

# Technical Notes and Data Appendix

## Sampling and Participation

Samples of schools and students in Puerto Rico were selected to be representative of their jurisdiction. To ensure unbiased samples, NCES and the Governing Board established participation rate standards that states and jurisdictions were required to meet in order for their results to be reported. School participation rates for the original sample needed to be at least 85 percent to meet reporting requirements.

In Puerto Rico, approximately 2,800 students from 100 public schools at each grade (4 and 8) participated in the 2007 NAEP mathematics assessment. School and student participation information for Puerto Rico and the nation is presented in table A-1. The school participation rate for Puerto Rico was 100 percent at each grade, and student participation rates were 96 percent for grade 4 and 94 percent for grade 8. For public schools in the nation, the school participation rates were 100 percent at both grades, and student participation rates were 95 percent at grade 4 and 92 percent at grade 8.

**Table A-1. School and student participation rates in NAEP mathematics for public school students in Puerto Rico and the nation, by grade: 2007**

Grade	School participation		Student participation	
	Number of schools participating	Weighted percent	Number of students assessed	Weighted percent
<b>Grade 4</b>				
Puerto Rico	100	100	2,800	96
Nation	7,300	100	189,800	95
<b>Grade 8</b>				
Puerto Rico	100	100	2,800	94
Nation	6,400	100	147,300	92

NOTE: The numbers of schools and students are rounded to the nearest hundred.  
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

## Translation

The 2007 NAEP mathematics assessment was translated into Spanish specifically for use in Puerto Rico. The translation process was designed to produce an assessment that was psychometrically equivalent to the English version of the assessment administered to students in the national sample. Rather than a word-by-word translation from English to Spanish, the process began with the translation of the assessment by a team of bilingual assessment specialists, and included thorough reviews by editorial and fairness reviewers, mathematics teachers designated by the Puerto Rico Department of Education, and Spanish language content experts. During the translation and review processes, mathematics textbooks used in Puerto Rico were consulted to ensure plausible contexts and accurate mathematical terminology. In addition, NCES carried out an independent translation verification review process to ensure the adequacy of wording in the context of Puerto Rico. Reviews at different stages provided valuable perspectives of how students in Puerto Rico might interpret specific wording and respond to certain contexts.

For students who are English-speaking Spanish language learners, a bilingual version of the assessment specifically designed for Puerto Rico was offered with English and Spanish versions of questions presented on facing pages.



## Accommodations and Exclusions

Testing accommodations, such as extra testing time or individual rather than group administration, are provided in the NAEP assessments for students with disabilities (SD) who could not fairly and accurately demonstrate their abilities without modified test administration procedures. In addition, accommodations are offered for students in the national sample identified as English language learners (ELL). For the Spanish-language version of the NAEP mathematics assessment in Puerto Rico, where the majority of students are Spanish speakers, accommodations were offered to students identified as Spanish language learners (SLL). Less than 1 percent of students in Puerto Rico were identified as SLL in 2007. Almost all of these SLL students were assessed with the bilingual accommodation, in which both English and Spanish versions of assessment questions were provided.

Even with the availability of accommodations, there still remains a portion of students excluded from the NAEP assessment due to jurisdictions' policies and practices regarding the identification and inclusion of SD and/or ELL students (SLL in Puerto Rico). The percentages of public school students with disabilities excluded and accommodated in Puerto Rico and the nation are presented in table A-2. More information

**Table A-2. Students with disabilities identified, excluded, and accommodated in NAEP mathematics as a percentage of all public school students in Puerto Rico and the nation, by grade: 2007**

Grade	Identified	Excluded	Assessed without accommodations	Assessed with accommodations
<b>Grade 4</b>				
Puerto Rico	20	#	1	19
Nation	14	3	3	8
<b>Grade 8</b>				
Puerto Rico	14	1	1	12
Nation	13	4	2	6

# Rounds to zero.

NOTE: Less than 1 percent of students in Puerto Rico were identified as Spanish language learners (SLL) in 2007. Almost all of these SLL students were assessed with the bilingual accommodation. 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.

about NAEP's policy on inclusion of special-needs students is available at <http://nces.ed.gov/nationsreportcard/about/inclusion.asp>.

