

TRANSMISSION VERIFICATION REPORT

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1035

TO: Regan Burke

FROM: Mike Cohen

Attached are several things that can help with your effort to make the carpet look interesting. The are pulled from various sets of material people in ED have provides us, and there is no orderly way to explain or sort them. Think of this as raw material you can mold as you need to. When you figure out what you want to do, you probably ought to run it by us first in the oft chance that, as a result of your imaginative adaptation of these materials you are about to make a serious technical error that will set the leadership of the math or reading community, or the testing wizards, against us forever.

These are basically the best examples we've got-- with "best" meaning the ones we thought would be most appropriate for POTUS to use to explain what these tests were all about and how they reflected high standards. They were not picked with carpeting in mind; if they don't work for you, let us know and we can look for more.

I've got calls in to Terry Peterson and Carol Rasco to track down reading lists. However, it may be just as appropriate for the local school district to select books they think are most appropriate, to avoid any hint of a federal reading list.

22 pages

**FOURTH GRADE
READING ACHIEVEMENT
ATTACHMENT "A"**

The following sample passage is from *Charlotte's Web*, by E.B. White. Similar to NAEP items, it helps illustrate the kinds of skills expected of students.

Having promised Wilbur that she would save his life, she was determined to keep her promise. Charlotte was naturally patient. She knew from experience that if she waited long enough, a fly would come to her web; and she felt sure that if she thought long enough about Wilbur's problem, an idea would come to her mind. Finally, one morning toward the middle of July, the idea came. "Why how perfectly simple!" she said to herself. "The way to save Wilbur's life is to play a trick on Zuckerman. If I can fool a bug," thought Charlotte, "I can surely fool a man. People are not as smart as bugs."

NAEP 8th GRADE NUMBERS AND OPERATIONS ITEM

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

Treena won a 7-day scholarship worth \$1,000 to the Pro Shot Basketball Camp. Round-trip travel expenses to the camp are \$335 by air or \$125 by train. At the camp she must choose between a week of individual instruction at \$60 per day or a week of group instruction at \$40 per day. Treena's food and other expenses are fixed at \$45 per day. If she does not plan to spend any money other than the scholarship, what are all choices of travel and instruction plans that she could afford to make?

Explain your reasoning.

Did you use the calculator on this question?

Yes

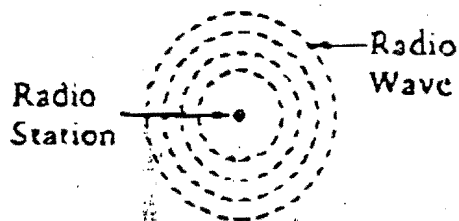
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NAEP 8th GRADE MEASUREMENT ITEM

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it understand you thinking. It is important that you show all your work.

Radio station KMAT in math City is 200 miles from radio station KGEO in Geometry City. Highway 7, a straight road, connects the two cities.

KMAT broadcasts can be received up to 150 miles in all directions from the station and KGEO broadcasts can be received up to 125 miles in all directions. Radio waves travel from each radio station through the air, as represented below.



On the next page, draw a diagram that shows the following.

- Highway 7
- The location of the two radio stations
- The part of High 7 where both radio stations can be received

Be sure to label distances along the highway and the length in miles of the part of the highway and where both stations can be received.

Q5. Three-fifths of the students in a class are girls. If 5 girls and 5 boys are added to the class, which statement is true of the class?

- A. There are more girls than boys.
- B. There are the same number of girls as there are boys.
- C. There are more boys than girls.
- D. You cannot tell whether there are more girls or boys from the information given.

Q-5

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	A	Proportionality	Solving Problems	65%	62%	487

3

A rubber ball rebounds to half the height it drops. If the ball is dropped from a rooftop 18 m above the ground, what is the total distance traveled by the time it hits the ground the third time?

- A. 31.2 m
- B. 40.5 m
- ☒ C. 45 m
- D. 63 m

Item 3

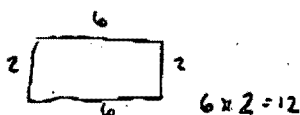
Singapore	42
Korea	36
Japan	41
U.S.	27 % correct

Item 3 was difficult for students in all the countries. Still, nearly half the U.S. eighth graders selected the distance travelled by the ball if it only travelled downward, but didn't travel back up into the air between bounces (option A).

It is unclear why U.S. students seem to use single-step strategies to solve such problems. This could be due to a less-than-thoughtful approach to solving the problems, an inability to deal with more than one condition in a context, or poorly developed reading skills. The tendency was present in items across all content areas.

4

The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?



Answer: 12

Item 4

Singapore	86
Korea	66
Japan	66
U.S.	22 % correct

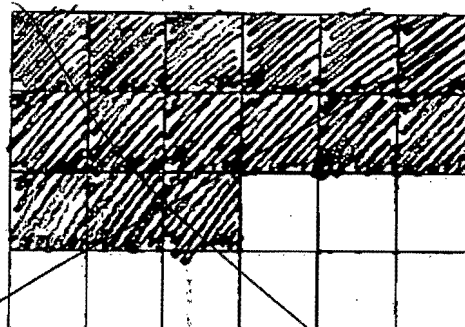
Arithmetic

use 1 beginnings of a script.

Improving Thoughtful Problem-Solving in Mathematics

In this age of information and technology, society's expanding use of data makes it imperative for all citizens to have the facility to reason using quantities. It is in this area of reasoning that U.S. eighth graders often fell behind their counterparts in Singapore, Japan, and Korea.

U.S. students have a tendency to attempt to solve multi-step problems as though they involved single-step procedures. For example, in Item 1, about one-fourth of the U.S. eighth graders shaded in 5 squares, presumably because they did not account for the fact that the grid had 24 rather than 8 squares. In Item 2, the most prevalent mistake – made by one-third of the U.S. students – was to select the amount of fuel used on the trip (option C) rather than the amount of fuel remaining in the tank.

Shade in $\frac{5}{8}$ of the unit squares in the grid.**Item 1**

Singapore	92
Korea	81
Japan	80
U.S.	43

% correct

A car has a fuel tank that holds 35 L of fuel. The car consumes 7.5 L of fuel for each 100 km driven. A trip of 250 km was started with a full tank of fuel. How much fuel remained in the tank at the end of the trip?

- (A) 16.25 L
 B. 17.65 L
 C. 18.75 L
 D. 23.75 L

Item 2

Singapore	70
Korea	50
U.S.	34

% correct

data not available for Japan

ATTACHMENT "C"

Other questions that could be asked about Charlotte's Web:

There are four types of questions in NAEP. Below are examples of questions related to the excerpt from Charlotte's Web that fit into each of these categories.

Forming an Initial Understanding

Based on this paragraph how would you describe Charlotte to a friend? Include evidence from the passage to support your description.

Based on this excerpt from Charlotte's Web, how does Charlotte intend to save Wilbur's life?

Developing an interpretation

Why did Charlotte just wait until an idea came to her?

Why was it necessary for Charlotte to be patient?

Personal Reflection and Response

Describe how Charlotte compares to one of your very special friends.

In this excerpt Charlotte says, "People are not as smart as bugs." Why does Charlotte think this is the case? Why do you agree or disagree with Charlotte.

Critical Stance

Based on evidence from this excerpt from Charlotte's Web, describe at least two ways that the author makes Charlotte more than just a bug.

How does giving Charlotte a name and having her outsmart Zuckerman change the way you think about spiders?

estimation

U1. Teresa wants to record 5 songs on tape. The length of time each song plays for is shown in the table.

Song	Amount of Time
1	2 minutes 41 seconds
2	3 minutes 10 seconds
3	2 minutes 51 seconds
4	3 minutes
5	3 minutes 32 seconds

ESTIMATE to the nearest minute the total time taken for all five songs to play and explain how this estimate was made.

Estimate: _____

Explain:

U-1a

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Part A

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next page	Fractions and Number Sense	Solving Problems	35%	31%	631

OPTIONAL FORM 99 (7-90)

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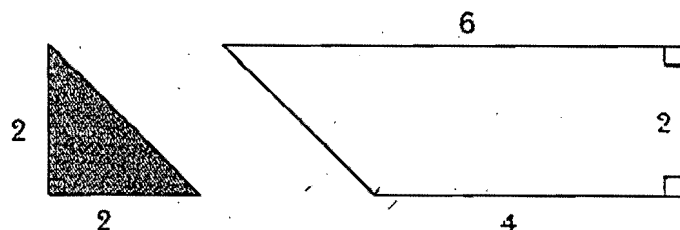
of pages **5**

To Bill Kincaid	From MSOX
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Fax # 456-7028	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

NT TO EXAMINE STUDENT ACHIEVEMENT

TIMSS found that the content of U.S. mathematics classes is not as advanced as in the top-performing countries, and this is reinforced by the achievement results. When the concepts were more specialized, such as in measurement and geometry, U.S. eighth-grade students had particular difficulty. For example, Items 4 and 5 required understanding of important concepts in perimeter and area and of the properties of rectangles and triangles. Item 6 indicates that students also may have insufficient understanding of some concepts in analytic geometry.



How many triangles of the shape and size of the shaded triangle can the trapezoid above be divided into?

- A. Three
- B. Four
- ☒ C. Five
- D. Six

Item 5

Singapore	75
Korea	81
Japan	84
U.S.	44

% correct

Item 6

Singapore	59
Korea	42
Japan	47
U.S.	41

% correct

A straight line on a graph passes through the points (3,2) and (4,4). Which of these points also lies on the line?

- A. (1,1)
- B. (2,4)
- ☒ C. (5,6)
- D. (6,3)
- E. (6,5)

ACHIEVING EXCELLENCE: TIMSS AS A STARTING POINT TO EXAMINE STUDENT ACHIEVEMENT

7

The numbers in the sequence 2, 7, 12, 17, 22, ... increase by fives. The numbers in the sequence 3, 10, 17, 24, 31, ... increase by sevens. The number 17 occurs in both sequences. If the two sequences are continued, what is the next number that will be seen in both sequences?

22, 27, 33, 38
31, 38 ←

Answer: 38

Item 7

Singapore	62
Korea	57
Japan	60
U.S.	42 % correct

8

Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

- A. $5 - 3n$
- B. $3n$
- C. $n - 5$
- D. $3n - 5$
- ☒ E. $3(n - 5)$

Item 8

Singapore	86
Korea	64
Japan	57
U.S.	49 % correct

The importance of extending and creating patterns is stressed in the NCTM *Curriculum and Evaluation Standards for School Mathematics*¹ (see *TIMSS as a Starting Point to Examine Teaching* for excerpts of the NCTM Standards). The results on several TIMSS items, including Item 7, suggest that U.S. eighth graders could use more emphasis in this area.

Students also had difficulty with more traditional algebra items such as those that required simplifying, evaluating, and writing expressions. For example, about half the U.S. students were not successful in identifying the correct expression to represent the number of Clarissa's hats (Item 8).

¹ National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1989.

ACHIEVING EXCELLENCE: TIMSS AS A STARTING POINT TO EXAMINE STUDENT ACHIEVEMENT

An algebraic equation with an unknown variable could have been used to solve Item 9, although only about 10 percent of the U.S. eighth graders used this approach. Most students used basic operations, but were unsuccessful in providing a correct solution. Regardless of the approach used, just 25 percent of the U.S. eighth graders answered this item correctly compared with 71 percent of those in Singapore.

There are 54 kilograms of apples in two boxes. The second box of apples weighs 12 kilograms more than the first. How many kilograms of apples are in each box? Show your work.

$$\begin{array}{r} 27 \\ 25 \overline{) 54} \end{array}$$

$$\begin{array}{r} \textcircled{1} \quad \textcircled{2} \\ 21 \quad 33 \end{array}$$

$$\begin{array}{r} 27 \quad 27 \\ + 6 \quad - 6 \\ \hline 33 \quad 21 \end{array}$$

Item 9

Singapore	71
Korea	43
Japan	54
U.S.	25

% correct

Percent of Students Using Equation

Singapore	35
Korea	29
Japan	29
U.S.	10

ACHIEVING EXCELLENCE: TIMSS AS A STARTING POINT TO EXAMINE STUDENT ACHIEVEMENT

10

Peter bought 70 items and Sue bought 90 items. Each item cost the same and the items cost \$800 altogether. How much did Sue pay?

Answer: _____

450

Items 10, 11, and 12 illustrate a range of TIMSS items involving proportionality. All were very difficult for U.S. eighth graders, highlighting the need for further work on this important kind of mathematical reasoning.

Item 10

Singapore	83
Korea	62
Japan	71
U.S.	24

% correct

11

The table shows the values of x and y , where x is proportional to y .

x	3	6	P
y	7	Q	35

What are the values of P and Q ?

- A. $P = 14$ and $Q = 31$
 B. $P = 10$ and $Q = 14$
 C. $P = 10$ and $Q = 31$
 D. $P = 14$ and $Q = 31$
 (E) $P = 15$ and $Q = 14$

Item 11

Singapore	47
Korea	41
Japan	49
U.S.	20

% correct

Item 12-a

Singapore	47
Korea	39
Japan	41
U.S.	15

% correct

Item 12-b

Singapore	21
Korea	14
Japan	17
U.S.	6

% correct

12

Two boxes of square-shaped cardboard pieces are available to make a larger pattern. There are 4 small squares in each piece.

All pieces in Box 1 look like



All pieces in Box 2 look like



In the required pattern, for every piece from Box 2 there are 2 pieces from Box 1.

- (a) If 60 pieces from Box 2 are used in the required pattern, how many pieces will be needed altogether?

Answer: 180

- (b) What fraction of the small squares in the required pattern will be black?

Answer: $\frac{1}{3}$

Taken separately and together, the TIMSS items can reveal considerable information about students' understanding of mathematics and their ability to engage in mathematical reasoning across various content areas. How would students in your state, district, school, and classroom perform on these items?

Sample Questions and Student Responses – Grade 4

Story:

Hungry Spider and the Turtle

"Hungry Spider and the Turtle" is a West African folktale that humorously depicts hunger and hospitality through the actions and conversations of two very distinct characters. The ravenous and generous Turtle who is tricked out of a meal by the gluttonous and greedy Spider finds a way to turn the tables and teach the Spider a lesson.

Questions:

Who do you think would make a better friend, Spider or Turtle? Explain why.

Reading Purpose: Literary Experience

Reading Stance: Personal Response

Responses to this question were scored
1) Unacceptable, or 2) Acceptable.

Grade 4 Overall Percentage "Acceptable"	Percentage "Acceptable" within Achievement Level Intervals		
	Basic 208-237*	Proficient 238-267*	Advanced 268 and above*
62 (1.4)	70 (2.7)	80 (2.1)	**

* NAEP Reading composite scale range. ** Sample size insufficient to permit reliable estimate. The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample.

