Pennsylvania PSSA 2016 Grade 8 Math

Reference Materials
Page 2

Exam & Answer Key Materials
Pages 3 - 38

Grade 8 Formula Sheet

Formulas that you may need to work questions on this test are found below.
You may refer back to this page at any time during the mathematics test.
You may use calculator π or the number 3.14.

2016
Grade 8

Exponential Properties

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{m \cdot n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

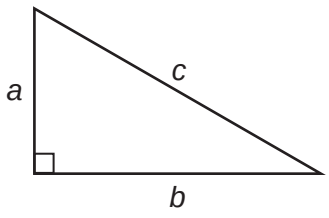
$$a^{-1} = \frac{1}{a}$$

Algebraic Equations

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

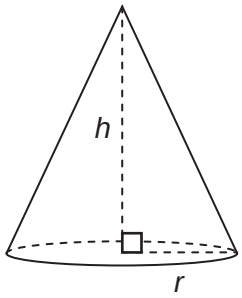
Slope-Intercept Form: $y = mx + b$

Pythagorean Theorem



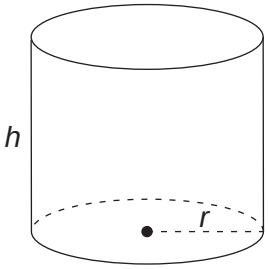
$$a^2 + b^2 = c^2$$

Cone



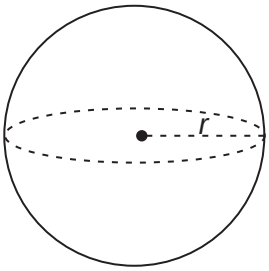
$$V = \frac{1}{3}\pi r^2 h$$

Cylinder



$$V = \pi r^2 h$$

Sphere

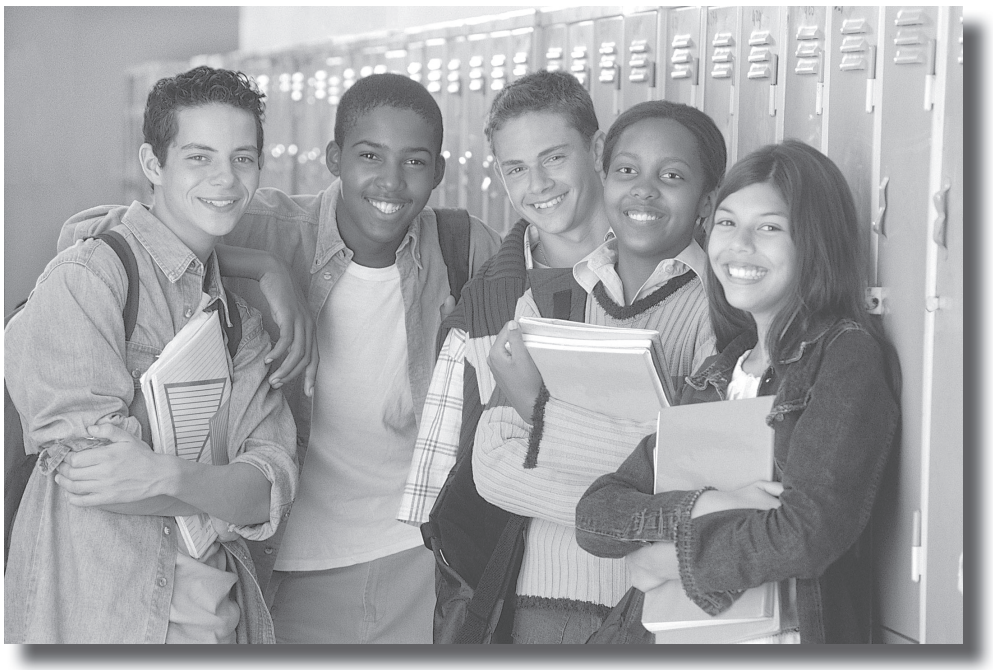


$$V = \frac{4}{3}\pi r^3$$

pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics
Item and Scoring Sampler



2016–2017
Grade 8

Pennsylvania Department of Education Bureau of Curriculum, Assessment and Instruction—September 2016

MATHEMATICS TEST DIRECTIONS

On the following pages are the mathematics questions.