## Reporting Puerto Rico Results on the NAEP Scale

In 2005, average scale score results for Puerto Rico were reported on the NAEP scale and provided the opportunity of investigating the validity of those results (see more details in the *Technical Report on the NAEP Mathematics Assessment in Puerto Rico: Focus on Statistical Issues*). Although average scale score results were also reported for the 2003 NAEP mathematics assessment in Puerto Rico, changes in the translation of the questions between 2003 and 2005 prevented direct comparisons between the results for these two years.

As with all NAEP data, the results for Puerto Rico went through extensive quality control procedures, including checking for consistency between changes over time in the average of the question scores and changes in the average scale score. Specifically, changes in question-level performance over time generally predict changes in scale scores. While the relationship is found to be consistent for other states and jurisdictions participating in NAEP, the pattern was found to be different in Puerto Rico. Therefore, the tentative scale score results for Puerto Rico in 2007 were determined not to accurately reflect student performance. As such, only the average of the question score results from the 2007 assessment are presented in this report. NCES is continuing to investigate ways to make meaningful comparisons between the performance of students in Puerto Rico and students in the nation.



## The Question Score

The question score provides a way of showing how students perform on multiple-choice and constructed-response questions. For a multiple-choice question or a constructed-response question that is scored either “Correct” or “Incorrect,” the question 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 question score is computed by adding the percent of students receiving full credit to a fraction of the percent of students receiving partial credit.

An example of computing the question score for a constructed-response question is provided below for the grade 4 sample question in this report that asks students to identify a property of odd numbers. Responses to this question were scored “Correct,” “Partial,” or “Incorrect.” For Puerto Rico, 12 percent of the students gave a fully correct answer, and an additional 24 percent of the students gave a partial answer. The question score for this question was computed as:  $12 + \frac{1}{2}(24) = 24$  or 0.24 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 (“Extended,” “Satisfactory,” “Partial,” and “Minimal”) would receive weights of  $\frac{3}{4}$  (Satisfactory),  $\frac{1}{2}$  (Partial), and  $\frac{1}{4}$  (Minimal). The fractions applied to partial responses are derived from the reciprocal of the number of credit levels for the question.

The question scores for both multiple-choice and constructed-response questions take 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 the question score. A student is considered to have not reached a question when neither that question nor any subsequent question in the test section has been answered.

Tables A-3 and A-4 list the NAEP 2007 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. For comparison purposes, the question score for each question is also presented for public school students in the nation (excluding Puerto Rico). Significant differences between question scores for the nation and Puerto Rico are noted.



