department of Education

Data Analysis and Probability

Data analysis is the process of collecting, organizing, summarizing, and interpreting data. This is the heart of the discipline called statistics. In the context of data analysis, probability can be thought of as the study of potential patterns in outcomes that have not yet been observed.

At grade 4, the data analysis and probability content area focuses on students' understanding of how data are collected and organized, how to read and interpret various representations of data, and basic concepts of probability. At grade 8, the emphasis is on students' ability to use a variety of techniques for organizing and summarizing data (including tables, charts, and graphs), to analyze statistical claims, and to use more formal terminology related to probability and data analysis.

Subtopics in the data analysis and probability content area are

- Data representation
- Characteristics of data sets
- Experiments and samples
- Probability

Overall Results

At grade 4, the average score in data analysis and probability for students in Puerto Rico was 188. For Puerto Rico students at grade 8, the average score in data analysis and probability was 224. These scores were lower, on average, than the scores for public school students in the nation.

While the results for public school students in the nation at grade 4 showed a higher average score for male students than for female students in data analysis and probability, the results for Puerto Rico

students showed no significant difference between the average scores for male and female students in this content area. The pattern was different at grade 8, where in Puerto Rico, the average score in data analysis and probability was higher for female students than for male students, but there was no significant difference between the scores of male and female students in the nation.

The next few pages contain sample questions from the data analysis and probability content area in the 2005 NAEP mathematics assessment.

Figure 11
Average fourth-grade NAEP scores for data analysis and probability in 2005, by gender

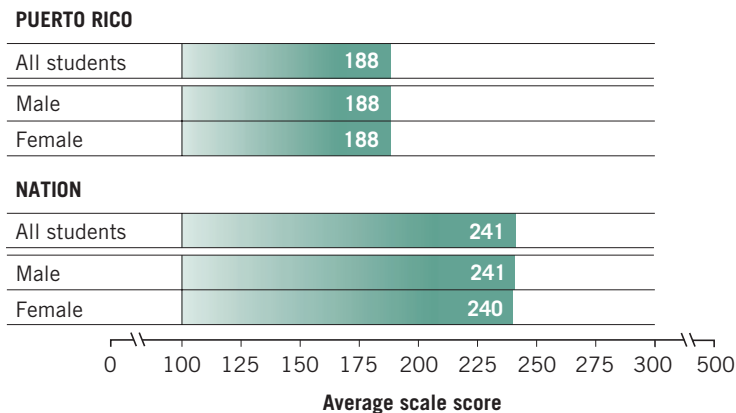
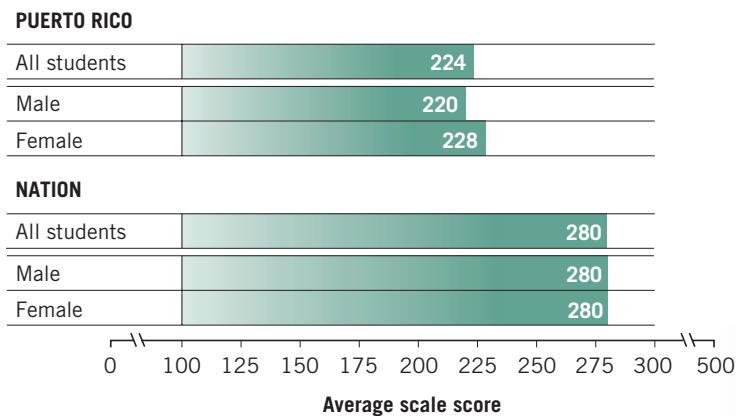
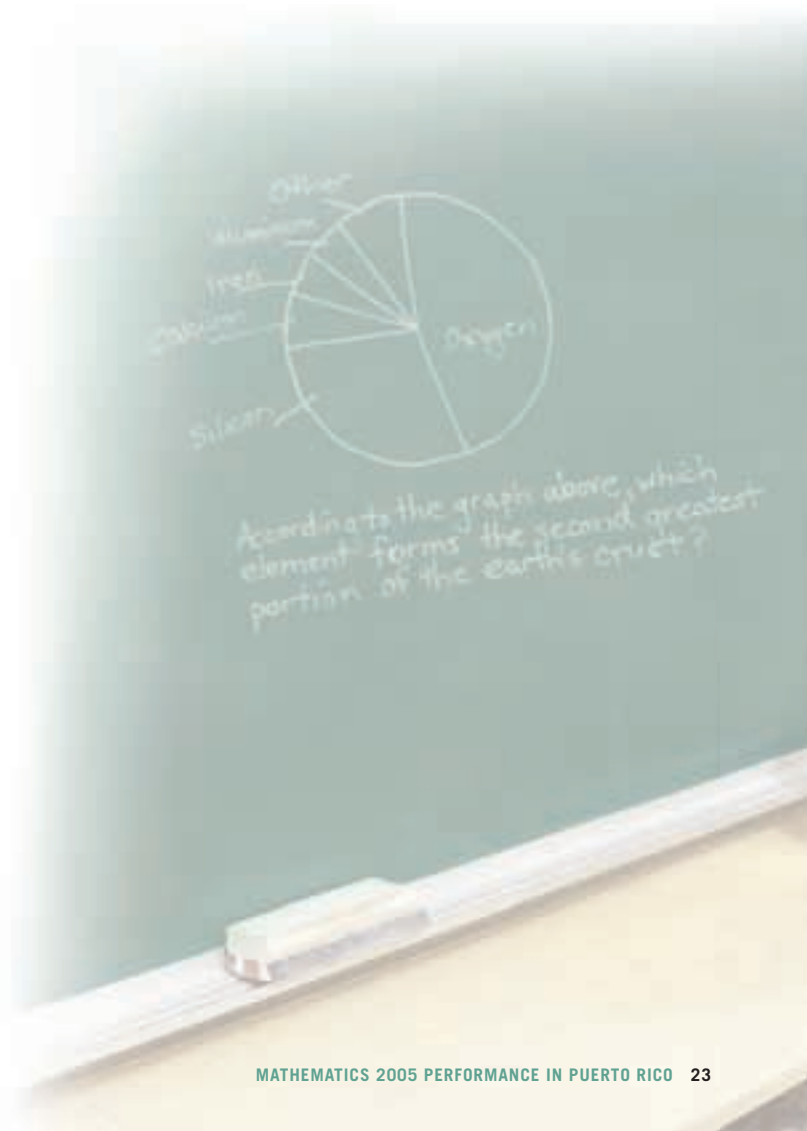