Sample Response (score of 2):

I think Turtle because insted
of get angry with Spider he just pad
him a lesson.

Acceptable responses (score of 2) indicated which character would make a better friend and provided appropriate evidence from the story in support of the selection.

Why did Spider invite Turtle to share his food?

- A. To amuse himself
- B. To be kind and helpful
- C. To have company at dinner
- D. To appear generous

Reading Purpose: Literary Experience **Reading Stance:** Developing an Interpretation

Grade 4 Overall Percentage Correct	Percentage Correct within Achievement Level Intervals		
	<i>Basic</i> 208-237*	<i>Proficient</i> 238-267*	<i>Advanced</i> 268 and above*
40 (1.2)	45 (2.4)	73 (3.9)	**

* NAEP Reading composite scale range. ** Sample size insufficient to permit reliable estimate. The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample.

Think about Spider and Turtle in the story. Pick someone you know, have read about, or have seen in the movies or on television and explain how that person is like either Spider or Turtle.

Reading Purpose: Literary Experience

Reading Stance: Personal Response

Responses to this question were scored according to a four-level rubric as
1) Unsatisfactory, 2) Partial, 3) Essential, or 4) Extensive.

Grade 4 Overall Percentage "Essential" or Better	Percentage "Essential" or Better within Achievement Level Intervals		
	Basic 208-237*	Proficient 238-267*	Advanced 268 and above*
29 (1.3)	33 (2.8)	54 (3.0)	**

* NAEP Reading composite scale range. ** Sample size insufficient to permit reliable estimate. The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample.

Sample response (score of 3):

a boy named Patrick
in the book called Indian is the
Cupboard. He is selfish like Spider.
He wants all the plastic toys.
A girl named Omri in that
book is not selfish. She's willing
to share the toys with Patrick.

Responses scored Essential (score of 3) demonstrated adequate understanding of the character of Spider or Turtle by providing any story-supported character trait and relating or linking that trait to a fictional character or real-life person.

I think Spider reminds me of the rabbit in the book The Great Race because the rabbit thought that he could track and beat the turtle easily. Turtle reminds me of the turtle in The Great Race because the turtle outsmarted the rabbit and won the race.

Responses that reached the Extensive level (score of 4) demonstrated a full understanding of the character of Spider or Turtle. In their comparison to a fictional character or real-life person, these responses often discussed both characters and the interaction between them.

Amanda Clement: The Umpire in a Skirt

Marilyn Kratz

IT WAS A HOT SUNDAY AFTERNOON in Hawarden, a small town in western Iowa. Amanda Clement was sixteen years old. She sat quietly in the grandstand with her mother, but she imagined herself right out there on the baseball diamond with the players. Back home in Hudson, South Dakota, her brother Hank and his friends often asked her to umpire games. Sometimes she was even allowed to play first base.

Today, Mandy, as she was called, could only sit and watch Hank pitch for Renville against Hawarden. The year was 1904, and girls were not supposed to participate in sports. But when the umpire for the preliminary game between two local teams didn't arrive, Hank asked Mandy to make the calls.

Mrs. Clement didn't want her daughter to umpire a public event, but at last Hank and Mandy persuaded her to give her consent. Mandy eagerly took her position behind the pitcher's mound. Because only one umpire was used in those days, she had to call plays on the four bases as well as strikes and balls.

Mandy was five feet ten inches tall and looked very impressive as she accurately called the plays. She did so well that the players for the big game asked her to umpire for them—with pay!

Mrs. Clement was shocked at that idea. But Mandy finally persuaded her mother to allow her to do it. Amanda Clement became the first paid woman baseball umpire on record.

Mandy's fame spread quickly. Before long, she was umpiring games in North and South Dakota, Iowa, Minnesota, and Nebraska. Flyers, sent out to announce upcoming games, called Mandy the "World Champion Woman Umpire." Her uniform was a long blue skirt, a black necktie, and a white blouse with UMPS stenciled across the front. Mandy kept her long dark hair tucked inside a peaked cap. She commanded respect and attention—players never said, "Kill the umpire!" They argued more politely, asking, "Beg your pardon, Miss Umpire, but wasn't that one a bit high?"

Mandy is recognized in the Baseball Hall of Fame in Cooperstown, New York; the Women's Sports Hall of Fame; and the Women's Sports Foundation in San Francisco, California. In 1912 she held the world record for a woman throwing a baseball: 279 feet.

Mandy's earnings for her work as an umpire came in especially handy. She put herself through college and became a teacher and coach, organizing teams and encouraging athletes wherever she lived. Mandy died in 1971. People who knew her remember her for her work as an umpire, teacher, and coach, and because she loved helping people as much as she loved sports.

Example 1 -- Grade 4 Basic

Which event came first in Mandy's career?

- A. *Mandy was paid to umpire a game.*
- B. *Mandy was recognized in the Baseball Hall of Fame.*
- C. *Mandy became a teacher and a coach.*
- D. *Mandy umpired games for her brother and his friends.*

Question Type: Developing an Interpretation

Overall Percentage Correct: 68 (1.4)

Conditional Percentage Basic Interval: 78 (2.7)

Example 2 -- Grade 4 Advanced

The information in the passage is presented mainly by

- A. *comparing Mandy to other umpires.*
- B. *discussing important events in Mandy's life.*
- C. *describing the game of baseball.*
- D. *providing details about life in the early 1900's.*

Question Type: Demonstrating a Critical Stance

Overall Percentage Correct 49 (1.5)

Conditional Percentage Advanced Interval: 89 (9.5)

Example 3 -- Grade 4 Advanced

Give three examples showing that Mandy was not a quitter.

Question type: Developing an Interpretation

Overall percentage correct: 43 (1.9)

Conditional Percentage Advanced Interval: 86 (6.6)

- **Unacceptable** responses demonstrate a weak grasp of how Mandy is portrayed in the psassage, and an inability to cite specific information.
 - *She always was understanding. She is cooperative. She hates to be mad, always happy.*
 - *Mandy was not a quitter she wanted money, car and clothes probably.*
- **Acceptable** responses indicate an understanding of how the passage presents Mandy's character, and an ability to choose specific information that to support the point.
 - *Women were not supposed to. She didn't stop cause she was a woman. She didn't stop if people didn't like here.*
 - *She played in a lot of games. She became a coach. She became a teacher in sports.*
 - *One is her mother did not want her to umpire but she persuaded her mother to let her. She did not quit when she had to watch and when she kept going.*

Example 4 -- Grade 4 Advanced

What was Hank's role in Mandy's early career?

Question Type: Developing an Interpretation

Overall percentage correct: 42 (2.0)

Conditional Percentage Advanced Interval: 88 (5.6)

- **Unacceptable** responses may have shown minimal grasp of events, but did not indicate an ability to relate events to one another or to characters.
 - *That she was an umpire.*
 - *She could only play if umpire wasn't there. She had to watch of the umpire was there.*
 - *Hank help her with her baseball.*
- **Acceptable** responses indicate an understanding of how Hank assisted Mandy by letting her umpire.
 - *He is the one who asked her to umpire his team's game.*
 - *Hank asked Mandy to umpire his game first. Then, when people saw how good she was they wanted her to umpire their games till Mandy was famous.*

**POTUS OUTLINING IMPORTANCE OF EXAMPLE OF CHALLENGING STUDENTS
IN READING AND MATH**

Board 1: What do we know about student learning? Students and schools will raise to the high expectations and standards we set for them. Our students must master the basics to get ahead.

- Strong schools with clear standards of achievement and discipline are essential to our children and our society.
- These standards are needed to help instill the skills, fundamental American values, and hard work that our children need to get on the right track.
- Toward that end we must establish meaningful standards for what the students should be expected to learn and achieve in the basics and core subjects.

Board 2: Where do we start? Reading well and independently by the end of grade 3/start of grade 4 is the most basic national standard, and mastering math including algebra by the end of grade 8 is essential to get on the right course.

- If you don't know where you are trying to go, it is hard to get there. This is true if you are driving a car, building a house, or running a small business, or reading well, or mastering math. To succeed, you need to know of what success looks like so you know how to work to get there. The same is true in education. If parents and students and teachers don't know where they are headed --what they agree students should know and be able to do --it is hard to all pull together to get there.
- Students know this. 70% of high school students say that they would pay more attention to school work and learn more if standards were raised and consistently enforced. (Public Agenda)
- Parents know this. 60% of Americans say that standards are too low in their own local school. (Public Agenda)
- Two critical areas are reading and math. Every child should read independently by the end of third grade/start of fourth grade. Every child should master challenging mathematics, including the essentials of algebra and some geometry, by the end of 8th grade.

Board 3: How do we know if we are meeting our standards? The best way for parents and teachers to know how their students are doing is to check themselves against what is expected. The widely regarded National Assessment of Educational Progress tests at grade 4 in reading and grade 8 in math demonstrate what we should expect of our students.

- Tests can help us know how we are doing in these basics. Parents will know how their child is performing, not only in relation to other students in their school--but to students around the nation and around the world.
- Tests can be given as "check ups" at critical turning points in students' academic careers--4th grade in reading and 8th grade in math.
- Need to read independently by the end of third grade/start of fourth grade in order to read to learn other subjects--history, science--in the later grades. Students who read who read well early are more likely to stay in school and do well than those who do not.
- Need to master challenging mathematics by end of 8th grade in order to take the required math and science courses students in high school need to go on to college and be employable for high paying jobs.

Board 4: Read passages [*Charlotte's Web*--See attachment "A"]

Board 5: A fourth grade student reading at the:

"Basic" level can recognize most words on the page, understand the question being asked and identify important information.

"Proficient" level can quickly recognize words, summarize a passage, pick out specific information; describe the way the author presented the information.

"Advanced" level can do everything a proficient reader can and also can provide much more information than is needed to just answer questions about what has been read.

Board 6: (note: if board 6, may not need board 5)

Basic: *keeps her word, patient, confident*

Proficient: *Charlotte works hard to keep her word. At the beginning of the paragraph she made a promise to Wilbur and by the end of the paragraph she figured out how to do it. Charlotte was going to play a trick on Zuckerman.*

Advanced: *Charlotte was a loyal friend who kept her word. She was also very clever. In this paragraph Charlotte thinks about how she can keep her promise to save Wilbur's life by tricking Zuckerman. Her idea her the small spider a way to outsmart Zuckerman who is much larger than she is.*

- A "basic" answer is a solid answer that virtually every child should be able to do. For this great passage from Charlotte's Web, one question you might want to ask a 4th grader is this:

Based on this paragraph how would you describe Charlotte to a friend? Include Evidence from the passage to support your description (note: other possible questions Attachment "C").

A student at the basic level would be able to list characteristics that are described in the paragraph. For example they might say that any of the following traits described Charlotte: keeps her word, patient, confident, cunning, clever, smart

A student at the proficient level would list one or more of those characteristics and make references to a particular sentence in the passage. For example, they might write:

Charlotte works hard to keep her word. At the beginning of the paragraph she made a promise to Wilbur and by the end of the paragraph she figured out how to do it. Charlotte was going to play a trick on Zuckerman.

A student at the advance level would include more than one trait, and associated explanations. For example, they might write:

Charlotte was a loyal friend who kept her word. She was also very clever. In this paragraph Charlotte thinks about how she can keep her promise to save Wilbur's life by tricking Zuckerman. Her Idea gives her the small spider a way to outsmart Zuckerman who is much larger than she is.

Of our fourth graders, almost 40% are below basic. That means that they can not read this passage and have a solid understanding of it. They can't do that basic

answer I described. And, only about 39% of all our students perform at the proficient level or above.

[add 1-2 brief points on importance of reading well]

Board 7: Mathematics item [to be chosen; sample are in Attachment "B"]

- To be able to answer this question, a student has to understand x , and then has to think through a couple of steps--first he has to x , then he/she has to y and he/she has to put it together in.....
 - (depending on the question chosen, give explanation of importance of being able to do multi-step problems, represent data, etc.....)
-

Board 8: Example of student response to math question

- This student understood the question. You can see how she did x , then y
-

**Board 9: $x\%$ of U.S. students can answer this question
 $x\%$ of student in other nations can answer this question**

- [add 1-2 points on importance of mathematics]

FOLLOWUP DISCUSSION WITH AUDIENCE

1. We have teachers, business people, college representatives, parents and students in the audience today.
 - a. Perhaps middle or junior high teachers could tell us why it is so important for children to read well by the end of the 3rd grade/start of fourth grade before they come to your classes?
 - b. Perhaps a student can give us an important perspective on the empowerment and importance of reading well?
 - c. Is there a high school science teacher here? Could you tell us whether students in your class need to be able to do the kind of challenging math that we talked about to be able to really do well in chemistry and physics?
 - d. What do employers need today in terms of reading, math and writing skills?
 - e. What does it take today to be accepted in colleges and to be successful in terms of reading, math and other skills?
2. It is clear reading well is absolutely essential. But how do we help children read better?
 - a. We have some teachers and principals who done some remarkable things to boost student achievement in elementary school, especially reading. What needs to be done? What works?
3. Students in many other countries perform better in 8th grade math. But our students are just as smart as students in any other country.
 - a. So, what do we need to do so that our kids do better in math? How can all of us--not just teachers--help out?
 - b. There are places that have really turned around their mathematics programs. What can we learn from them?

**FOURTH GRADE
READING ACHIEVEMENT
ATTACHMENT "A"**

The following sample passage is from *Charlotte's Web*, by E.B. White. Similar to NAEP items, it helps illustrate the kinds of skills expected of students.

Having promised Wilbur that she would save his life, she was determined to keep her promise. Charlotte was naturally patient. She knew from experience that if she waited long enough, a fly would come to her web; and she felt sure that if she thought long enough about Wilbur's problem, an idea would come to her mind. Finally, one morning toward the middle of July, the idea came. "Why how perfectly simple!" she said to herself. "The way to save Wilbur's life is to play a trick on Zuckerman. If I can fool a bug," thought Charlotte, "I can surely fool a man. People are not as smart as bugs."

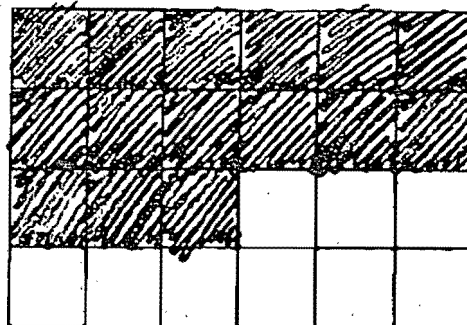
use 1 beginning of a script.