**Table A-3. Question scores on selected NAEP mathematics questions at grade 4, by content area: 2007**

Number properties and operations	Puerto Rico		Nation	Geometry	Puerto Rico		Nation
	Rico	Nation			Rico	Nation	
<i>Order four-digit numbers from smallest to largest</i>	0.49	0.83*		<i>Reason to identify figure based on description</i>	0.69	0.90*	
<i>Identify place value representation of a number</i>	0.47	0.87*		<i>Locate an object in a picture</i> <sup>1</sup>	0.59	0.91*	
<i>Find a sum based on place value</i>	0.45	0.81*		<i>Find number of right angles in a picture</i>	0.42	0.41	
<i>Determine problem easiest to solve by mental math</i>	0.43	0.70*		<i>Identify 3-D shape resulting from folding paper</i> <sup>1</sup>	0.42	0.65*	
<i>Identify fraction modeled by picture</i>	0.32	0.80*		<i>Determine number of blocks used to build a figure</i>	0.27	0.56*	
<i>Find sum of numbers represented by base ten model</i>	0.30	0.67*		Outline different squares in a figure	0.18	0.47*	
<i>Use place value to recognize a number</i>	0.29	0.42*		Outline different triangles in a figure	0.11	0.38*	
Identify odd and even numbers	0.29	0.76*		Outline non-rectangular, four-sided shape in a figure	0.01	0.13*	
Recognize property of odd numbers	0.24	0.65*					
List fractions equivalent to given fractions	0.24	0.60*		<b>Data analysis and probability</b>			
<i>Solve story problem involving addition and subtraction</i>	0.22	0.36*		<i>Read information from a pictograph</i>	0.35	0.84*	
Compare unit fractions to solve a problem	0.21	0.41*		Complete a bar graph	0.29	0.79*	
<i>Use place value to determine amount of increase</i>	0.20	0.61*		<i>Determine probability of a specific outcome</i>	0.21	0.64*	
<i>Interpret calculator output in a context</i> <sup>1</sup>	0.19	0.29*		Identify color with highest chance of being chosen	0.17	0.56*	
<i>Find total quantity based on place value</i>	0.19	0.58*		<i>Identify picture representing greatest probability</i> <sup>1</sup>	0.14	0.45*	
Determine what fraction of a figure is shaded <sup>1</sup>	0.19	0.78*		Add data to a bar graph	0.06	0.42*	
<i>Solve a story problem involving subtraction</i> <sup>1</sup>	0.17	0.73*		Label a spinner to satisfy a given condition	0.03	0.24*	
<i>Solve story problem involving multiple operations</i> <sup>1</sup>	0.13	0.21*					
Solve story problem requiring multiple operations	0.12	0.36*		<b>Algebra</b>			
Identify all numbers having a certain factor <sup>1</sup>	0.08	0.37*		<i>Identify number sentence that models balanced scale</i> <sup>1</sup>	0.56	0.79*	
Calculate total cost using sales tax table <sup>1</sup>	0.06	0.35*		<i>Identify expression that represents a scenario</i>	0.47	0.81*	
Use unit costs to solve a problem <sup>1</sup>	0.02	0.17*		<i>Find missing figure in a pattern of shapes</i>	0.37	0.45*	
				<i>Identify number that would be in a pattern</i>	0.27	0.55*	
				<i>Relate input to output from a table of values</i> <sup>1</sup>	0.23	0.19*	
<b>Measurement</b>							
<i>Determine attribute being measured from picture</i>	0.64	0.75*					
<i>Recognize a reasonable measurement for an object</i>	0.55	0.89*					
<i>Convert a quantity of pints to quarts</i> <sup>1</sup>	0.47	0.65*					
<i>Estimate length of rope</i> <sup>1</sup>	0.43	0.78*					
<i>Solve problem involving time</i> <sup>1</sup>	0.31	0.49*					
<i>Identify best unit for measuring an object</i>	0.27	0.40*					
<i>Find area of square with inscribed triangle</i>	0.26	0.48*					
<i>Read a speedometer to solve a problem</i>	0.19	0.63*					
<i>Find figure with same perimeter as given figure</i>	0.15	0.37*					
Explain how to find perimeter of a given shape	0.08	0.53*					
Determine cost to carpet a room <sup>1</sup>	0.04	0.24*					

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

<sup>1</sup> This question was included in a section that allowed the use of a calculator.

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The question score 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), 2007 Mathematics Assessment.

Table A-4. Question scores on selected NAEP mathematics questions at grade 8, by content area: 2007