Figure 12
Average eighth-grade NAEP scores for data analysis and probability in 2005, by gender



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



Grade 4

Sample question 13 addresses the data representation subtopic, which includes questions about data presented in pictographs, bar graphs, circle graphs, line graphs, line plots, tables, and tallies. Sample question 14 addresses the probability subtopic, which includes questions about informal probabilistic thinking and counting or representing the outcomes of given events.

Sample Multiple-Choice Question

Sample question 13 asks students to select an appropriate title for a bar graph. The framework objective measured in this question is “Read or interpret a single set of data.”

In Puerto Rico, 32 percent of the grade 4 students answered this question correctly. The following incorrect answer choices to this question are based on misinterpretations of what could be represented by each axis of the graph:

- The units on the scale are not appropriate (choice B).
- The number of categories does not match the number of bars on the graph (choice C and choice D).

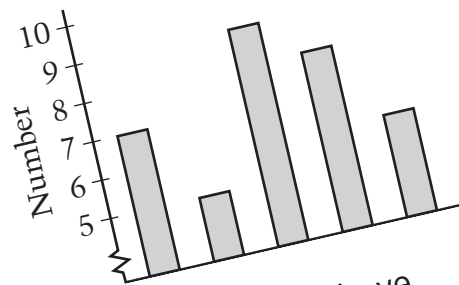
Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Choice A	32	53
Choice B	17	20
Choice C	18	10
Choice D	32	16
Omit	2	1

NOTE: 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), 2005 Mathematics Assessment.

Sample question 13



Jin made the graph above. Which of these could be the title for the graph?

- Number of students who walked to school on Monday through Friday
- Number of dogs in five states
- Number of bottles collected by three students
- The number of students in ten clubs

Sample Multiple-Choice Question

Sample question 14 asks students to identify the most likely outcome of a random event. The framework objective measured in this question is “Use informal probabilistic thinking to describe chance events (i.e., likely and unlikely, certain and impossible).”

In Puerto Rico, 57 percent of the grade 4 students answered this question correctly. The incorrect answer choices in this question are the other colors of the gumballs.

Sample question 14

In a gumball machine there are 100 red, 75 blue, 50 green, and 125 yellow gumballs. These 350 gumballs are mixed up. Sam puts money in and one gumball comes out. Which color is most likely to come out?

- (A) Red
- (B) Blue
- (C) Green
- Yellow

Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Choice A	17	4
Choice B	11	2
Choice C	15	3
Choice D	57	91
Omit	1	#

The estimate rounds to zero.

NOTE: 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), 2005 Mathematics Assessment.