Improving Thoughtful Problem-Solving in Mathematics

In this age of information and technology, society's expanding use of data makes it imperative for all citizens to have the facility to reason using quantities. It is in this area of reasoning that U.S. eighth graders often fell behind their counterparts in Singapore, Japan, and Korea.

U.S. students have a tendency to attempt to solve multi-step problems as though they involved single-step procedures. For example, in Item 1, about one-fourth of the U.S. eighth graders shaded in 5 squares, presumably because they did not account for the fact that the grid had 24 rather than 8 squares. In Item 2, the most prevalent mistake – made by one-third of the U.S. students – was to select the amount of fuel used on the trip (option C) rather than the amount of fuel remaining in the tank.

Shade in $\frac{5}{8}$ of the unit squares in the grid.

**Item 1**

Singapore	92
Korea	81
Japan	80
U.S.	43

% correct

A car has a fuel tank that holds 35 L of fuel. The car consumes 7.5 L of fuel for each 100 km driven. A trip of 250 km was started with a full tank of fuel. How much fuel remained in the tank at the end of the trip?

- A. 16.25 L
- B. 17.65 L
- C. 18.75 L
- D. 23.75 L

Item 2

Singapore	70
Korea	50
U.S.	34

% correct

data not available for Japan

3

A rubber ball rebounds to half the height it drops. If the ball is dropped from a rooftop 18 m above the ground, what is the total distance traveled by the time it hits the ground the third time?

- A. 31.2 m
- B. 40.5 m
- ☒ C. 45 m
- D. 63 m

Item 3

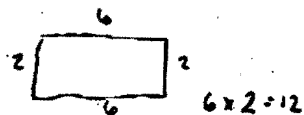
Singapore	42
Korea	36
Japan	41
U.S.	27 % correct

Item 3 was difficult for students in all the countries. Still, nearly half the U.S. eighth graders selected the distance travelled by the ball if it only travelled downward, but didn't travel back up into the air between bounces (option A).

It is unclear why U.S. students seem to use single-step strategies to solve such problems. This could be due to a less-than-thoughtful approach to solving the problems, an inability to deal with more than one condition in a context, or poorly developed reading skills. The tendency was present in items across all content areas.

4

The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?



Answer: 12

Item 4

Singapore	86
Korea	66
Japan	66
U.S.	22 % correct

Q5. Three-fifths of the students in a class are girls. If 5 girls and 5 boys are added to the class, which statement is true of the class?

- A. There are more girls than boys.
- B. There are the same number of girls as there are boys.
- C. There are more boys than girls.
- D. You cannot tell whether there are more girls or boys from the information given.

Q-5

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	A	Proportionality	Solving Problems	65%	62%	487

- U1. Teresa wants to record 5 songs on tape. The length of time each song plays for is shown in the table.

Song	Amount of Time
1	2 minutes 41 seconds
2	3 minutes 10 seconds
3	2 minutes 51 seconds
4	3 minutes
5	3 minutes 32 seconds

ESTIMATE to the nearest minute the total time taken for all five songs to play and explain how this estimate was made.

Estimate: _____

Explain:

U-1a

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Part A

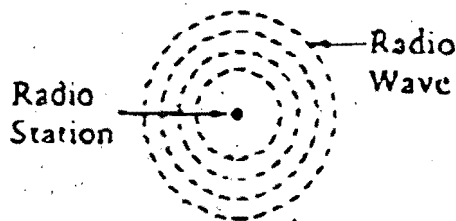
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next page	Fractions and Number Sense	Solving Problems	35%	31%	631

NAEP 8th GRADE MEASUREMENT ITEM

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it understand you thinking. It is important that you show all your work.

Radio station KMAT in math City is 200 miles from radio station KGEO in Geometry City. Highway 7, a straight road, connects the two cities.

KMAT broadcasts can be received up to 150 miles in all directions from the station and KGEO broadcasts can be received up to 125 miles in all directions. Radio waves travel from each radio station through the air, as represented below.



On the next page, draw a diagram that shows the following.

- Highway 7
- The location of the two radio stations
- The part of High 7 where both radio stations can be received

Be sure to label distances along the highway and the length in miles of the part of the highway and where both stations can be received.

NAEP 8th GRADE NUMBERS AND OPERATIONS ITEM

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

Treena won a 7-day scholarship worth \$1,000 to the Pro Shot Basketball Camp. Round-trip travel expenses to the camp are \$335 by air or \$125 by train. At the camp she must choose between a week of individual instruction at \$60 per day or a week of group instruction at \$40 per day. Treena's food and other expenses are fixed at \$45 per day. If she does not plan to spend any money other than the scholarship, what are all choices of travel and instruction plans that she could afford to make?

Explain your reasoning.

Did you use the calculator on this question?

Yes

No

ATTACHMENT "C"

Other questions that could be asked about Charlotte's Web:

There are four types of questions in NAEP. Below are examples of questions related to the excerpt from Charlotte's Web that fit into each of these categories.

Forming an Initial Understanding

Based on this paragraph how would you describe Charlotte to a friend? Include evidence from the passage to support your description.

Based on this excerpt from Charlotte's Web, how does Charlotte intend to save Wilbur's life?

Developing an interpretation

Why did Charlotte just wait until an idea came to her?

Why was it necessary for Charlotte to be patient?

Personal Reflection and Response

Describe how Charlotte compares to one of your very special friends.

In this excerpt Charlotte says, "People are not as smart as bugs." Why does Charlotte think this is the case? Why do you agree or disagree with Charlotte.

Critical Stance

Based on evidence from this excerpt from Charlotte's Web, describe at least two ways that the author makes Charlotte more than just a bug.

How does giving Charlotte a name and having her outsmart Zuckerman change the way you think about spiders?

4th Grade Reading Success

Advanced = can also provide more explanatory information

Proficient = can quickly recognize words and summarize passage

Basic = can recognize most words and identify information

4th Grade Reading Success: General Standards

Basic

- can recognize most words on the page
- can understand the question being asked
- can identify important information

Proficient

- can quickly recognize words
- can summarize a passage
- can pick out specific information
- can describe the way author presented the information

Advanced

- does everything proficient reader can
- can also provide much more explanatory information

4th Grade Reading Success: Definition of Achievement Levels

“Based on this paragraph, how would you describe Charlotte to a friend? Include evidence from the passage to support your description.”

Basic

- simply lists characteristics described in the passage

Proficient

- lists one or more characteristics
- makes reference to a particular sentence

Advanced

- describes multiple characteristics
- makes appropriate references
- makes associated explanations

Student Answer--Basic Level

Based on this paragraph, how would you describe Charlotte to a friend? Include evidence from the passage to support your description.

Basic Level

- simply lists characteristics described in the passage

Student Answer

keeps her word, patient, confident [present in student handwriting]

Student Answer--Proficient Level

Based on this paragraph, how would you describe Charlotte to a friend? Include evidence from the passage to support your description.

Proficient Level

- lists one or more characteristics and makes reference to a particular sentence

Student Answer

Charlotte works hard to keep her word. At the beginning of the paragraph she made a promise to Wilbur and by the end of the paragraph she figured out how to do it. Charlotte was going to play a trick on Zuckerman.[present in student handwriting]

Student Answer--Advanced Level

Based on this paragraph, how would you describe Charlotte to a friend? Include evidence from the passage to support your description.

Advanced Level

- describes multiple characteristics and associated explanations

Student Answer

Charlotte was a loyal friend who kept her word. She was also very clever. In this paragraph Charlotte thinks about how she can keep her promise to save Wilbur's life by tricking Zuckerman. Her idea gives the small spider a way to outsmart Zuckerman who is much larger than she is. [present in student handwriting]

4th Grade Reading Success: U.S. Student NAEP Scores

Percentage of U.S. Students at or Above...

Advanced level = 7%

Proficient level = 30%

Basic level = 60%

====> **40%** of Students **below basic level** on 4th grade reading.

Source: 1994 NAEP



UNITED STATES DEPARTMENT OF EDUCATION
OFFICE OF THE ASSISTANT SECRETARY
FOR EDUCATIONAL RESEARCH AND IMPROVEMENT

FAX COVER SHEET

DATE: May 19

TIME: 10:10

TO:

Bill Kincaid

FAX#:

456-7028

FROM:

Meen

Number of pages including fax cover: _____

PLEASE CALL (202) 219-1335 IF THERE IS ANY PROBLEM IN TRANSMITTAL.

Special Comments:

These are the ones we discussed of study -

For POTUS - consider: K-5, K-7, O-1, Q-4, R-8, S-2, U-2

For Press packet consider: I-8, I-9, K-8, K-14, N-17, Q-1, R-14

We are getting US statistics on all

U-1

18. A straight line on a graph passes through the points (3,2) and (4,4). Which of these points also lies on the line?

- A. (1,1)
- B. (2,4)
- C. (5,6)
- D. (6,3)
- E. (6,5)

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	C	Geometry	Solving Problems	41%	38%	597

- I9. In a bag of cards $\frac{1}{6}$ are green, $\frac{1}{12}$ are yellow, $\frac{1}{2}$ are white and $\frac{1}{4}$ are blue. If someone takes a card from the bag without looking, which color is it most likely to be?

- A. White
- B. Blue
- C. Green
- D. Yellow

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	A	Data Representation, Analysis & Probability	Using Complex Procedures	67%	60%	490

- K5. The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?

K-5

Answer: _____

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next page	Measurement	Solving Problems	40%	32%	613

K7. A drawer contains 28 pens; some white, some blue, some red, and some gray. If the probability of selecting a blue pen is $\frac{2}{7}$, how many blue pens are in the drawer?

K-7

- A. 4
- B. 6
- C. 8
- D. 10
- E. 20

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	C	Data Representation, Analysis & Probability	Solving Problems	53%	48%	550

- K8. These triangles are congruent. The measures of some of the sides and angles of the triangles are shown.

What is the value of x ?

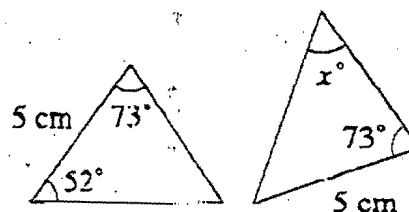
A. 52

B. 55

C. 65

D. 73

E. 75



K-8

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	B	Geometry	Performing Routine Procedures	35%	27%	639

L14. The table shows the values of x and y , where x is proportional to y .

x	3	6	P
y	7	Q	35

What are the values of P and Q ?

- A. $P = 14$ and $Q = 31$
- B. $P = 10$ and $Q = 14$
- C. $P = 10$ and $Q = 31$
- D. $P = 14$ and $Q = 15$
- E. $P = 15$ and $Q = 14$

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	E	Proportionality	Performing Routine	24%	20%	693

N17. A car has a fuel tank that holds 35 L of fuel. The car consumes 7.5 L of fuel for each 100 km driven. A trip of 250 km was started with a full tank of fuel. How much fuel remained in the tank at the end of the trip?

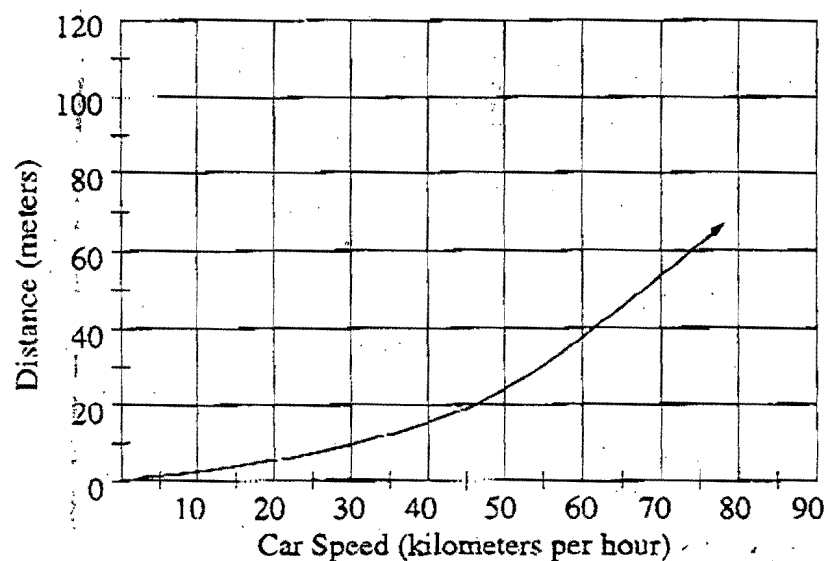
- A. 16.25 L
- B. 17.65 L
- C. 18.75 L
- D. 23.75 L

N-1

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
		Fractions and Number	Solving Problems	39%	35%	611

- O1. The graph shows the distance traveled before coming to a stop after the brakes are applied for a typical car traveling at different speeds.



A car traveling on a highway stopped 30 m after the brakes were applied. About how fast was the car traveling?

- A. 48 km per hour
- B. 55 km per hour
- C. 70 km per hour
- D. 160 km per hour

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
		Data Representation.		60%	51%	535

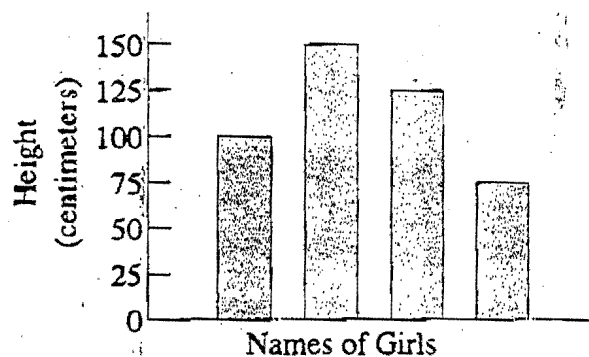
Q1. Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

- A. $5 - 3n$
- B. $3n$
- C. $n - 5$
- D. $3n - 5$
- E. $3(n - 5)$

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
			Using Complex			

Q4. The graph shows the heights of four girls.



The names are missing from the graph. Debbie is the tallest. Amy is the shortest. Dawn is taller than Sarah. How tall is Sarah?