- You may not use a calculator for question 1. You may use a calculator for all other questions on this test.

Directions for Multiple-Choice Questions:

Some questions will ask you to select an answer from among four choices.

For the multiple-choice questions:

- First solve the problem on scratch paper.
- Choose the correct answer and record your choice in the answer booklet.
- If none of the choices matches your answer, go back and check your work for possible errors.
- Only one of the answers provided is the correct response.

Directions for Open-Ended Questions:

Some questions will require you to write your response.

For the open-ended questions:

- These questions have more than one part. Be sure to read the directions carefully.
- You cannot receive the highest score for an open-ended question without completing all tasks in the question. For example, if the question asks you to show your work or explain your reasoning, be sure to show your work or explain your reasoning in the space provided.
- If the question does **not** ask you to show your work or explain your reasoning, you may use the space provided, but only those parts of your response that the question specifically asks for will be scored.
- Write your response in the appropriate location within the response box in the answer booklet. Some answers may require graphing, plotting, labeling, drawing, or shading. If you use scratch paper, be sure to transfer your final response and any needed work or reasoning to the answer booklet.

General Description of Scoring Guidelines for Mathematics Open-Ended Questions

4 – The response demonstrates a *thorough* understanding of the mathematical concepts and procedures required by the task.

The response provides correct answer(s) with clear and complete mathematical procedures shown and a correct explanation, as required by the task. Response may contain a minor "blemish" or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

3 – The response demonstrates a *general* understanding of the mathematical concepts and procedures required by the task.

The response and explanation (as required by the task) are mostly complete and correct. The response may have minor errors or omissions that do not detract from demonstrating a *general* understanding.

2 – The response demonstrates a *partial* understanding of the mathematical concepts and procedures required by the task.

The response is somewhat correct with *partial* understanding of the required mathematical concepts and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

1 – The response demonstrates a *minimal* understanding of the mathematical concepts and procedures required by the task.

0 – The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task for that grade level.

Response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank).....Blank, entirely erased, or written refusal to respond
OT.....Off task
LOE .....Response in a language other than English
IL .....Illegible

Question 1 in this sampler is to be solved without the use of a calculator.

MULTIPLE-CHOICE ITEMS

1. Simplify: $7^{-8} \times 7^{-4}$

A. $\frac{1}{7^{12}}$

B. $\frac{1}{7^{4}}$

C. 7^{12}

D. 7^{32}

Item Information	
Alignment	B-E.1.1.1
Answer Key	A
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
41%	12%	29%	18%

Option Annotations

A. correct
B. ignores the negative in the second exponent
C. thinks 2 negatives make it positive
D. multiplies the exponents

A calculator is permitted for use in solving questions 2–17 in this sampler.

2. Which equation shows how to find the product of 1,000,000 and 1,000,000 using scientific notation?

A. $1{,}000{,}000 \times 1{,}000{,}000 = (1 \times 10^6) \times (1 \times 10^6) = 1 \times 10^{(6 + 6)} = 1 \times 10^{12}$

B. $1{,}000{,}000 \times 1{,}000{,}000 = (1 \times 10^6) \times (1 \times 10^6) = 1 \times 10^{(6 \times 6)} = 1 \times 10^{36}$

C. $1{,}000{,}000 \times 1{,}000{,}000 = (1 \times 10^7) \times (1 \times 10^7) = 1 \times 10^{(7 + 7)} = 1 \times 10^{14}$

D. $1{,}000{,}000 \times 1{,}000{,}000 = (1 \times 10^7) \times (1 \times 10^7) = 1 \times 10^{(7 \times 7)} = 1 \times 10^{49}$

Item Information	
Alignment	B-E.1.1.4
Answer Key	A
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
75%	13%	7%	5%

Option Annotations

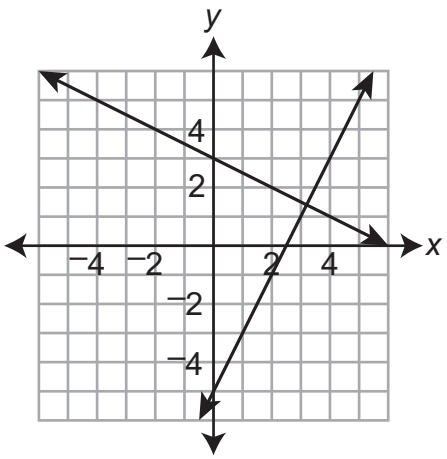
A. correct
B. multiplies the exponents
C. incorrectly uses 7, because of 7 digits
D. incorrectly uses 7, because of 7 digits, and multiplies the exponents

3. Mr. Carter is mapping the boundaries of a park on a coordinate grid. The park's headquarters are located at the origin. The equations shown below represent two boundaries of the park.