Grade 8

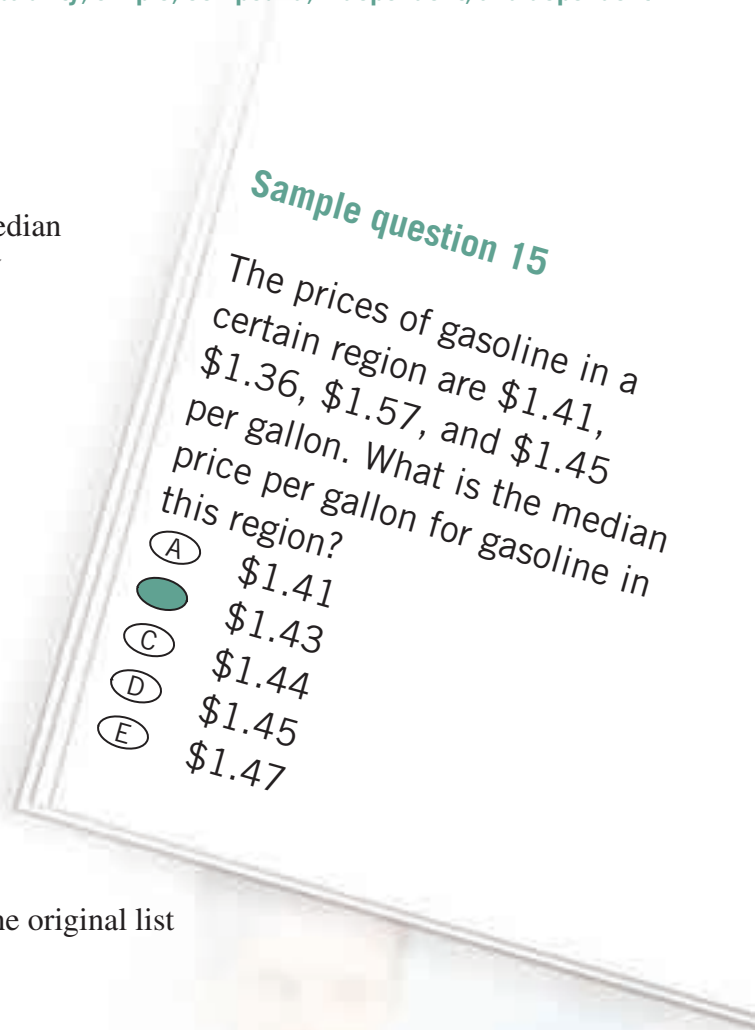
Sample question 15 addresses the characteristics of data sets subtopic, which includes questions about statistical measures that describe data sets, such as the mean, median, mode, range, interquartile range, and standard deviation; the effect of outliers; and scatterplots. Sample question 16 addresses the probability subtopic, which includes questions about theoretical and experimental probability; simple, compound, independent, and dependent events; and sample spaces.

Sample Multiple-Choice Question

Sample question 15 asks students to determine the median of a data set. The median of four numbers is found by listing the numbers from least to greatest and then finding the average of the two middle numbers. The framework objective measured in this question is “Calculate, use, or interpret mean, median, mode, or range.”

In Puerto Rico, 15 percent of the grade 8 students answered this question correctly. The incorrect choices for this question reflect the following misconceptions and errors:

- Listing the numbers from least to greatest and then selecting one of the middle numbers (choice A and choice D)
- Using a correct strategy with an arithmetic error (choice C)
- Finding the average of the two middle numbers in the original list (choice E)



Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Choice A	23	10
Choice B	15	51
Choice C	19	16
Choice D	25	15
Choice E	16	8
Omit	2	1

NOTE: 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), 2005 Mathematics Assessment.



Sample Short Constructed-Response Question

Sample question 16 is a short constructed-response question that requires students to reason about and explain the probability of a particular outcome for a problem in a real-world setting that involves dependent events. This question measures a student’s ability to analyze a situation that involves the probability of an event.

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

Correct Responses presented a correct answer and explanation. For example:

Bill is incorrect because two of the candies that Bill ate were blue, which leaves only 8 blue candies. A total of 28 candies remain, which gives a probability of $\frac{8}{28}$ (or $\frac{4}{14}$ or $\frac{2}{7}$) or 0.29.

Partial Responses showed some understanding of sampling without replacement (i.e., that the number of blue candies has decreased because he already removed two), but the explanation was not complete enough to earn full credit.

Incorrect All incorrect responses.

One percent of grade 8 student responses in Puerto Rico were rated as “correct.”

Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Correct	1	17
Partial	10	30
Incorrect	68	48
Omit	21	4

NOTE: 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), 2005 Mathematics Assessment.

Sample question 16

A package of candies contained only 10 red candies, 10 blue candies, and 10 green candies. Bill shook up the package, opened it, and started taking out one candy at a time and eating it. The first 2 candies he took out and ate were blue. Bill thinks the probability of getting a blue candy on his third try is $\frac{10}{30}$ or $\frac{1}{3}$.

Is Bill correct or incorrect?

Explain your answer.



Photo by Norma Curet, Communications Office, Puerto Rico Department of Education

Algebra

The concepts of algebra provide students with a powerful tool for understanding mathematics. A main focus in the study of algebra is representation, for example, using variables, functions, and coordinate geometry. Symbolic algebra easily and efficiently provides methods to represent problems and solve equations.

At grade 4, students are assessed in their understanding of algebraic representation, patterns, and rules; graphing points on a line or a grid; and the use of symbols to represent unknown quantities. Much of the emphasis of the algebra content area at grade 4 is on recognizing, describing, and extending patterns and rules. At grade 8, the emphasis is on students' understanding of patterns and functions; algebraic representations; algebraic expressions, equations, and inequalities; and linearity, including slope.

Subtopics in the algebra content area are

- Patterns, relations, and functions
- Algebraic representations
- Variables, expressions, and operations
- Equations and inequalities

Overall Results

At grade 4, the average score in the algebra content area was 191 for students in Puerto Rico. At grade 8, the average score in algebra for Puerto Rico students was 222. These scores were lower, on average, than the scores for public school students in the nation.

The results by gender at grade 4 showed a higher average score in algebra for male students than for

female students in the nation. However, in Puerto Rico, there was no significant difference between the average scores in algebra for male and female students. At grade 8, there were no significant differences between male and female students' performance in algebra in Puerto Rico or in the nation.