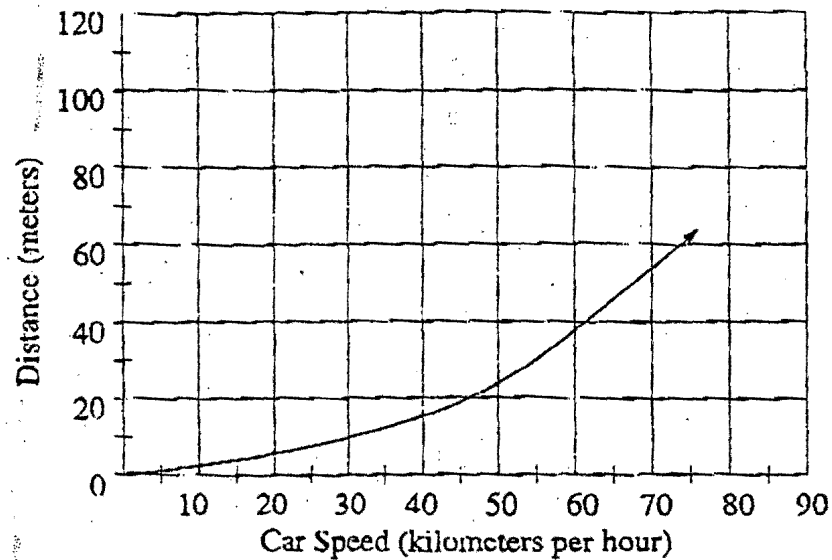
- A. 75 cm
- B. 100 cm
- C. 125 cm
- D. 150 cm

Q-4

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	B.	Data Representation	Using Complex Reasoning	83%	81%	376

- R8. The graph shows the distance traveled before coming to a stop after the brakes are applied for a typical car traveling at different speeds.



A car is traveling 80 km per hour. About how far will the car travel after the brakes are applied?

- A. 60 m
- B. 70 m
- C. 85 m
- D. 100 m

R-8

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
				49%	44%	565

R14. Peter bought 70 items and Sue bought 90 items. Each item cost the same and the items cost \$800 altogether. How much did Sue pay?

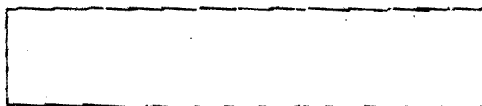
Answer: Sue paid _____

R-14

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next page	Proportionality	Solving Problems	38%	32%	617

- S2. The figure consists of 5 squares of equal size. The area of the whole figure is 405 cm^2 .



Find the area of one square.

Answer _____ square centimeters

Find the length of the side of one square.

Answer _____ centimeters

Find the perimeter of the whole figure in centimeters

Answer _____ centimeters

S-2a

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Part A

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
				40%	53%	499

- U1. Teresa wants to record 5 songs on tape. The length of time each song plays for is shown in the table.

Song	Amount of Time
1	2 minutes 41 seconds
2	3 minutes 10 seconds
3	2 minutes 51 seconds
4	3 minutes
5	3 minutes 32 seconds

ESTIMATE to the nearest minute the total time taken for all five songs to play and explain how this estimate was made.

Estimate: _____

Explain:

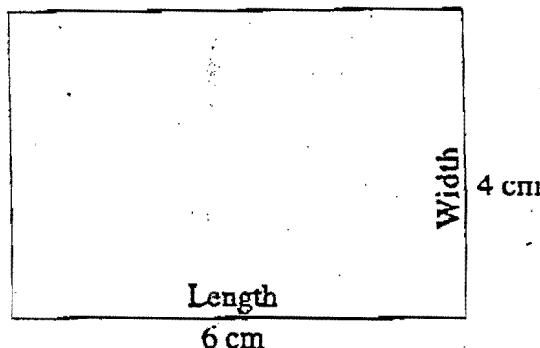
U-1a

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Part A

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next	Fractions and Number	Solving Problems	35%	31%	631

U2.



- a. In the space below, draw a new rectangle whose length is one and one half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.

- b. What is the ratio of the area of the new rectangle to the area of the first one?

Show your work.

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U-2

Part A

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Mathematics	next	Measurement	Solving Problems	31%	24%	621

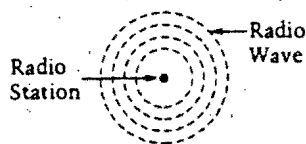
Grade 8 Question: Radio Stations

The Task

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

Radio station KMAT in Math City is 200 miles from radio station KGEO in Geometry City. Highway 7, a straight road, connects the two cities.

KMAT broadcasts can be received up to 150 miles in all directions from the station and KGEO broadcasts can be received up to 125 miles in all directions. Radio waves travel from each radio station through the air, as represented below.

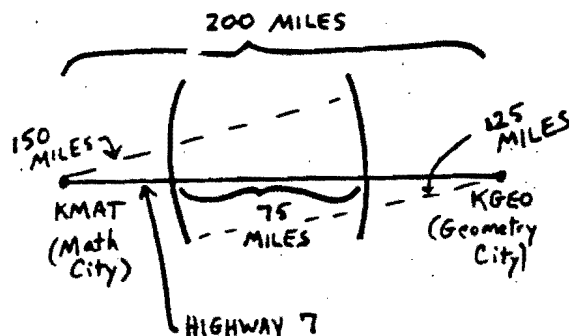


On the next page, draw a diagram that shows the following.

- Highway 7
- The location of the two radio stations
- The part of Highway 7 where both radio stations can be received

Be sure to label the distances along the highway and the length in miles of the part of the highway where both stations can be received.

Possible Solution



There is a 75-mile part of Highway 7 that is within both broadcast areas. It starts 75 miles outside Math City and ends 150 miles outside Math City.

Students need to assimilate and translate semantic information in order to draw a diagram that graphically depicts the location of the radio stations and Highway 7 accurately in terms of given boundary conditions. A graphical approach to this task should enable students to determine the length of the overlapping portion of Highway 7, along which both radio stations can be received. Any satisfactory response must clearly illustrate an overlapping region, whereas, in addition, any extended response must clearly identify the overlap and correctly determine its length to be 75 miles.

National Results, Scoring Guide, and Sample Responses

National Percent for Each Category*

16 (1.1)

Rating and Performance Category

0 No Response

* The standard errors of the estimated percentages appear in parentheses.

**National Percent
for Each Category**

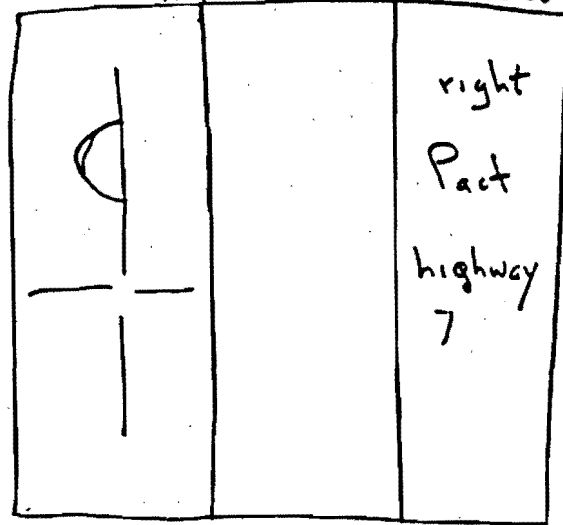
45 (1.6)

This **INCORRECT** response does not relate the information given in the problem in a manner that conveys either a meaningful problem solving approach or an adequate solution.

Rating and Performance Category

- 1 Incorrect -- The work is completely incorrect or irrelevant, or the response states, "I don't know."

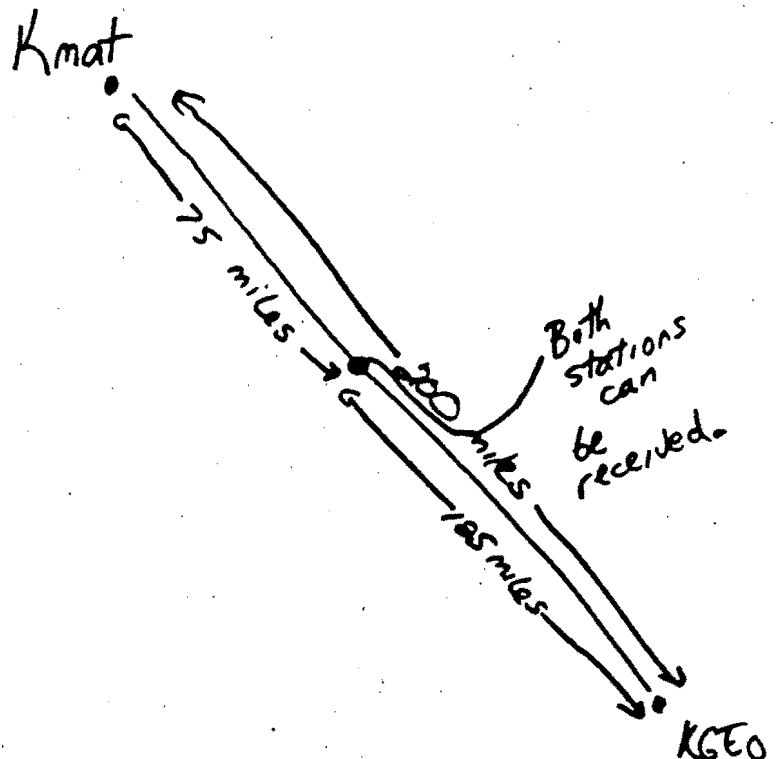
Highway 7 - two radio stations where highway / station receive



22 (1.2)

This **MINIMAL** response correctly depicts two pieces of information (radio stations KMAT and KGEO are 200 miles apart and station KGEO can broadcast 125 miles) and shows rudimentary understanding. It does not show the common broadcast area as a length along the highway.

- 2 Minimal -- Diagram with only cities, Highway 7, and 200 miles labeled; or a diagram that shows some, but not all, of the given distances: 125, 150, or 200 miles. Minimal responses do not recognize that the common broadcast area is a length along the highway.



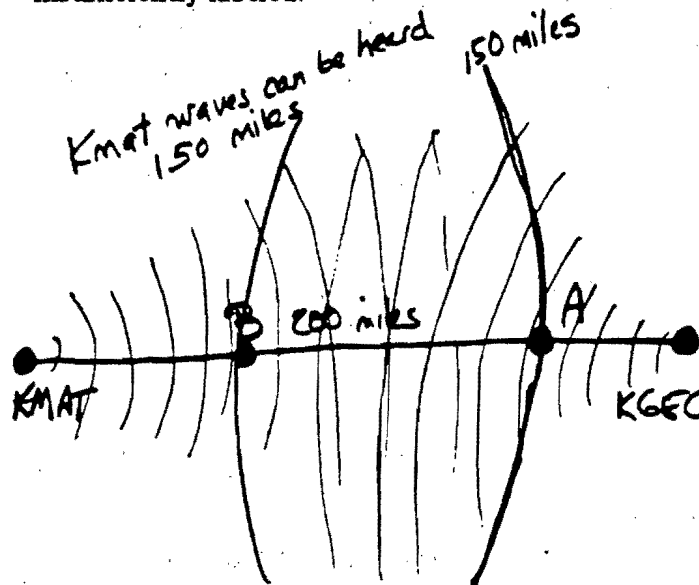
**National Percent
for Each Category**

13 (0.9)

This is PARTIAL response indicates considerable understanding of the task relative to the given information. The diagram shows the radio stations to be 200 miles apart and that KMAT can broadcast 150 miles. Additionally, the diagram shows a part of the highway (from A to B) along which both radio stations can be heard. However, the response does not show the broadcast range of station KGEO and does not indicate the length of the common broadcast area.

Rating and Performance Category

- 3 Partial -- Diagram with cities, Highway 7, and 200 miles labeled and identification of common broadcast area as a length along (or not on) the highway. Two or more of the radio wave distances 250, 125, and 75 are insufficiently labeled.

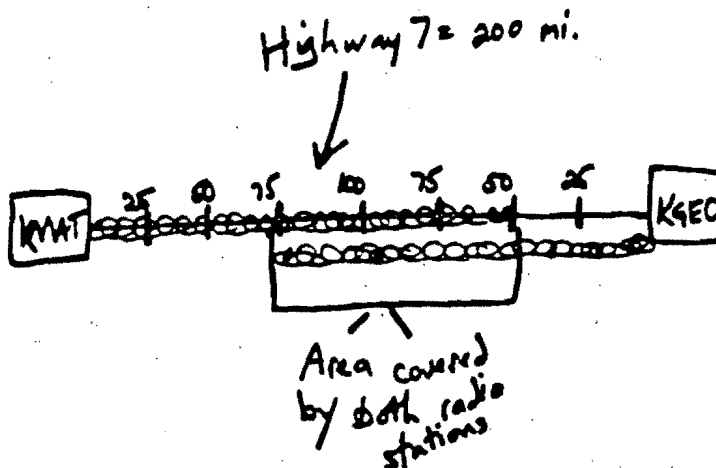


The can both be heard between A & B

4 (0.5)

This SATISFACTORY diagram shows a good understanding of the problem. Although the student correctly labeled the common area along Highway 7 where the two stations could be heard, the length in miles of this region was not indicated.

- 4 Satisfactory -- Diagram with cities, Highway 7, 200 miles, and all radio wave distances labeled and identification of common broadcast area on Highway 7 as a length. At the same time, omits or incorrectly computes length of the highway along which both radio stations can be received.



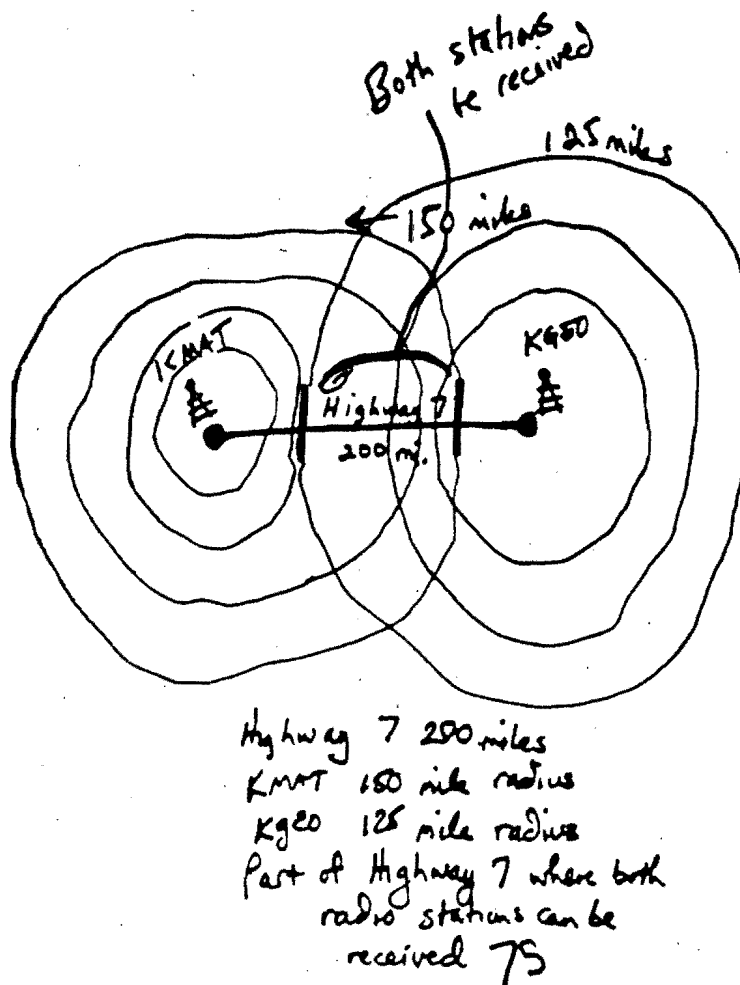
National Percent
for Each Category

1 (0.3)

This is a solid EXTENDED response. The diagram is accurate and well labeled. Additionally, below the diagram a statement correctly concludes that the length of the part of Highway 7 along which both radio stations can be heard is 75 miles.