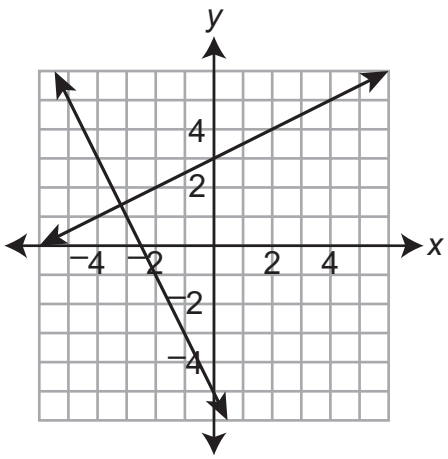
$$y = 2x - 5$$
$$2x + 4y = 12$$

The park's entrance is located at the intersection of these two boundaries. Which coordinate grid correctly shows the two boundaries and the park's entrance?

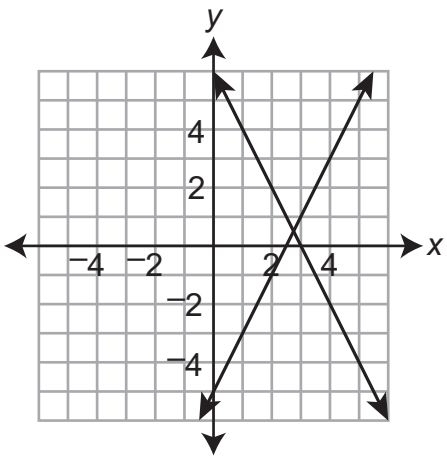
A.



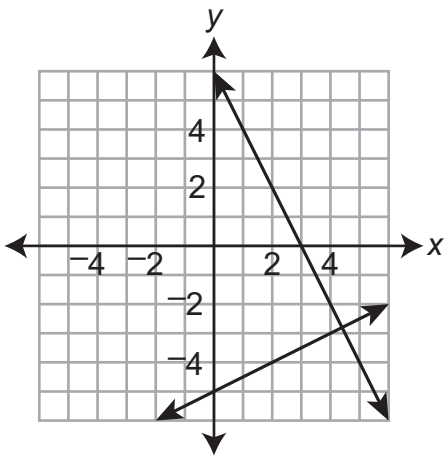
B.



C.



D.



Item Information	
Alignment	B-E.3.1.4
Answer Key	A
Depth of Knowledge	1

p-values			
A	**B**	**C**	**D**
46%	19%	22%	13%

Option Annotations

A. correct
B. uses a negative slope for the first equation and a positive slope for the second equation
C. uses the correct first equation but reverses the intercepts for the second equation
D. uses the reciprocal of the slope for the first equation and reverses the intercepts for the second equation

4. A cleaning company charges x dollars per hour to clean floors and y dollars per hour to clean the rest of a house.

- When the company spends 2 hours to clean floors and 3 hours to clean the rest of a house, the total charge is $84.
- When the company spends 1 hour to clean floors and 4 hours to clean the rest of a house, the total charge is $87.

Which ordered pair represents the hourly charges to clean floors and to clean the rest of the house?

A. (12, 20)

B. (15, 18)

C. (18, 15)

D. (20, 12)

Item Information	
Alignment	B-E.3.1.5
Answer Key	B
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
19%	55%	15%	11%

Option Annotations

A. tries these values in the first example; $2 \times 12 + 3 \times 20 = 84$
B. correct
C. reverses the solution
D. reverses the meaning of each value in the ordered pair and tries the values in the first example

5. Marianna has been adding $30 to her savings account every month. Which model could represent the money in Marianna's savings account (y) after x months?