The next few pages contain sample questions from the algebra content area in the 2005 NAEP mathematics assessment.

Figure 13
Average fourth-grade NAEP scores for algebra in 2005, by gender

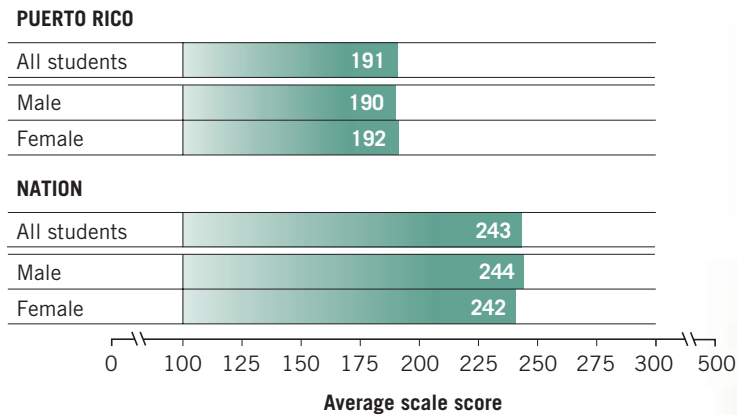
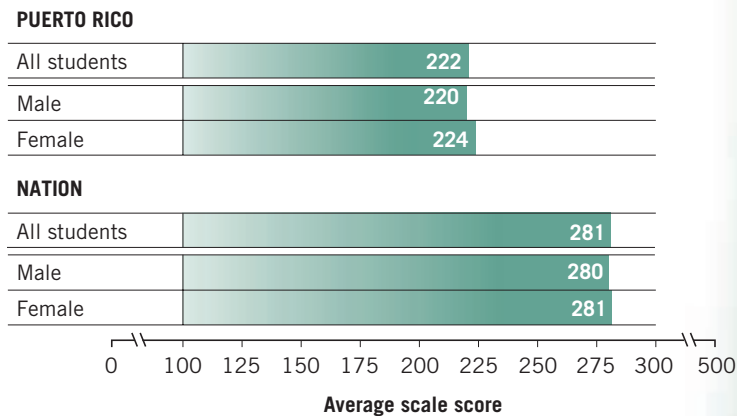
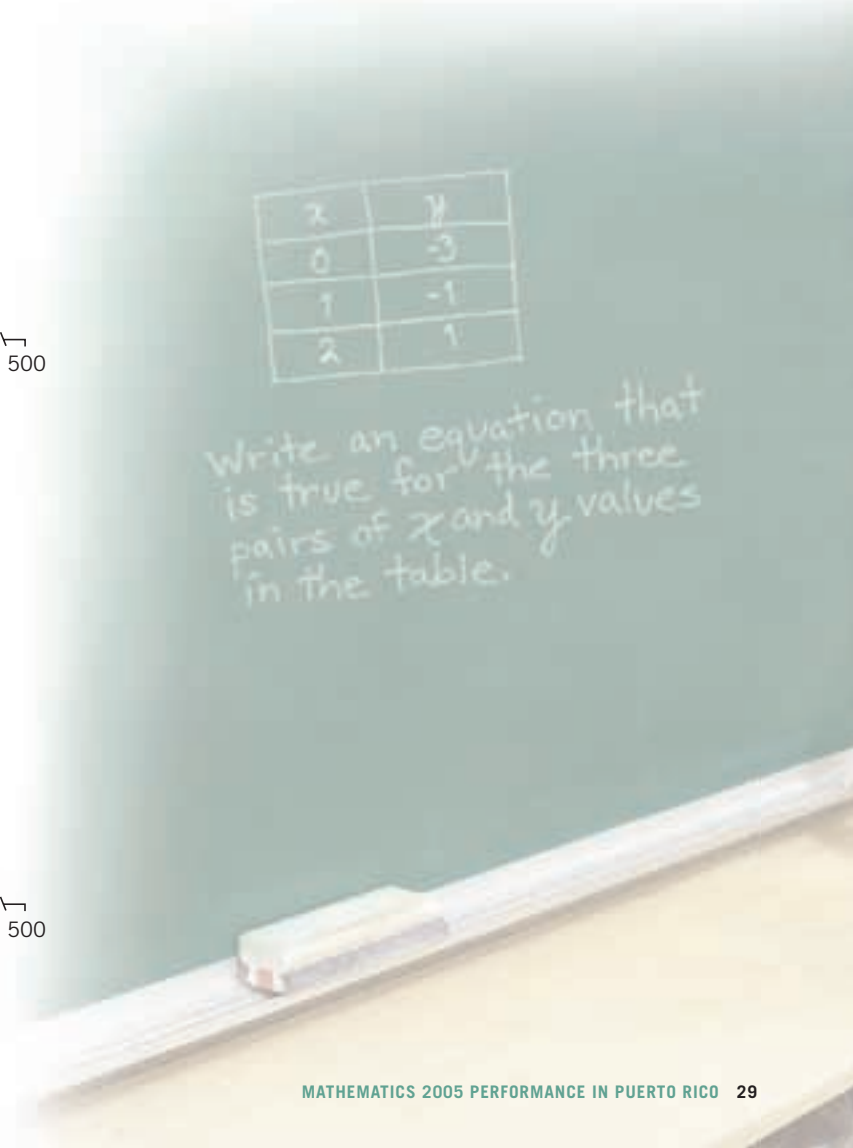


Figure 14
Average eighth-grade NAEP scores for algebra in 2005, by gender



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



Grade 4

Sample question 17 addresses the variables, expressions, and operations subtopic, which includes questions about representing unknown quantities with symbols and expressing simple mathematical relationships in number sentences. Sample question 18 addresses the patterns, relations, and functions subtopic, which includes questions about recognizing, describing, and extending patterns and rules.