Rating and Performance Category

- 5 Extended -- An accurate, well-labeled diagram (as described in the score 4 category) clearly indicating that the portion of Highway 7 along which both radio stations can be received is 75 miles in length.



Performance Highlights: Radio Stations

An important aspect of mathematical power is the need to use logic and diagrams to make sense of a situation and to communicate this reasoning. However, as the results in TABLE 2.9 indicate, many students have yet to recognize that diagrams can be effective analytical and communications tools. Even though a variety of diagrams or explanations could be used to help explain the intersection of the broadcast areas of the two radio stations and no particular approach was preferred, only 5 percent of the eighth graders were able to read and interpret the question and translate this information to develop a labelled model that represented the situation.

TABLE 2.9 National Results for Demographic Subgroups for the Extended-Response Task, "Radio Stations"

Grade 8							
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
Nation	16 (1.1)	45 (1.6)	22 (1.2)	13 (0.9)	4 (0.5)	1 (0.3)	5 (0.6)
Northeast	15 (1.7)	42 (3.5)	22 (2.0)	15 (2.5)	5 (1.2)	1 (0.4)	6 (1.1)
Southeast	18 (2.1)	50 (2.8)	17 (1.7)	12 (1.4)	3 (0.8)	0 (0.3)	3 (0.8)
Central	12 (2.2)	43 (2.0)	26 (2.8)	14 (2.4)	5 (1.3)	1 (0.2)	6 (1.3)
West	17 (2.5)	43 (3.5)	23 (2.5)	10 (1.2)	4 (1.1)	2 (0.9)	6 (1.4)
White	11 (1.2)	40 (2.0)	26 (1.6)	16 (1.2)	5 (0.8)	2 (0.4)	7 (0.9)
Black	32 (4.1)	55 (4.2)	8 (2.1)	4 (1.6)	1 (0.6)	0 (0.0)	1 (0.6)
Hispanic	26 (2.5)	58 (2.9)	11 (2.0)	4 (1.3)	1 (0.6)	0 (0.0)	1 (0.6)
Male	17 (1.2)	46 (2.1)	19 (1.8)	13 (1.3)	4 (0.7)	1 (0.3)	4 (0.8)
Female	14 (1.7)	43 (2.0)	24 (1.7)	12 (1.3)	4 (0.8)	2 (0.5)	6 (1.0)
Advantaged Urban	4 (1.7)	32 (3.2)	30 (3.3)	24 (3.1)	7 (1.8)	3 (1.0)	10 (1.5)
Disadvantaged Urban	38 (4.6)	49 (4.7)	7 (1.7)	4 (1.0)	2 (1.5)	0 (0.0)	2 (1.5)
Extreme Rural	15 (4.9)	39 (7.3)	30 (5.6)	14 (4.8)	2 (1.0)	0 (0.5)	2 (1.2)
Other	15 (1.5)	47 (2.2)	21 (1.4)	12 (0.9)	4 (0.7)	1 (0.4)	5 (0.8)
Public	17 (1.2)	45 (1.8)	21 (1.4)	12 (1.1)	4 (0.6)	1 (0.3)	5 (0.7)
Catholic and Other Private	8 (1.6)	42 (2.7)	25 (2.3)	18 (2.2)	6 (1.3)	1 (0.4)	7 (1.4)

The standard errors of the estimated percentages appear in parentheses. It can be said with about 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). When the proportion of students is either 0 percent or 100 percent, the standard error is inestimable. However, percentages 99.5 percent and greater were rounded to 100 percent and percentages 0.5 percent or less were rounded to 0 percent. Percentages may not total 100 percent due to rounding error.

SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment

Students with incorrect responses provided no evidence that they were able to make sense of the problem, often copying a piece of information from the problem or submitting a meaningless drawing (or both). Forty-five percent of the eighth graders nationally provided such responses and another 16 percent did not answer the question at all. Although this meant the majority appeared to be essentially at a loss as to the nature of this task, about one-third did seem to have some understanding of the information presented in relation to the task required. Approximately 22 percent received minimal credit and another 13 percent received partial credit, the difficulty with these responses being an incomplete approach, at best understandable only by those familiar with the problem. These sketchy solutions appeared in spite of directions explicitly telling students what to diagram and to be sure to label the distances and the part of the highway where both stations can be received.

Across the categories of students by region, race/ethnicity, gender, type of community, and type of school, a majority of only one subgroup provided at least minimal responses: advantaged urban students. From 32 percent (advantaged urban) to 58 percent (Hispanic) of the students by subgroup provided meaningless information.

As shown in TABLE 2.10, the percentages of success for public-school eighth graders in the jurisdictions participating in the Trial State Assessment Program were similar to those for the nation. However, in two states, Iowa and Minnesota, at least 10 percent of the students were estimated to have provided satisfactory or better diagrams. For five states, Iowa, Minnesota, Nebraska, New Hampshire, and North Dakota, the majority of the students were estimated to have provided minimal or better responses.

TABLE 2.10

Percentages for Responses to Extended-Response Question, "Radio Stations"

PUBLIC SCHOOLS	Grade 8 - 1992						
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
NATION	17 (1.2)	45 (1.8)	21 (1.4)	12 (1.1)	4 (0.6)	1 (0.3)	5 (0.7)
Northeast	17 (2.0)	40 (4.2)	22 (2.6)	16 (3.1)	4 (1.5)	1 (0.5)	5 (1.6)
Southeast	19 (2.4)	52 (2.7)	15 (1.8)	11 (1.4)	2 (0.7)	0 (0.3)	3 (0.7)
Central	14 (2.6)	43 (2.5)	25 (3.3)	13 (2.9)	4 (1.3)	1 (0.2)	5 (1.4)
West	17 (2.8)	44 (4.0)	23 (2.7)	9 (1.4)	4 (1.2)	3 (1.0)	7 (1.5)
STATES							
Alabama	22 (2.0)	53 (2.4)	14 (1.5)	8 (1.1)	2 (0.6)	1 (0.4)	3 (0.8)
Arizona	16 (1.7)	48 (2.3)	20 (1.8)	13 (1.6)	2 (0.7)	1 (0.4)	3 (0.9)
Arkansas	13 (1.8)	57 (2.6)	18 (1.8)	8 (1.2)	2 (0.6)	1 (0.3)	3 (0.7)
California	19 (1.7)	44 (2.3)	19 (2.1)	13 (2.1)	3 (0.9)	1 (0.5)	4 (1.1)
Colorado	11 (1.2)	43 (2.0)	23 (1.6)	16 (1.7)	5 (0.9)	2 (0.6)	7 (1.1)
Connecticut	10 (1.2)	44 (2.3)	23 (2.0)	16 (1.7)	6 (1.0)	2 (0.4)	7 (1.2)
Delaware	16 (2.0)	51 (2.4)	17 (1.5)	12 (1.8)	3 (0.9)	1 (0.5)	4 (1.0)
Dist. Columbia	30 (2.1)	57 (2.3)	8 (1.0)	3 (1.1)	1 (0.5)	1 (0.5)	2 (0.7)
Florida	22 (1.8)	46 (2.2)	19 (1.9)	10 (1.3)	3 (0.9)	1 (0.3)	4 (0.9)
Georgia	19 (1.7)	49 (2.1)	19 (1.6)	7 (1.1)	4 (0.9)	1 (0.5)	5 (0.9)
Hawaii	23 (1.8)	47 (2.3)	15 (1.6)	11 (1.3)	3 (0.8)	1 (0.4)	3 (0.8)
Idaho	11 (1.1)	46 (2.2)	21 (2.0)	15 (1.2)	5 (1.0)	2 (0.6)	7 (1.2)
Indiana	7 (1.1)	48 (2.6)	25 (2.1)	15 (1.9)	3 (0.7)	1 (0.6)	5 (1.0)
Iowa	6 (0.9)	35 (1.8)	28 (1.9)	21 (2.0)	6 (0.9)	4 (1.1)	10 (1.2)
Kentucky	13 (1.4)	52 (2.3)	22 (1.7)	10 (1.1)	2 (0.5)	1 (0.4)	3 (0.6)
Louisiana	24 (2.2)	54 (2.1)	15 (1.4)	6 (1.0)	1 (0.4)	0 (0.2)	1 (0.5)
Maine	7 (0.9)	46 (2.1)	21 (1.9)	18 (1.8)	6 (0.9)	2 (0.6)	8 (1.1)
Maryland	15 (1.7)	48 (2.1)	20 (1.8)	13 (1.6)	3 (0.9)	1 (0.5)	5 (1.1)
Massachusetts	12 (1.2)	45 (2.8)	22 (2.4)	14 (1.9)	5 (0.9)	2 (0.7)	7 (1.0)
Michigan	15 (1.6)	46 (1.9)	21 (1.9)	12 (1.1)	5 (0.9)	2 (0.6)	7 (1.1)
Minnesota	6 (1.1)	41 (2.3)	20 (1.9)	21 (2.4)	7 (1.0)	4 (1.0)	11 (1.6)
Mississippi	20 (1.9)	57 (2.2)	14 (1.7)	6 (1.2)	2 (0.6)	0 (0.2)	2 (0.6)
Missouri	10 (1.2)	47 (2.1)	23 (1.9)	12 (1.6)	5 (0.9)	2 (0.7)	8 (1.2)
Nebraska	6 (1.4)	44 (2.8)	23 (2.0)	20 (3.0)	6 (1.0)	1 (0.6)	7 (1.1)
New Hampshire	8 (1.1)	42 (2.1)	24 (1.8)	18 (1.5)	5 (1.0)	3 (0.9)	8 (1.3)
New Jersey	12 (1.6)	46 (2.3)	22 (2.0)	14 (1.8)	5 (0.9)	1 (0.5)	6 (1.0)
New Mexico	17 (1.7)	51 (2.2)	19 (1.6)	11 (1.4)	3 (0.7)	1 (0.3)	3 (0.8)
New York	15 (2.1)	44 (2.4)	22 (1.6)	11 (1.5)	5 (0.9)	2 (0.7)	7 (1.2)
North Carolina	12 (1.4)	54 (2.2)	21 (1.8)	10 (1.5)	2 (0.5)	1 (0.4)	3 (0.7)
North Dakota	6 (1.2)	43 (2.5)	25 (2.0)	18 (1.8)	5 (0.9)	3 (1.2)	8 (1.5)
Ohio	12 (1.3)	47 (2.1)	25 (2.1)	12 (1.8)	5 (1.0)	0 (0.2)	5 (1.0)
Oklahoma	10 (1.4)	46 (2.0)	23 (1.6)	16 (1.7)	3 (0.8)	2 (0.8)	5 (1.1)
Pennsylvania	12 (1.2)	44 (2.1)	22 (1.7)	14 (1.4)	6 (1.1)	3 (0.7)	8 (1.5)
Rhode Island	10 (1.1)	49 (3.5)	25 (2.9)	12 (1.6)	2 (0.8)	2 (0.6)	5 (1.0)
South Carolina	12 (1.4)	55 (2.1)	21 (1.7)	10 (1.2)	2 (0.6)	1 (0.4)	3 (0.6)
Tennessee	16 (1.5)	51 (2.4)	22 (1.7)	10 (1.6)	1 (0.5)	0 (0.2)	2 (0.6)
Texas	16 (1.9)	45 (2.2)	21 (1.5)	12 (1.4)	3 (0.7)	3 (1.1)	5 (1.3)
Utah	10 (1.4)	46 (2.5)	20 (1.7)	16 (1.5)	7 (1.2)	2 (0.4)	8 (1.3)
Virginia	13 (1.5)	48 (2.5)	22 (1.7)	12 (1.4)	4 (0.8)	1 (0.5)	5 (1.0)
West Virginia	13 (1.5)	53 (2.4)	21 (1.7)	10 (1.2)	3 (0.6)	0 (0.3)	3 (0.6)
Wisconsin	9 (1.9)	43 (1.8)	23 (1.8)	18 (1.9)	4 (1.0)	4 (1.0)	8 (1.2)
Wyoming	8 (1.2)	45 (2.4)	22 (1.7)	18 (1.6)	6 (0.9)	3 (0.7)	8 (1.1)
TERRITORIES							
Guam	45 (2.4)	40 (2.4)	10 (1.9)	3 (1.0)	2 (0.8)	1 (0.5)	3 (0.8)
Virgin Islands	47 (3.4)	47 (3.3)	4 (1.1)	1 (0.7)	0 (0.3)	0 (0.0)	0 (0.3)

The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). Percentages may not total 100 percent due to rounding error.

SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment.

Grade 8 Question: Treena's Budget

The Task

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

Treena won a 7-day scholarship worth \$1,000 to the Pro Shot Basketball Camp. Round-trip travel expenses to the camp are \$335 by air or \$125 by train. At the camp she must choose between a week of individual instruction at \$60 per day or a week of group instruction at \$40 per day. Treena's food and other expenses are fixed at \$45 per day. If she does not plan to spend any money other than the scholarship, what are all choices of travel and instruction plans that she could afford to make? Explain your reasoning.

Did you use the calculator on this question?

Yes No

Possible Solution

The solution to this task requires students to use everyday consumer sense to determine Treena's fixed expenses and analyze the various choices she has for travel (plane or train) and instruction (individual or group). Students also must compare the total cost for **each** of the four alternatives to which this analysis leads to the \$1,000 value of Treena's scholarship, in order to conclude which choices meet the given conditions.

Treena's fixed expenses will be $\$45 \times 7 = \315 for the seven days. Therefore, she has $\$1,000 - \$315 = \$685$ to spend on travel and instruction. Travel costs are either train (\$125) or plane (\$335). Instruction costs are either group ($\$40 \times 7 = \280), or individual ($\$60 \times 7 = \420).