A. $y = 10x + 30$

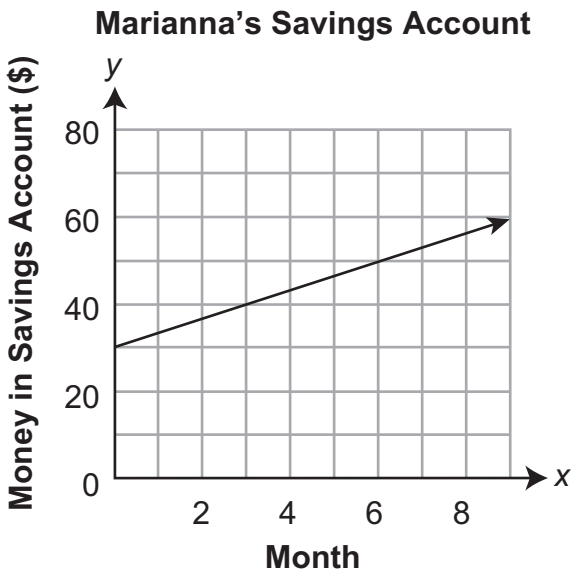
B. $y = 10 - 30x$

C.

Marianna's Savings Account

Month (x)	Money in Savings Account (y)
3	$100
5	$160
7	$220

D.

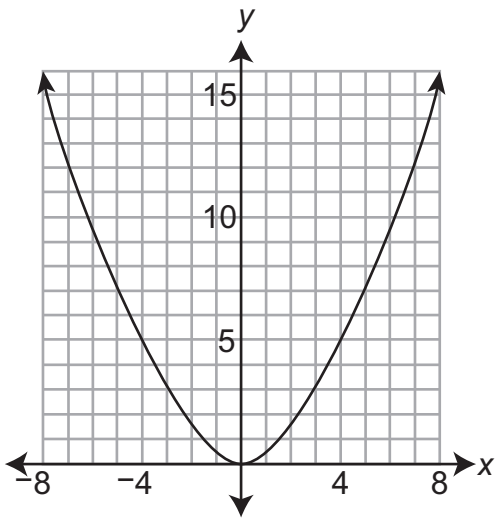


Item Information				
Alignment	B-F.1.1			
Answer Key	C			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
28%	9%	48%	15%	

Option Annotations

A. sees 30 is represented, but not as slope
B. sees 30 and ignores the negative part of the slope
C. correct
D. identifies slope as 30/1 instead of 10/3

6. The graph below represents a function.



Which single transformation could be applied to the graph so that it no longer represents a function?

A. reflection across the *x*-axis

B. reflection across the *y*-axis

C. rotation of 90° clockwise about the origin

D. translation 5 units to the left

Item Information				Option Annotations
Alignment	B-F.1.1.1 C-G.1.1.1			A. thinks a function must have some positive *y*-values B. confuses this with a reflection across $y = x$ C. correct D. thinks all functions must go through the origin
Answer Key	C			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
14%	22%	48%	16%	

7. Two linear functions of x are shown below.

Function 1

$y = 30x + 19$

Function 2

x	y
−12	−311
−8	−211
−3	−86
1	14

Which statement about the functions is true?

A. Function 2 can be described by the equation $y = 35x – 109$.

B. Function 2 can be described by the equation $y = 100x – 11$.

C. The y-intercept of function 1 is less than the y-intercept of function 2.

D. The rate of change of function 1 is greater than the rate of change of function 2.

Item Information	
Alignment	B-F.1.1.2 B-F.1.1.3
Answer Key	D
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
10%	12%	30%	48%

Option Annotations

A. sees $35x + 109$ works for first pair in table, but writes as $35x – 109$
B. uses difference of first two y-values as slope
C. misidentifies y-intercept of function 2
D. correct

8. Luis is building a new deck and needs to have a slab of concrete poured. He knows the contractor charges an initial cost of $75 plus an additional $2.50 per square foot of concrete. Which equation can be used to determine the cost (y), in dollars, to pour a concrete slab with an area of x square feet?