Sample Multiple-Choice Question

Sample question 17 asks students to identify the mathematical expression that represents a situation described in words. The framework objective measured in this question is “Use letters and symbols to represent an unknown quantity in a simple mathematical expression.”

In Puerto Rico, 30 percent of the grade 4 students answered this question correctly.

The incorrect answer choices for this question represent a misunderstanding of the mathematical relationship (multiplication) between the two quantities (hours per night and nights per week) given in the question.

Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Choice A	39	26
Choice B	12	4
Choice C	30	61
Choice D	17	8
Omit	3	1

NOTE: 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), 2005 Mathematics Assessment.

Sample question 17

N stands for the number of hours of sleep Ken gets each night. Which of the following represents the number of hours of sleep Ken gets in 1 week?

- (A) $N + 7$
- (B) $N - 7$
- (C) $N \times 7$
- (D) $N \div 7$

Sample Multiple-Choice Question

Sample question 18 requires students to identify a rule, given symbolically, that describes a pattern given in the table. The framework objective measured in this question is “Given a pattern or sequence, construct or explain a rule that can generate the terms of the pattern or sequence.”

In Puerto Rico, 15 percent of the grade 4 students answered this question correctly.

The incorrect answer choices represent the following misconceptions and errors:

- Finding a rule that describes only the relationship in the first row in the table (choice A)
- Recognizing that the number in the first column is doubled, but adding an incorrect constant value (choice B and choice D)

Sample question 18

□	△
4	9
5	11
6	13
7	15

- Which rule describes the pattern shown in the table?
- (A) $\square + 5 = \triangle$
- (B) $\square + \square = \triangle$
- (C) $\square + \square + 1 = \triangle$
- (D) $\square + \square + 2 = \triangle$

Percentage of fourth-grade students in each response category

	PUERTO RICO	NATION
Choice A	53	43
Choice B	15	20
Choice C	15	24
Choice D	12	11
Omit	4	2

NOTE: 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), 2005 Mathematics Assessment.



Grade 8

Sample question 19 addresses the algebraic representations subtopic, which includes questions about analyzing, interpreting, and translating among different representations (symbolic, graphical, tabular, verbal, and pictorial) of a linear relationship; representing points in a rectangular coordinate system; and recognizing common nonlinear relationships in meaningful contexts. Sample question 20 addresses the equations and inequalities subtopic, which focuses on questions about linear equations and inequalities.

Sample Multiple-Choice Question

Sample question 19 presents a graph in the xy -coordinate plane and requires students to estimate the x -intercept of the graph. The framework objective measured in this question is “Graph or interpret points that are represented by ordered pairs of numbers on a rectangular coordinate system.”

In Puerto Rico, 22 percent of the grade 8 students answered this question correctly.

Incorrect answer choices reflect the following misconceptions and errors:

- Finding the y -intercept (choice A)
- Misreading the scale or incorrectly estimating the x -coordinate (choice B, choice D, and choice E)

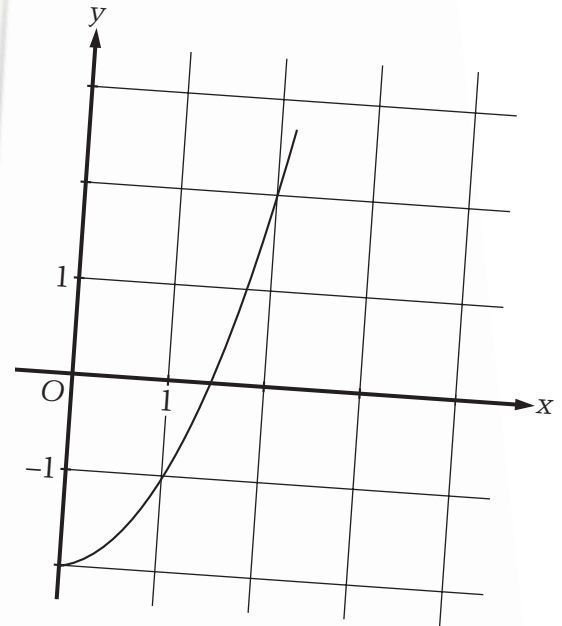
Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Choice A	27	18
Choice B	28	17
Choice C	22	49
Choice D	8	8
Choice E	11	6
Omit	3	1

NOTE: 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), 2005 Mathematics Assessment.

Sample question 19



On the curve above, what is the best estimate of the value of x when $y = 0$?