The four choices Treena has are:

Travel by train, group instruction, and fixed expenses: $\$125 + \$280 + \$315 = \720

Travel by plane, group instruction, and fixed expenses: $\$335 + \$280 + \$315 = \930

Possible Solution (continued)

Travel by train, individual instruction, and fixed expenses: $\$125 + \$420 + \$315 = \860

Travel by plane, individual instruction, and fixed expenses: $\$335 + \$420 + \$315 = \$1,070$

Students must realize that Treena cannot choose the individual plan and travel by plane because the total expenses (\$1,070) would be greater than the allotted scholarship. Any full credit response must clearly communicate that Treena has three options that do not exceed \$1,000, what the three options are, and how the student arrived at the three options.

National Results, Scoring Guide, and Sample Responses

National Percent for Each Category*

Rating and Performance Category

22 (1.2)

0

No Response

37 (1.6)

1

Incorrect -- The work is completely incorrect or irrelevant, or the response states, "I don't know."

This INCORRECT response appears to be somewhat on task but the work shown does not warrant credit even at the minimal level.

*Add everything other
then scholarship and
you will get 230.*

* The standard errors of the estimated percentages appear in parentheses.

**National Percent
for Each Category**

22 (1.2)

This MINIMAL response does illustrate one valid budget option, but does not show any supporting calculations.

Rating and Performance Category

- 2 Minimal -- a) Student indicates one or more options only (such as group and train) with no supporting evidence, or b) Student work contains major mathematical errors and/or flaws in reasoning (for example, the student does not consider Treena's fixed expenses).

she could take the train to camp have individual instruction and eat everyday and not run out of money.

15 (1.0)

This PARTIAL response illustrates one acceptable budget alternative (group and train) and the corroborating computational work.

- 3 Partial -- The student a) indicates one or more correct options; additional supporting work beyond the minimal level must be present, but the work may contain some computational errors; or b) demonstrates correct mathematics for one or two options, but does not indicate the options that are supported by his or her mathematics.

train at \$ 425

$$\begin{array}{r} 40 \\ \times 7 \\ \hline 280 \end{array}$$

group at

$$\begin{array}{r} 345 \\ \times 7 \\ \hline 315 \end{array}$$

\$ 720 would she all spend

She just took the cheapest ones of her choices

now she has money left over

National Percent
for Each Category

2 (0.3)

Rating and Performance Category

4

Satisfactory -- The student a) shows correct mathematical evidence that Treena has three options, but the supporting work is incomplete; or b) shows correct mathematical evidence for any two of Treena's three options and the supporting work is clear and complete.

This SATISFACTORY response illustrates two appropriate budget options (both individual and train and group and plane) as well as the correct supporting calculations.

$$125 + 420 + 315 = \$860$$

$$\$1000 > \$860$$

If \$1000 is more than \$860 she has money left over so she could take private lessons, a train and her food.

$$335 + 315 + 280 = 930$$

$$\$1000 > \$930$$

She could take a plane, her food, and group lessons

National Percent
for Each Category

Rating and Performance Category

2 (0.4)

5

Extended -- The correct solution indicates what the three possible options are and includes supporting work for each option.

This outstanding EXTENDED response provides the correct calculations in terms of the excess dollars that remain from the \$1,000 scholarship, for the three acceptable budget options.

$$\begin{array}{r}
 \cancel{1000} \\
 \cancel{- 335} \\
 \cancel{665} \\
 \cancel{- 420} \\
 \cancel{245} \\
 \cancel{315} \\
 \hline
 60 \\
 \times 7 \\
 \hline
 420 \\
 45 \\
 \times 7 \\
 \hline
 315
 \end{array}$$

$$\begin{array}{r}
 1. \quad 1000 \\
 \quad - 335 \\
 \quad \hline
 \quad 665 \\
 \quad - 280 \\
 \quad \hline
 \quad 385 \\
 \quad - 315 \\
 \quad \hline
 \quad \$ 70
 \end{array}$$

$$\begin{array}{r}
 2. \quad 1,000 \\
 \quad - 125 \\
 \quad \hline
 \quad 875 \\
 \quad - 280 \\
 \quad \hline
 \quad 595 \\
 \quad - 315 \\
 \quad \hline
 \quad \$ 280
 \end{array}$$

$$\begin{array}{r}
 1000 \\
 - 125 \\
 \hline
 875 \\
 - 420 \\
 \hline
 455 \\
 - 315 \\
 \hline
 140
 \end{array}$$

1. take air, group, food
2. train, group, food
3. train, individual, food

Performance Highlights: Treena's Budget

As shown in TABLE 2.7, eighth graders had considerable difficulty understanding and persevering with this problem situation. Because the mathematics involved whole number computations and the context was budgeting, both thought to be familiar to eighth graders, high performance was anticipated. Further, students were given a calculator. However, nationally, more than one-fifth of the students left their papers blank. Another 37 percent could not seem to make the translation from the problem to the required calculations. Many of these responses, as depicted in the illustration, ignored the question asked, instead providing a calculation or two based on numbers in the problem or providing otherwise unrelated information. These students did not communicate that they even understood the set of boundary conditions and how they related to the stated budget constraints.

TABLE 2.7 National Results for Demographic Subgroups for the Extended-Response Task, "Treena's Budget"

Grade 8							
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
Nation	22 (1.2)	37 (1.6)	22 (1.2)	15 (1.0)	2 (0.3)	2 (0.4)	4 (0.5)
Northeast	23 (3.0)	37 (3.7)	21 (2.7)	14 (2.0)	2 (0.4)	2 (1.0)	4 (1.0)
Southeast	23 (1.9)	43 (3.0)	22 (2.3)	10 (1.7)	2 (0.6)	1 (0.5)	3 (0.8)
Central	17 (2.0)	34 (3.9)	25 (2.6)	18 (1.6)	4 (0.8)	2 (1.2)	6 (1.1)
West	26 (2.9)	34 (2.3)	21 (2.2)	17 (2.5)	2 (0.7)	1 (0.7)	3 (0.9)
White	18 (1.5)	34 (2.1)	25 (1.6)	18 (1.2)	3 (0.4)	2 (0.6)	5 (0.6)
Black	30 (2.9)	50 (3.4)	13 (2.1)	7 (1.7)	0 (0.5)	0 (0.0)	0 (0.5)
Hispanic	36 (3.3)	40 (3.0)	19 (2.7)	5 (1.3)	1 (0.4)	0 (0.4)	1 (0.6)
Male	28 (1.8)	38 (2.1)	19 (1.5)	12 (1.1)	1 (0.4)	1 (0.4)	2 (0.5)
Female	16 (1.8)	36 (1.9)	26 (1.7)	17 (1.8)	3 (0.6)	3 (0.8)	6 (0.8)
Advantaged Urban	10 (3.2)	33 (3.4)	35 (3.4)	15 (3.0)	3 (1.3)	4 (1.6)	7 (2.7)
Disadvantaged Urban	42 (3.3)	39 (4.1)	10 (2.5)	8 (2.1)	2 (1.1)	0 (0.0)	2 (1.1)
Extreme Rural	24 (5.3)	30 (5.1)	23 (3.9)	19 (4.1)	2 (1.3)	3 (1.7)	4 (1.8)
Other	21 (1.4)	38 (2.0)	22 (1.5)	15 (1.4)	2 (0.5)	2 (0.5)	4 (0.6)
Public	23 (1.4)	37 (1.8)	21 (1.3)	14 (1.1)	2 (0.4)	2 (0.5)	4 (0.5)
Catholic and Other Private	14 (2.3)	35 (2.7)	30 (2.4)	16 (2.2)	2 (0.8)	2 (0.7)	4 (1.0)

The standard errors of the estimated percentages appear in parentheses. It can be said with about 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). When the proportion of students is either 0 percent or 100 percent, the standard error is inestimable. However, percentages 99.5 percent and greater were rounded to 100 percent and percentages 0.5 percent or less were rounded to 0 percent. Percentages may not total 100 percent due to rounding error.

SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment

More than one-third of the students received either minimal (22 percent) or partial (15 percent) credit for their work. These students appeared to have understood the mathematics and the question, but failed to heed the instructions asking that work be shown, reasoning explained, and multiple budget options explored. Only 4 percent of the students provided fully documented work -- explanations and supporting computations -- for at least two of the three viable budget options.

Across the subgroups of students, the highest percentage of satisfactory or better responses appeared to have been posted by advantaged urban students -- 7 percent, although this result was not statistically different from the percentages attained by students in any other types of communities. The very low performance overall precluded substantial differences among subgroups in levels of successful performance. However, 30 percent or more of the Black and Hispanic students left this question blank in comparison to 18 percent of their White counterparts. Similarly, 42 percent of the disadvantaged urban students left this question blank compared to 10 percent of the advantaged urban students. It may be that in learning to engage in more complex assessment scenarios, students need to be encouraged to spend more time simply digesting the question. Also, it may be that the communication aspects of reading and listening need to be emphasized as well as their counterparts of writing and discussing. Because from an estimated one-third to half the students across the demographic groups provided incorrect and unrelated information, the results suggest that some students may rush to provide an answer through meaningless manipulations without thinking through problems and strategies for solving them.

Given that for this question, ratings of minimal or better indicated basic understanding of the mathematics and task (albeit incomplete implementation), it is interesting to note that only nine states had an estimated majority of their students reach this level or better: Connecticut, Iowa, Maine, Minnesota, Nebraska, New Hampshire, North Dakota, Wisconsin, and Wyoming (see TABLE 2.8). The percentages of students providing a satisfactory or better response ranged from 0 to 8 percent. States with 7 to 8 percent of their students estimated to have provided such responses included Colorado, Connecticut, and Iowa.

TABLE 2.8

Percentages for Responses to Extended-Response Question, "Treena's Budget"

PUBLIC SCHOOLS	Grade 8 - 1992						
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
NATION	23 (1.4)	37 (1.8)	21 (1.3)	14 (1.1)	2 (0.4)	2 (0.5)	4 (0.5)
Northeast	23 (3.8)	40 (4.5)	19 (2.7)	13 (2.7)	2 (0.3)	3 (1.3)	5 (1.3)
Southeast	24 (2.2)	43 (3.7)	20 (2.5)	10 (1.8)	2 (0.7)	1 (0.5)	3 (0.9)
Central	18 (2.2)	34 (4.2)	25 (2.9)	18 (1.6)	4 (0.9)	2 (1.3)	6 (1.2)
West	27 (3.1)	34 (2.4)	20 (2.4)	17 (2.5)	2 (0.7)	1 (0.7)	3 (1.0)
STATES							
Alabama	26 (2.2)	40 (2.1)	20 (1.6)	12 (1.6)	2 (0.6)	0 (0.3)	2 (0.7)
Arizona	23 (2.0)	35 (2.0)	23 (1.9)	16 (1.8)	3 (0.8)	1 (0.3)	4 (0.9)
Arkansas	24 (2.0)	38 (1.8)	25 (1.9)	11 (1.2)	2 (0.6)	0 (0.2)	2 (0.6)
California	27 (2.2)	36 (2.5)	22 (1.7)	12 (1.7)	2 (0.8)	0 (0.3)	3 (0.8)
Colorado	18 (1.4)	33 (2.0)	24 (1.8)	19 (1.7)	4 (0.6)	3 (0.8)	7 (0.9)
Connecticut	21 (1.9)	29 (2.3)	23 (1.8)	20 (1.9)	4 (0.9)	3 (0.7)	7 (1.0)
Delaware	24 (2.5)	31 (2.4)	23 (2.0)	17 (1.9)	4 (1.2)	1 (0.4)	4 (1.4)
Dist. Columbia	41 (2.4)	38 (2.4)	14 (1.9)	5 (1.2)	0 (0.4)	1 (0.6)	1 (0.7)
Florida	24 (2.2)	37 (2.3)	24 (2.4)	12 (1.5)	2 (0.6)	2 (0.7)	4 (0.9)
Georgia	24 (1.8)	36 (2.0)	25 (1.9)	13 (1.5)	2 (0.5)	0 (0.2)	2 (0.6)
Hawaii	34 (2.0)	36 (2.0)	16 (1.8)	13 (1.4)	1 (0.4)	0 (0.3)	1 (0.5)
Idaho	19 (1.5)	37 (1.9)	23 (1.7)	17 (2.0)	3 (0.7)	1 (0.4)	4 (0.7)
Indiana	17 (1.8)	35 (2.0)	27 (2.2)	18 (2.1)	2 (0.7)	1 (0.4)	3 (0.8)
Iowa	11 (1.1)	29 (2.2)	30 (2.1)	22 (1.9)	4 (0.7)	4 (0.8)	8 (1.1)
Kentucky	19 (1.6)	32 (1.8)	27 (1.8)	18 (1.4)	2 (0.7)	1 (0.4)	4 (0.9)
Louisiana	35 (2.3)	36 (2.0)	19 (1.9)	8 (1.2)	1 (0.4)	0 (0.2)	1 (0.5)
Maine	17 (1.8)	29 (2.0)	29 (2.3)	20 (1.6)	3 (0.9)	2 (0.6)	5 (1.1)
Maryland	26 (2.3)	30 (2.3)	20 (1.8)	20 (1.9)	3 (0.8)	2 (0.5)	4 (0.9)
Massachusetts	21 (1.9)	31 (2.0)	26 (2.1)	17 (1.8)	3 (0.7)	2 (0.6)	5 (1.0)
Michigan	21 (1.7)	34 (2.3)	25 (1.8)	16 (1.8)	2 (0.7)	1 (0.5)	4 (0.9)
Minnesota	13 (1.5)	34 (2.1)	27 (2.7)	19 (1.7)	4 (0.9)	3 (0.9)	6 (1.4)
Mississippi	29 (2.2)	39 (1.9)	23 (1.9)	8 (1.1)	1 (0.4)	1 (0.3)	1 (0.5)
Missouri	20 (1.8)	37 (2.0)	23 (1.6)	16 (1.7)	2 (0.6)	2 (0.3)	4 (0.7)
Nebraska	17 (1.7)	30 (2.1)	29 (1.9)	20 (1.6)	4 (0.8)	1 (0.4)	5 (0.9)
New Hampshire	18 (1.3)	31 (2.1)	26 (1.7)	20 (2.1)	3 (0.7)	1 (0.5)	5 (0.8)
New Jersey	21 (2.2)	33 (3.1)	24 (2.0)	17 (1.6)	3 (0.9)	2 (0.7)	5 (1.3)
New Mexico	22 (1.7)	37 (2.0)	26 (2.0)	13 (1.4)	1 (0.5)	0 (0.1)	1 (0.5)
New York	23 (1.9)	36 (2.4)	21 (1.9)	15 (1.6)	2 (0.7)	2 (0.6)	4 (1.0)
North Carolina	24 (2.1)	35 (2.0)	25 (1.7)	14 (1.4)	2 (0.6)	1 (0.3)	3 (0.8)
North Dakota	14 (1.4)	32 (2.4)	29 (2.1)	19 (1.6)	4 (0.9)	2 (0.6)	6 (1.2)
Ohio	21 (1.9)	33 (1.6)	22 (2.0)	19 (1.9)	3 (0.9)	2 (0.6)	5 (1.0)
Oklahoma	16 (1.6)	37 (2.3)	28 (2.0)	16 (1.9)	2 (0.8)	1 (0.4)	3 (0.8)
Pennsylvania	19 (1.5)	35 (2.3)	23 (1.9)	20 (1.6)	2 (0.6)	1 (0.5)	3 (0.8)
Rhode Island	21 (3.2)	33 (2.5)	24 (2.2)	16 (2.2)	3 (0.9)	2 (0.8)	6 (1.1)
South Carolina	26 (1.9)	37 (2.4)	23 (2.0)	11 (1.4)	1 (0.4)	1 (0.5)	2 (0.5)
Tennessee	26 (2.1)	36 (2.1)	21 (1.9)	14 (1.6)	2 (0.6)	1 (0.4)	3 (0.7)
Texas	24 (1.9)	31 (2.4)	28 (2.0)	13 (1.6)	2 (0.6)	2 (0.8)	4 (1.0)
Utah	21 (1.5)	36 (2.0)	23 (1.6)	16 (1.3)	3 (0.6)	1 (0.3)	4 (0.8)
Virginia	18 (1.4)	33 (2.1)	25 (2.0)	19 (1.9)	2 (0.7)	2 (0.6)	4 (0.9)
West Virginia	22 (1.7)	38 (2.1)	25 (1.6)	13 (1.3)	2 (0.6)	0 (0.3)	2 (0.7)
Wisconsin	16 (2.3)	32 (2.3)	27 (2.6)	19 (2.4)	3 (0.9)	3 (0.7)	6 (1.0)
Wyoming	15 (1.5)	29 (2.0)	31 (2.1)	19 (1.9)	3 (0.7)	2 (0.7)	5 (0.9)
TERRITORIES							
Guam	49 (3.1)	33 (2.8)	12 (1.9)	5 (1.5)	0 (0.3)	0 (0.3)	1 (0.4)
Virgin Islands	61 (2.3)	27 (2.9)	10 (2.1)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)