	Puerto Rico	Nation		Puerto Rico	Nation
<b>Number properties and operations</b>			<b>Data analysis and probability</b>		
<i>Use place value to write a number</i>	0.70	0.81*	<i>Determine most appropriate graph for a situation</i> <sup>1</sup>	0.56	0.84*
<i>Determine fraction of figure shaded</i>	0.67	0.89*	<i>Find total cost based on unit price for a quantity</i>	0.38	0.80*
<i>Find total charges given operating costs</i> <sup>1</sup>	0.42	0.67*	<i>Identify relationship in scatterplot</i> <sup>1</sup>	0.26	0.61*
<i>Estimate time given rate and distance</i>	0.40	0.71*	<i>Explain which survey is better</i> <sup>1</sup>	0.25	0.68*
<i>Identify number line representing given situation</i> <sup>1</sup>	0.35	0.58*	<i>Determine an expected outcome</i>	0.20	0.59*
<i>Convert raw points to a percentage</i> <sup>1</sup>	0.28	0.62*	<i>Use graph to identify incorrect written statements</i> <sup>1</sup>	0.12	0.39*
<i>Solve a story problem involving costs and profit</i> <sup>1</sup>	0.28	0.52*	<i>Find number of combinations satisfying a condition</i>	0.12	0.18*
<i>Divide to find greatest whole quantity</i> <sup>1</sup>	0.28	0.61*	<i>Explain which statistic is best in given situation</i> <sup>1</sup>	0.10	0.16*
<i>Identify number rounded to nearest hundred</i>	0.25	0.58*	<i>Determine probability of a given event</i> <sup>1</sup>	0.01	0.33*
<i>Divide large numbers in a given context</i> <sup>1</sup>	0.19	0.50*			
<i>Analyze a mathematical relationship</i> <sup>1</sup>	0.15	0.42*	<b>Algebra</b>		
<i>Determine distance given rate and time</i>	0.12	0.36*	<i>Solve system of linear equations given in context</i>	0.56	0.73*
<i>Interpret number expressed in scientific notation</i> <sup>1</sup>	0.11	0.33*	<i>Recognize equivalent expressions</i> <sup>1</sup>	0.47	0.65*
<i>Convert sum of fractions to decimal number using place value</i> <sup>1</sup>	0.07	0.45*	<i>Determine an expression to model a scenario</i>	0.43	0.72*
<i>Identify fractions listed in ascending order</i> <sup>1</sup>	0.04	0.49*	<i>Identify point on a graph with specified coordinates</i>	0.33	0.78*
			<i>Solve an algebraic equation</i> <sup>1</sup>	0.32	0.82*
<b>Measurement</b>			<i>Use algebra to solve a story problem</i>	0.31	0.46*
<i>Determine dimensions that give greatest volume</i>	0.59	0.75*	<i>Complete a table and write an algebraic expression</i> <sup>1</sup>	0.30	0.55*
<i>Recognize unit associated with specific attribute</i> <sup>1</sup>	0.47	0.68*	<i>Determine equation relating sales and profit</i> <sup>1</sup>	0.24	0.53*
<i>Solve story problem involving milliliters and liters</i> <sup>1</sup>	0.27	0.36*	<i>Evaluate an expression for a specific value</i> <sup>1</sup>	0.19	0.79*
<i>Estimate side length of a square given area</i> <sup>1</sup>	0.22	0.49*	<i>Identify the graph of a linear equation</i>	0.13	0.25*
<i>Approximate the length of the radius of a circle</i>	0.13	0.19*	<i>Use formula to solve a problem</i> <sup>1</sup>	0.11	0.49*
<i>Determine value of marks on scale</i>	0.06	0.48*	<i>Convert temperature from Fahrenheit to Celsius</i> <sup>1</sup>	0.09	0.35*
			<i>Extend pattern of shapes and find perimeter</i> <sup>1</sup>	0.04	0.29*
<b>Geometry</b>					
<i>Identify shape formed after folding paper</i> <sup>1</sup>	0.32	0.41*			
<i>Recognize shape formed by overlapping figures</i> <sup>1</sup>	0.31	0.53*			
<i>Determine measure of angle in triangle</i> <sup>1</sup>	0.31	0.54*			
<i>Describe region of intersection of two rays</i>	0.29	0.40*			
<i>Find angle measure of minor arc of a circle</i> <sup>1</sup>	0.28	0.34*			
<i>Identify type of triangle from picture</i>	0.23	0.44*			
<i>Use similarity of right triangles to solve problem</i> <sup>1</sup>	0.08	0.12*			
<i>Determine if given figure is parallelogram and explain</i>	0.05	0.26*			
<i>Assemble given shapes and determine total area</i> <sup>1</sup>	0.05	0.28*			
<i>Find container height given dimensions of contents</i> <sup>1</sup>	0.03	0.27*			

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

<sup>1</sup> This question was included in a section that allowed the use of a calculator.

NOTE: Regular type denotes a constructed-response question. *Italic* type denotes a multiple-choice question. The question score 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), 2007 Mathematics Assessment.

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#### Mathematics 2007 Performance of Public School Students in Puerto Rico

December 2008

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