- (A) -2.0
- (B) 1.1
- (C) 1.4
- (D) 1.7
- (E) 1.9

Sample Multiple-Choice Question

Sample question 20 asks students about the relationship between two variables when the value of one of the variables is changed. The framework objective measured in this question is “Interpret ‘=’ as an equivalence between two expressions and use this interpretation to solve problems.”

In Puerto Rico, 26 percent of the grade 8 students answered this question correctly. The incorrect answer choices represent misconceptions about the relationship between the expressions $4x$ and $4(x + 2)$, which is equal to $4x + 8$.

Sample question 20

In the equation $y = 4x$, if the value of x is increased by 2, what is the effect on the value of y ?

- It is 8 more than the original amount.
- (B) It is 6 more than the original amount.
- (C) It is 2 more than the original amount.
- (D) It is 16 times the original amount.
- (E) It is 8 times the original amount.

Percentage of eighth-grade students in each response category

	PUERTO RICO	NATION
Choice A	26	33
Choice B	23	9
Choice C	29	42
Choice D	9	4
Choice E	11	10
Omit	2	2

NOTE: 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), 2005 Mathematics Assessment.

Technical Notes and Data Appendix

Tables A-1 and A-2 list the NAEP 2005 mathematics questions for grades 4 and 8 that were released to the public after the assessment. They are organized by content area and increasing order of difficulty for students in Puerto Rico.

Student results are presented in terms of the average score for each question. An average score for a question is expressed as a fraction of the maximum possible score and ranges from 0.00 to 1.00.

The average score provides a way of comparing the difficulty of multiple-choice and constructed-response questions. For a multiple-choice question or a constructed-response question that is scored correct or incorrect, the average score is the percentage of correct responses expressed as a decimal. For a constructed-response question in which students could earn partial credit if they did not have a completely correct response, the average score is computed by adding the percent of students receiving full credit to a fraction of the percent of the students receiving partial credit.

An example of computing an average score for a constructed-response question can be provided for the grade 8 measurement question shown on page 15 that asks students to draw one rectangular region enclosed by another. Responses to this question were scored “Correct,” “Partial,” or “Incorrect.” For Puerto Rico, 16 percent of the students gave a fully correct answer, and an additional 4 percent of the students gave a partial answer. The average score for this question was computed as: $16 + \frac{1}{2}(4) = 18$ or 0.18 when expressed as a decimal. The partial results were weighted by $\frac{1}{2}$ because there were two levels of credit (correct and partial) for the question. Partial responses to a question with four levels of credit would receive weights of $\frac{1}{4}$ (minimal), $\frac{1}{2}$ (partial), and $\frac{3}{4}$ (satisfactory). The fractions applied to partial responses are derived from the reciprocal of the number of credit levels for the question.

The average score for both multiple-choice and constructed-response questions takes into account those students who answered the question incorrectly, as well as those who reached the question but did not attempt to answer it. However, students who did not reach the question are not included in the calculation of an average score. (A student is considered as not reaching a question when neither that question nor any question following it in the section has been answered.)

For purposes of comparison, average scores for each question are also presented for public school students in the nation (excluding Puerto Rico). Significant differences between the average scores for a question for the nation and Puerto Rico are noted.

Table A-1. Average score on selected fourth-grade NAEP mathematics questions in 2005, by content area

	Puerto Rico			Puerto Rico	
	Rico	Nation		Rico	Nation
Number properties and operations			Data analysis and probability		
Fill in missing numbers on a number line	0.51	0.77*	<i>Determine the most likely outcome in a story problem</i>	0.57	0.91*
<i>Identify a number given in expanded notation</i>	0.50	0.86*	<i>Identify the appropriate title for a graph</i>	0.32	0.53*
<i>Solve a multi-step division problem</i>	0.48	0.57*	Complete a bar graph from a description of data ¹	0.13	0.46*
Given a solution, determine the numbers in the problem	0.41	0.68*	Algebra		
<i>Subtract fractions with common denominators</i>	0.36	0.53*	<i>Identify the missing figure in a pattern</i> ¹	0.32	0.72*
Subtract two-digit number from three-digit number ¹	0.36	0.75*	<i>Represent a situation with an algebraic expression</i>	0.30	0.61*
<i>Determine number of pieces from cutting wholes into fifths</i>	0.34	0.53*	Determine next number in given pattern	0.23	0.68*
<i>Subtract two-digit numbers to solve a story problem</i>	0.22	0.79*	<i>Identify equation to describe pattern given in table</i>	0.15	0.24*
<i>Identify number sentence matching a situation</i>	0.22	0.33*	Determine missing numbers in number sentence	0.10	0.44*
Determine the value of a point on a number line ¹	0.17	0.55*	Extend a pattern on a grid ¹	0.08	0.38*
<i>Identify numbers rounded to whole numbers</i> ¹	0.14	0.45*			
Determine the greatest even number less than 20	0.07	0.72*			
Solve a multi-step story problem ¹	0.06	0.43*			
Measurement					
<i>Approximate fraction of an hour given minutes</i>	0.37	0.49*			
<i>Determine which attribute could be measured with a meter stick</i>	0.36	0.77*			
<i>Determine the area of shaded region on grid</i> ¹	0.17	0.47*			
Geometry					
<i>Identify which shapes are cylinders</i> ¹	0.69	0.87*			
<i>Determine how many angles are less than 90 degrees</i> ¹	0.18	0.44*			
Complete a set of written directions from a map	0.17	0.67*			
Arrange tiles in different ways to satisfy given condition	0.16	0.36*			
<i>Determine the width of a rectangle after it is folded</i>	0.16	0.53*			
Mark a piece of paper to satisfy a given condition ¹	0.10	0.31*			

* Significantly different ($p < .05$) from Puerto Rico.