The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). Percentages may not total 100 percent due to rounding error.

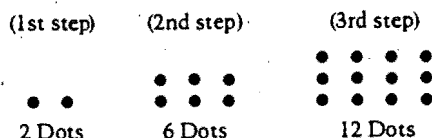
SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment.

Grade 8 Question: Marcy's Dot Pattern

The Task

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

A pattern of dots is shown below. At each step, more dots are added to the pattern. The number of dots added at each step is more than the number added in the previous step. The pattern continues infinitely.



Marcy has to determine the number of dots in the 20th step, but she does not want to draw all 20 pictures and then count the dots.

Explain or show how she could do this and give the answer that Marcy should get for the number of dots.

Did you use the calculator on this question?

Yes No

Possible Solution

The explanation should include one of the following ideas with no false statements:

- a) For each successive step, the number of rows and the number of columns is increasing by 1, forming a pattern. For example, the first step shows a pattern of dots that consists of one row by two columns, the second step shows a pattern of dots that consists of two rows by three columns; the third step three rows by four columns, and so on. Continuing in this pattern, the twentieth step would have 20×21 , or 420, dots.

Possible Solution (continued)

b) Look at successive differences between consecutive steps. The differences 4, 6, 8, 10, ... form a pattern. There are 19 differences forming the pattern 4, 6, 8, 10, ... 38, 40, and this sum is equal to $(9 \times 44) + 22$, or 418. However, 2 must be added for the first step, yielding a response of 420.

The solution to this task requires students to analyze several steps in a pattern of dots in order to conjecture about a general rule for determining the number of dots for any particular step in the pattern. Additionally, students are required to use their rule to find the number of dots at a particular step in an extension of the pattern where it no longer is convenient to draw all of the intermediate dot figures. One approach is to think of the steps in the pattern as consisting of dots in rows and columns and to realize that the number of dots in the n th step can be expressed as

$$x_n = n(n+1) \text{ for } n = 1, 2, 3 \dots \text{ and thus}$$

$$x_{20} = 20(20 + 1) = (20)21 = 420.$$

Other approaches are possible and students could use arithmetic or algebraic concepts to explain their reasoning. Although a few students did write an algebraic equation to express a rule for the general term in a recursive relationship, it was neither expected nor necessary for students to do so.

National Results, Scoring Guide, and Sample Responses

National Percent for Each Category*

16 (1.0)

63 (1.3)

It is difficult to discern an explanation for this INCORRECT response. One possibility is that the student apportioned the total of 20 dots in the three steps shown into two 2 x 5 sets.

Rating and Performance Category

0 No Response

1 Incorrect -- The work is completely incorrect or irrelevant, or the response states, "I don't know."

(1st step) (2nd step)

• • • • • • • • • •
• • • • • • • • • •
10 dots 10 dots

National Percent for Each Category

10 (0.7)

This MINIMAL response illustrates a student's attempt to display the first 12 steps in the pattern. There is some understanding of the number of total dots in each entry but no attempt is made to explain the pattern in terms of rows and columns.

Rating and Performance Category

2 Minimal -- An attempt to generalize the pattern on a superficial level or to draw all 20 pictures in the pattern (with a clear understanding of the pattern).

12 20 30 42 56
+8 +10 +12 +14 +16
20 30 42 56 72
(4th step) (5th step) (6th step) (7th step) (8th step)

72 90 110 131 155
+18 +20 +22 +24 +26
90 110 132 155 181
(9th step) (10th step) (11th step) (12th step)

* The standard errors of the estimated percentages appear in parentheses.

National Percent
for Each Category*

6 (0.7)

This PARTIAL response does begin to formulate an explanation of the total number of dots for an entry. However, the last sentence incorrectly uses the term "multiply" in an attempt to discuss the 20th step. At this point, the explanation falters.

National Percent
for Each Category

1 (0.2)

This SATISFACTORY response provides sufficient evidence of how to generate the various steps in the pattern by multiplying the number of rows times the number of columns. However, the student does not determine the number of dots in the 20th step.

Rating and Performance Category

3 Partial -- The response has communicated a partially correct generalization of the pattern.

When the pattern starts with 2 dots the next step is to add 4 dots to it and the 3rd step is to add 6 dots to it so every time there is a new step you add 2 dots to the last amount you added on to the last step. you would multiply two dots on and on until you reached the 20th step.

Rating and Performance Category

4 Satisfactory -- The response contains a completely correct generalization of the pattern but does not include -- or incorrectly states -- the number of dots (420) in the 20th step.

Multiply each step by $\sqrt{n}$
higher such as
 $1 = 1 \times 2$
 $2 = 2 \times 3$
 $3 = 3 \times 4$
 $4 = 4 \times 5$

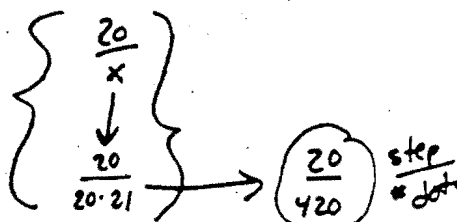
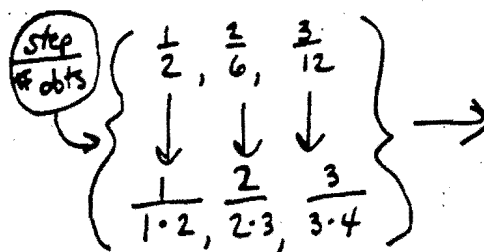
**National Percent
for Each Category***

5 (0.6)

This is a strong EXTENDED response. The student clearly related the number of dots in a step to an appropriate multiplication rule. This student then moves directly from step three to step 20 and determines the correct number of dots for that step.

Rating and Performance Category

5 Extended -- This response contains a completely correct generalization of the pattern and specifies that there are 420 dots in the 20th step.



Step # 20 has 420 dots.

Performance Highlights: Marcy's Dot Pattern

Because only about half the eighth graders are enrolled in prealgebra (28 percent) or algebra (20 percent),¹³ it was expected that this multistep prealgebra question would be difficult for students, given its challenging requirements. First, students needed to identify a pattern in the dots that continues indefinitely. Second, they needed to develop and communicate a generalization to describe any term in the pattern. Finally, they had to apply their generalization to the 20th term in the pattern.

Because the answer could have been given as an algebraic expression for the n th term of an equation, this question was designed to provide the eighth graders enrolled in prealgebra and algebra an opportunity to demonstrate their understanding, while still having several numbers and operations based solutions available for all students. A satisfactory or better response, however, did need to state an accurate recursion rule or provide some computational information with an explanation.

As shown by the results presented in TABLE 2.11, most of the eighth graders fell short of detecting and communicating a pattern in the dots. Nationally, 16 percent did not respond and 63 percent provided irrelevant or inaccurate information about the dot pattern. Of the students who were able to detect the pattern, most were not able to complete the step of generalizing to a rule that could be used to find the dots in any term. Ten percent were able to demonstrate their understanding of the pattern by working some number of the terms beyond those given and another 6 percent tried to provide a generalization. Only 6 percent of the students provided satisfactory or better responses. The 1 percent of the students providing satisfactory rather than extended responses provided a generalization but failed to apply it to the 20th term. The remaining 5 percent worked the problem in full.

In general, the results were relatively consistent across demographic subgroups. However, 13 percent of the advantaged urban students provided satisfactory or better responses compared to 1 percent of the disadvantaged urban students. Also, 13 percent of the private-school eighth graders provided satisfactory or better responses compared to 5 percent of the public-school students.

¹³ *Data Compendium for the NAEP 1992 Mathematics Assessment of the Nation and the States* (Washington, DC: National Center for Education Statistics, 1993).

TABLE 2.11 National Results for Demographic Subgroups for the Extended-Response Task, "Marcy's Dot Pattern"

Grade 8							
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
Nation	16 (1.0)	63 (1.3)	10 (0.7)	6 (0.7)	1 (0.2)	5 (0.6)	6 (0.7)
Northeast	18 (3.2)	61 (3.2)	10 (1.9)	4 (0.7)	2 (0.5)	6 (1.8)	8 (1.6)
Southeast	20 (2.0)	64 (2.2)	9 (1.5)	3 (0.7)	1 (0.4)	4 (1.1)	4 (1.3)
Central	10 (1.5)	65 (2.1)	10 (1.4)	8 (1.4)	1 (0.4)	6 (1.1)	7 (1.4)
West	16 (2.0)	62 (2.8)	10 (1.1)	7 (1.8)	0 (0.2)	4 (1.1)	4 (1.1)
White	12 (1.1)	63 (1.5)	11 (0.8)	7 (0.8)	1 (0.2)	6 (0.8)	8 (0.9)
Black	24 (2.9)	67 (2.9)	6 (1.6)	2 (0.9)	0 (0.0)	1 (0.5)	1 (0.5)
Hispanic	28 (2.8)	61 (3.1)	7 (2.0)	3 (1.2)	0 (0.0)	1 (0.5)	1 (0.5)
Male	19 (1.5)	63 (2.2)	8 (1.0)	5 (0.9)	1 (0.2)	5 (0.9)	5 (0.9)
Female	13 (1.2)	63 (1.6)	12 (1.1)	6 (1.0)	1 (0.3)	5 (0.8)	6 (0.9)
Advantaged Urban	8 (2.9)	62 (5.1)	10 (1.9)	6 (1.6)	1 (0.6)	11 (2.5)	13 (2.6)
Disadvantaged Urban	32 (3.9)	59 (4.7)	4 (1.3)	4 (1.9)	1 (0.6)	1 (0.5)	1 (0.7)
Extreme Rural	16 (2.9)	69 (3.6)	8 (2.3)	2 (1.1)	1 (0.7)	4 (2.0)	5 (2.3)
Other	15 (1.3)	62 (1.5)	11 (0.9)	6 (0.9)	1 (0.2)	4 (0.7)	5 (0.7)
Public	16 (1.2)	64 (1.4)	9 (0.8)	6 (0.7)	1 (0.2)	4 (0.6)	5 (0.6)
Catholic and Other Private	11 (1.7)	56 (2.7)	12 (1.6)	7 (1.2)	2 (0.9)	10 (2.2)	13 (2.0)

The standard errors of the estimated percentages appear in parentheses. It can be said with about 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). When the proportion of students is either 0 percent or 100 percent, the standard error is inestimable. However, percentages 99.5 percent and greater were rounded to 100 percent and percentages 0.5 percent or less were rounded to 0 percent. Percentages may not total 100 percent due to rounding error.

SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment

The results for participating states and jurisdictions, shown in TABLE 2.12, mirror those for the nation. The reasoning and analysis required of students to conjecture, describe, and use a general approach for extending the pattern of dots proved to be a considerable challenge for most students. In general, 80 to 90 percent of the eighth graders attempted this task, but about 60 to 70 percent of them could not find or articulate the pattern in the dots. However, in Connecticut, Maine, Minnesota, New Jersey, and Wisconsin, an estimated 30 percent or more of the students identified a pattern, receiving minimal credit or better for their responses. In four states, an estimated 10 percent or more of the eighth graders provided responses judged satisfactory or better -- Connecticut, Maine, New Jersey, and Wisconsin.