¹ Question was also administered to students at grade 8.

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The average score for a question is expressed as a fraction of the maximum possible score and ranges from 0.00 to 1.00.

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

Table A-2. Average score on selected eighth-grade NAEP mathematics questions in 2005, by content area

	Puerto Rico		Nation	
Number properties and operations				
Subtract two-digit number from three-digit number ¹	0.73	0.88*		
Determine the value of a point on a number line ¹	0.49	0.88*		
Solve a multi-step story problem ¹	0.43	0.76*		
<i>Convert a written number to decimal form</i>	0.38	0.67*		
<i>Identify numbers rounded to whole numbers¹</i>	0.32	0.85*		
<i>Identify piece of information not needed¹</i>	0.26	0.62*		
Solve a story problem with multiple operations	0.24	0.58*		
<i>Recognize expanded form of number</i>	0.24	0.40*		
<i>Determine distance between points from a written description</i>	0.20	0.22		
Shade a fraction of a figure ¹	0.16	0.72*		
<i>Find the percent of a tip on a restaurant bill</i>	0.15	0.29*		
<i>Identify a point on a number line</i>	0.13	0.41*		
<i>Solve a story problem involving percent increase</i>	0.11	0.35*		
Write mathematical word problem given a scenario	0.02	0.11*		
Measurement				
<i>Determine the area of shaded region on grid¹</i>	0.34	0.77*		
<i>List angle measures from smallest to largest</i>	0.33	0.72*		
Draw arrow to represent direction on a figure	0.25	0.44*		
<i>Find length of a rectangle given perimeter and width</i>	0.21	0.39*		
Draw one rectangular region enclosed by another	0.18	0.50*		
<i>Calculate temperature increase on a thermometer</i>	0.16	0.69*		
Construct a figure on a grid	0.06	0.18*		
Find area then construct another figure with same area	0.02	0.26*		
Determine how many boxes of tile are needed	0.02	0.15*		
Geometry				
<i>Identify which shapes are cylinders¹</i>	0.90	0.93*		
<i>Identify which figure can be folded to form a prism</i>	0.79	0.87*		
Identify plane figure that results from opening a tube ¹	0.51	0.86*		
Draw the reflection of a figure	0.50	0.77*		
Shade a grid to form symmetric pattern	0.35	0.61*		
<i>Find the measure of an acute angle</i>	0.35	0.47*		
<i>Determine how many angles are less than 90 degrees¹</i>	0.31	0.68*		
<i>Determine how many colors are needed to paint a cube¹</i>	0.28	0.79*		
Mark a piece of paper to satisfy a given condition ¹	0.23	0.61*		
<i>Determine which shape cannot be formed by 2 overlapping tiles</i>	0.21	0.53*		
<i>Calculate midpoint of a line segment</i>	0.17	0.38*		
<i>Use properties of quadrilaterals to solve a problem</i>	0.14	0.24*		
Construct a figure using tiles	0.08	0.34*		
Data analysis and probability				
<i>Read and interpret a pie chart</i>	0.63	0.87*		
Complete a graph given a set of data ¹	0.59	0.90*		
Complete a bar graph from a description of data ¹	0.59	0.79*		
<i>Determine median price for a gallon of gasoline</i>	0.15	0.51*		
<i>Given probability, determine faces of a cube labeled R</i>	0.14	0.39*		
Solve problem involving dependent events	0.06	0.32*		
Algebra				
<i>Determine the location of a city on a grid</i>	0.66	0.85*		
<i>Reason to order quantities¹</i>	0.60	0.85*		
<i>Identify the missing figure in a pattern¹</i>	0.56	0.89*		
<i>Determine the 6th term in a pattern</i>	0.34	0.59*		
Extend a pattern on a grid ¹	0.28	0.63*		
<i>Determine effect of increasing the value of one variable</i>	0.26	0.33*		
Use graph of two linear equations to solve a problem	0.24	0.44*		
<i>Determine an equation given a table of x and y values</i>	0.23	0.53*		
<i>Estimate the x-coordinate from the graph of a curve</i>	0.22	0.49*		
<i>Determine coordinates to complete a rectangle</i>	0.17	0.59*		
<i>Identify the graph of whole numbers less than 5</i>	0.17	0.36*		
<i>Extend a pattern involving perfect squares</i>	0.15	0.39*		
<i>Identify an equivalent algebraic expression</i>	0.15	0.42*		
Reason about pattern on grid using concept of slope	0.02	0.24*		

* Significantly different ($p < .05$) from Puerto Rico.

¹ Question was also administered to students at grade 4.

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The average score for a question is expressed as a fraction of the maximum possible score and ranges from 0.00 to 1.00.

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

THIS PAGE INTENTIONALLY LEFT BLANK.

U.S. DEPARTMENT OF EDUCATION

The National Assessment of Educational Progress (NAEP) is a congressionally mandated project sponsored by the U.S. Department of Education. The National Center for Education Statistics, a department within the Institute of Education Sciences, administers NAEP. The Commissioner of Education Statistics is responsible by law for carrying out the NAEP project.

Margaret Spellings
Secretary
U.S. Department
of Education

Grover J. Whitehurst
Director
Institute of
Education Sciences

Mark Schneider
Commissioner
National Center for
Education Statistics

Peggy Carr
Associate Commissioner
National Center for
Education Statistics

THE NATIONAL ASSESSMENT GOVERNING BOARD

In 1988, Congress created the National Assessment Governing Board to set policy for the National Assessment of Educational Progress, commonly known as The Nation's Report Card™. The Board is an independent, bipartisan group whose members include governors, state legislators, local and state school officials, educators, business representatives, and members of the general public.

Darvin M. Winick, Chair
President
Winick & Associates
Austin, Texas

Amanda P. Avallone, Vice Chair
Assistant Principal and
Eighth-Grade Teacher
Summit Middle School
Boulder, Colorado

Francie Alexander
Chief Academic Officer,
Scholastic, Inc.
Senior Vice President,
Scholastic Education
New York, New York

David J. Alukonis
Chairman
Hudson School Board
Hudson, New Hampshire

Barbara Byrd-Bennett
Executive Superintendent-in-
Residence
Cleveland State University
Cleveland, Ohio

Gregory Cizek
Professor of Educational
Measurement
University of North Carolina
Chapel Hill, North Carolina

Shirley V. Dickson
Educational Consultant
Aliso Viejo, California

Honorable David P. Driscoll
Commissioner of Education
Massachusetts Department
of Education
Malden, Massachusetts

John Q. Easton
Executive Director
Consortium on Chicago
School Research
University of Chicago
Chicago, Illinois

Alan J. Friedman
Consultant
Museum Development and Science
Communications
New York, New York

David W. Gordon
County Superintendent of Schools
Sacramento County Office of
Education
Sacramento, California

Robin C. Hall
Principal
Beecher Hills Elementary School
Atlanta, Georgia

Kathi M. King
Twelfth-Grade Teacher
Messalonskee High School
Oakland, Maine

Honorable Keith King
Member
Colorado House of Representatives
Denver, Colorado

Kim Kozbial-Hess
Fourth-Grade Teacher
Hawkins Elementary School
Toledo, Ohio

James S. Lanich
President
California Business for
Education Excellence
Sacramento, California

Honorable Cynthia Nava
Senator
New Mexico State Senate
Las Cruces, New Mexico

Andrew C. Porter
Director, Learning Sciences
Institute
Peabody College,
Vanderbilt University
Nashville, Tennessee

Luis A. Ramos
Community Relations Manager
PPL Susquehanna
Berwick, Pennsylvania

Mary Frances Taymans, SND
Executive Director
Secondary Schools Department
National Catholic Educational
Association
Washington, D.C.

Oscar A. Troncoso
Principal
Socorro High School
El Paso, Texas

Honorable Thomas J. Vilsack
Former Governor of Iowa
Des Moines, Iowa

Honorable Michael E. Ward
Former North Carolina
Superintendent of
Public Instruction
Hattiesburg, Mississippi

Eileen L. Weiser
Former Member,
State Board of Education
Michigan Department of
Education
Lansing, Michigan

Grover J. Whitehurst
(Ex officio)
Director
Institute of Education Sciences
U.S. Department of Education
Washington, D.C.

Charles E. Smith
Executive Director
National Assessment
Governing Board
Washington, D.C.

THE NATION'S REPORT CARD

MATHEMATICS 2005

Assessment of
Student Performance
in Puerto Rico

March 2007

MORE INFORMATION

The report release site is
<http://nationsreportcard.gov>.
The NCES web electronic
catalog is [http://nces.ed.gov/
pubsearch](http://nces.ed.gov/pubsearch).

For ordering information,
write to
U.S. Department of Education
ED Pubs
P.O. Box 1398
Jessup, MD 20794-1398
or call toll free 1-877-4ED-Pubs
or order online at [http://www.
edpubs.org](http://www.edpubs.org)

SUGGESTED CITATION

Dion, G.S., Haberstroh, J.G.,
Dresher, A.R. (2007).
*The Nation's Report Card:
Mathematics 2005
Performance in Puerto Rico—
Focus on the Content Areas*
(NCES 2007-460). U.S.
Department of Education,
National Center for Education
Statistics. Washington, D.C.:
U.S. Government Printing Office.

CONTENT CONTACT

Emmanuel Sikali
202-502-7419
emmanuel.sikali@ed.gov



**"OUR MISSION IS TO ENSURE EQUAL ACCESS TO EDUCATION AND TO
PROMOTE EDUCATIONAL EXCELLENCE THROUGHOUT THE NATION."**

www.ed.gov