TABLE 2.12 | Percentages for Responses to Extended-Response Question, "Marcy's Dot Pattern"

PUBLIC SCHOOLS	Grade 8 - 1992						
	No Response	Incorrect	Minimal	Partial	Satisfactory	Extended	Satisfactory or Better
NATION	16 (1.2)	64 (1.4)	9 (0.8)	6 (0.7)	1 (0.2)	4 (0.6)	5 (0.6)
Northeast	18 (3.9)	62 (3.8)	9 (1.9)	4 (1.0)	1 (0.5)	6 (1.6)	7 (1.8)
Southeast	22 (2.2)	63 (2.3)	9 (1.5)	3 (0.7)	1 (0.6)	2 (0.9)	3 (1.1)
Central	10 (1.3)	66 (2.3)	9 (1.6)	8 (1.5)	1 (0.4)	6 (1.2)	7 (1.4)
West	17 (2.2)	63 (2.8)	10 (1.3)	7 (1.9)	0 (0.3)	3 (1.1)	4 (1.1)
STATES							
Alabama	15 (1.5)	70 (2.2)	8 (1.2)	4 (0.8)	0 (0.2)	3 (0.7)	3 (0.7)
Arizona	17 (1.4)	62 (2.3)	9 (1.2)	6 (1.1)	1 (0.5)	4 (0.9)	6 (1.1)
Arkansas	14 (1.8)	70 (2.3)	9 (1.5)	3 (0.9)	2 (0.4)	3 (0.7)	4 (0.9)
California	20 (1.6)	56 (2.5)	11 (1.6)	6 (1.0)	1 (0.5)	5 (0.9)	6 (1.1)
Colorado	12 (1.4)	61 (1.8)	13 (1.1)	8 (1.1)	2 (0.6)	5 (0.8)	6 (1.1)
Connecticut	11 (1.3)	58 (2.0)	12 (1.5)	9 (1.0)	2 (0.7)	8 (1.0)	10 (1.3)
Delaware	17 (2.2)	63 (2.5)	10 (1.4)	5 (1.0)	1 (0.4)	4 (1.1)	5 (1.1)
Dist. Columbia	24 (2.3)	64 (2.4)	6 (1.4)	2 (0.8)	1 (0.5)	4 (0.9)	5 (0.9)
Florida	19 (1.8)	64 (2.5)	8 (1.4)	4 (1.0)	1 (0.3)	4 (0.7)	5 (0.9)
Georgia	17 (1.7)	65 (2.1)	10 (1.4)	3 (0.7)	1 (0.5)	4 (0.9)	5 (0.9)
Hawaii	24 (1.7)	56 (2.2)	11 (1.5)	6 (0.9)	2 (0.6)	3 (0.7)	4 (0.9)
Idaho	13 (1.5)	63 (1.8)	9 (1.5)	9 (1.3)	1 (0.4)	5 (1.1)	6 (1.3)
Indiana	12 (1.1)	65 (2.1)	11 (1.6)	6 (0.9)	1 (0.5)	5 (0.9)	6 (1.0)
Iowa	6 (0.8)	67 (2.2)	11 (1.6)	8 (1.0)	3 (0.6)	6 (0.9)	8 (1.1)
Kentucky	10 (1.4)	68 (1.9)	11 (1.1)	5 (0.8)	1 (0.4)	4 (1.0)	5 (1.1)
Louisiana	18 (1.8)	66 (2.3)	9 (1.4)	3 (0.9)	1 (0.5)	1 (0.5)	3 (0.8)
Maine	9 (1.1)	60 (2.4)	15 (1.7)	6 (1.4)	2 (0.7)	7 (1.3)	10 (1.5)
Maryland	15 (2.0)	61 (2.4)	9 (1.2)	6 (1.1)	3 (0.9)	6 (1.1)	9 (1.4)
Massachusetts	14 (1.5)	57 (2.4)	13 (1.6)	7 (1.3)	2 (0.7)	7 (1.1)	9 (1.4)
Michigan	14 (1.6)	64 (2.0)	10 (1.3)	5 (0.9)	2 (0.5)	5 (1.2)	7 (1.1)
Minnesota	7 (1.0)	60 (2.0)	15 (1.6)	10 (1.2)	2 (0.5)	7 (1.1)	9 (1.2)
Mississippi	17 (2.1)	70 (2.2)	7 (1.0)	3 (0.6)	1 (0.5)	2 (0.7)	3 (0.9)
Missouri	11 (1.5)	64 (2.2)	11 (1.5)	6 (1.1)	1 (0.4)	7 (1.2)	8 (1.2)
Nebraska	9 (1.1)	64 (2.2)	12 (1.6)	6 (1.5)	2 (0.6)	7 (1.4)	9 (1.4)
New Hampshire	12 (1.5)	59 (2.3)	12 (1.5)	9 (1.3)	2 (0.6)	7 (1.1)	9 (1.2)
New Jersey	12 (1.6)	58 (2.5)	14 (1.6)	7 (1.3)	2 (0.8)	7 (1.3)	10 (1.6)
New Mexico	15 (1.5)	64 (2.1)	11 (1.5)	5 (1.1)	1 (0.4)	3 (0.7)	4 (0.8)
New York	16 (1.7)	61 (2.1)	11 (1.7)	7 (1.4)	1 (0.4)	4 (1.0)	5 (1.0)
North Carolina	14 (1.6)	66 (1.7)	9 (1.2)	5 (1.0)	1 (0.4)	5 (0.9)	6 (0.9)
North Dakota	8 (1.3)	66 (2.8)	12 (1.6)	7 (1.4)	2 (0.5)	5 (1.0)	7 (1.1)
Ohio	14 (1.4)	60 (2.6)	14 (2.2)	5 (0.8)	1 (0.5)	5 (1.1)	6 (1.1)
Oklahoma	11 (1.4)	67 (2.7)	11 (1.8)	4 (1.0)	1 (0.3)	5 (1.3)	6 (1.3)
Pennsylvania	12 (1.5)	63 (2.2)	12 (1.4)	6 (1.0)	1 (0.5)	6 (1.1)	7 (1.3)
Rhode Island	13 (1.5)	62 (2.3)	11 (2.0)	7 (1.6)	2 (0.6)	5 (1.1)	7 (1.2)
South Carolina	12 (1.4)	68 (1.9)	9 (1.3)	6 (1.0)	1 (0.4)	5 (0.8)	5 (1.0)
Tennessee	15 (1.4)	66 (2.2)	11 (1.9)	4 (0.8)	0 (0.3)	3 (0.7)	3 (0.8)
Texas	16 (1.6)	61 (2.4)	11 (1.4)	7 (1.2)	1 (0.4)	4 (0.9)	6 (1.0)
Utah	12 (1.5)	65 (1.8)	9 (1.1)	8 (1.2)	2 (0.6)	5 (0.8)	6 (1.0)
Virginia	14 (1.5)	62 (1.9)	12 (1.5)	6 (0.9)	2 (0.5)	5 (0.9)	7 (1.1)
West Virginia	16 (1.6)	68 (2.1)	8 (1.0)	4 (0.8)	1 (0.4)	3 (0.7)	4 (0.8)
Wisconsin	9 (1.5)	58 (2.4)	14 (1.7)	7 (1.2)	4 (1.6)	7 (1.2)	11 (2.0)
Wyoming	11 (1.4)	62 (2.1)	13 (1.5)	7 (1.1)	1 (0.5)	6 (1.1)	7 (1.1)
TERRITORIES							
Guam	33 (2.8)	52 (2.8)	7 (1.5)	6 (1.4)	2 (0.8)	0 (0.3)	2 (0.8)
Virgin Islands	48 (2.8)	49 (2.8)	3 (1.0)	0 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)

The standard errors of the estimated percentages appear in parentheses. It can be said with 95 percent certainty that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. In comparing two estimates, one must use the standard error of the difference (see Appendix for details). Percentages may not total 100 percent due to rounding error.

SOURCE: National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment.

Extended-Response Questions: Grade 12

High-school seniors were administered six extended-response tasks as part of NAEP's 1992 national assessment. (Again, the Trial State Assessment Program was administered at grades 4 and 8, but not at grade 12.) The three tasks released to the public are discussed in this section.

The "Effective Tax Rates" question asks students to work with a definition concerning a tax rate. Students could have approached the problem using either numbers and operations or algebra and functions to represent and model a situation involving variables. The first part of the problem, requiring application of the understanding of an effective tax rate of 5 percent, should be accessible to most high-school seniors. However, the second part -- determining whether or not the tax rate could be 6 percent -- requires an understanding of the conditions under which an equation has no real solution or some understanding of the concept of limit. Students were provided with a scientific calculator for this question.

In "Patterns of Squares," students were asked to use elementary algebraic concepts as well as basic numbers facts to explain why a statement is always true about the relationship among the squares of positive integers that end in the digit 5. That is, explain why, when positive integers ending in the digit 5 are squared, the resulting integer always ends in 25. Twelfth graders also were provided with a scientific calculator to use in answering this question.

The question about "Graphing the Path of an Object" required students to apply geometric and algebraic concepts usually encountered in college preparatory mathematics courses. More specifically, students needed working familiarity with the Pythagorean relationship, the rectangular coordinate system, the concept of slope, and graphic models. They were asked to graph the path of an object and answer questions based on their graph.

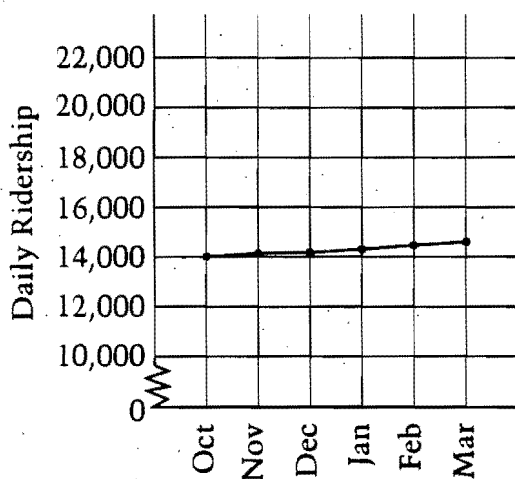
This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all of your work.

METRO RAIL COMPANY

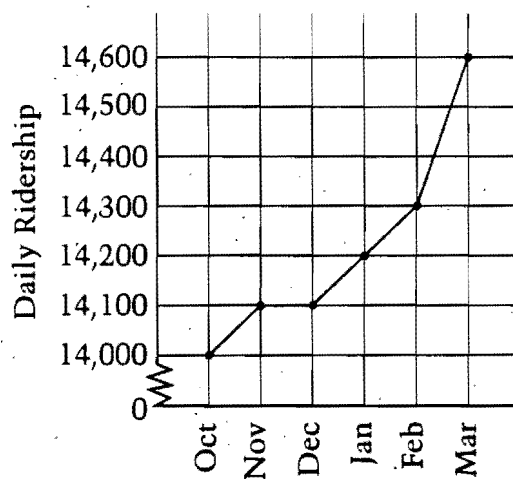
Month	Daily Ridership
October	14,000
November	14,100
December	14,100
January	14,200
February	14,300
March	14,600

The data in the table above has been correctly represented by both graphs shown below.

Graph A



Graph B



Which graph would be best to help convince others that the Metro Rail Company made a lot more money from ticket sales in March than in October?

Explain your reason for making this selection.

Why might people who thought that there was little difference between October and March ticket sales consider the graph you chose to be misleading?

This extended constructed-response question measures data analysis, statistics, and probability. Students' responses were scored using a four-point scoring guide that allowed for partial credit. Scores of 3 (Satisfactory) and 4 (Complete) are illustrated below.

Grade 8	PERCENTAGE "SATISFACTORY OR HIGHER" WITHIN ACHIEVEMENT LEVEL INTERVALS			
	Overall Percentage Satisfactory or Higher	Below Basic 261 and below*	Basic 262 to 298*	Proficient 299 to 332* Advanced 333 and above*
	20	7	22	35

* NAEP mathematics composite scale range

*** Sample size insufficient to permit reliable estimates

The following is a sample of a student response that received a Satisfactory score. A Satisfactory response to this question gives the correct response, Graph B, but provides an incomplete but partially correct explanation.

Graph B because it shows how the
graph goes up so much.

because it shows a big jump
because all they did was make
each square worth more ridership

The following is a sample of a student response that received the highest score, Complete. A Complete response to this question gives the correct response, Graph B, and provides a complete explanation.

graph B

Because it has a smaller scale for
daily ridership it looks like a greater
increase

because it appears its increased
a lot when its only increased \$600

FOURTH GRADE READING ACHIEVEMENT

The following sample passage is from *Charlotte's Web*, by E.B. White. Similar to NAEP items, it helps illustrate the kinds of skills expected of students.

Having promised Wilbur that she would save his life, she was determined to keep her promise. Charlotte was naturally patient. She knew from experience that if she waited long enough, a fly would come to her web; and she felt sure that if she thought long enough about Wilbur's problem, an idea would come to her mind. Finally, one morning toward the middle of July, the idea came. "Why how perfectly simple!" she said to herself. "The way to save Wilbur's life is to play a trick on Zuckerman. If I can fool a bug," thought Charlotte, "I can surely fool a man. People are not as smart as bugs."

- Students at the *basic* level are able to read the passage and then tell what Charlotte promised Wilbur.
- Students at the *proficient* level are able to describe why Charlotte thought she could fool Zuckerman.
- Students at the *advanced* level recognize that Charlotte compares waiting for ideas to entrapping a fly.

EIGHTH GRADE MATH ACHIEVEMENT

The following sample questions show what a student at or above the international average should know and be able to do.

1. A rubber ball rebounds to half the height it drops. If the ball is dropped from a rooftop 18 feet above the ground, what is the total distance traveled by the time it hits the ground the third time?

- A. 31.5 feet
- B. 40.5 feet
- C. 45 feet
- D. 63 feet

2. The table shows the values of x and y , where x is proportional to y .

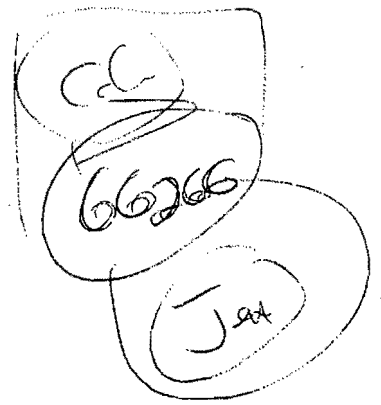
What are the values of P and Q ?

x	y
3	7
6	Q
P	35

- A. $P = 14$ and $Q = 31$
- B. $P = 10$ and $Q = 14$
- C. $P = 10$ and $Q = 31$
- D. $P = 14$ and $Q = 15$
- E. $P = 15$ and $Q = 14$

Response of ...

- sketch, job roll
- ...
- ... and related



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that ... that ...
needed



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② ...

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- ...

... time

③ ...

.../...

...
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...

where do you fit in with the anti
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Respect
accu hi
Cant

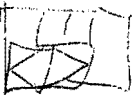
Service with
Cops
local minute

Mix people to
with him

HAC when it



~~Cardinal path of great town meeting~~

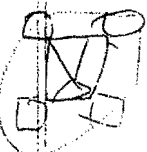


He needs to be real clear
[where public is]



e.g. goals to with part
which do j

disch, use best
rec. et, - not cool



Mike -

Here are some sample Questions to consider for the town hall meeting. If we use NAEP constructed response items there is a very limited pool.

Gary Phillips really hopes we can nail this down fast because of the technical issues.

Let me know when you, I and Debbie/Carol & Missy can discuss this - I may try to get Mike Justice's take as well.

Thanks

Jimmy

401-3281