A. $y = 2.5x + 75$

B. $y = 7.5x + 2.5$

C. $y = 75x + 2.5$

D. $y = 77.5x$

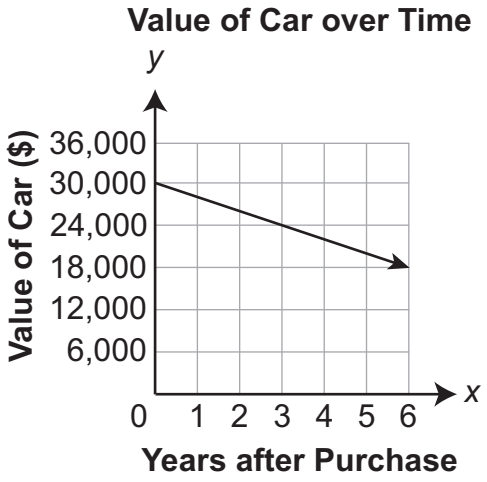
Item Information	
Alignment	B-F.2.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
70%	8%	17%	5%

Option Annotations

A. correct
B. converts 75 to 7.5 and uses it as the rate
C. reverses the rate and initial cost
D. adds 75 and 2.5 and assumes that is the rate per square foot

9. The graph below shows the relationship between the number of years after a car is purchased and the car's value.



Which statement correctly describes the relationship shown in the graph?

A. The car's initial value is $2,000, and the car's value increases $30,000 each year.

B. The car's initial value is $18,000, and the car's value increases $2,000 each year.

C. The car's initial value is $30,000, and the car's value decreases $2,000 each year.

D. The car's initial value is $30,000, and the car's value decreases $12,000 each year.

Item Information	
Alignment	B-F.2.1.2
Answer Key	C
Depth of Knowledge	2

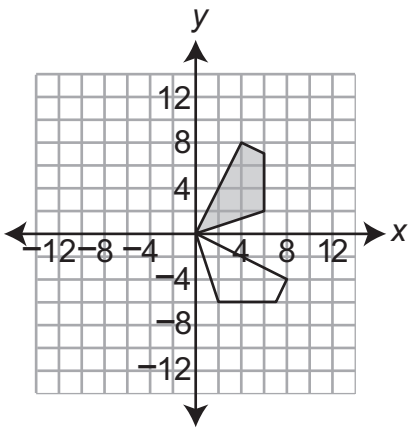
***p*-values**			
A	**B**	**C**	**D**
3%	5%	79%	13%

Option Annotations

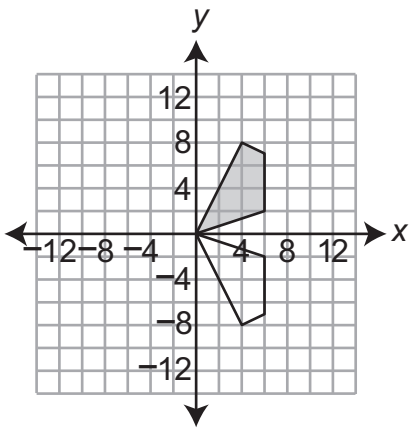
A. reverses meaning for slope and *y*-intercept and misreads direction of slope in graph
B. reads graph from right to left
C. correct
D. uses change in value at end of 6 years as rate of change

10. Which coordinate plane shows that the shaded polygon is the image of the unshaded polygon after a 90° counterclockwise rotation about the origin?

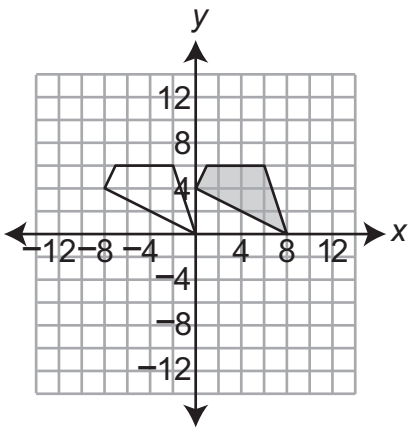
A.



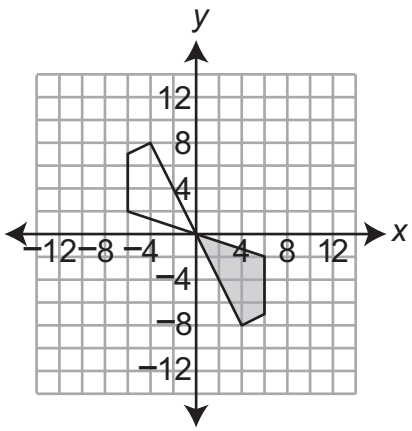
B.



C.



D.



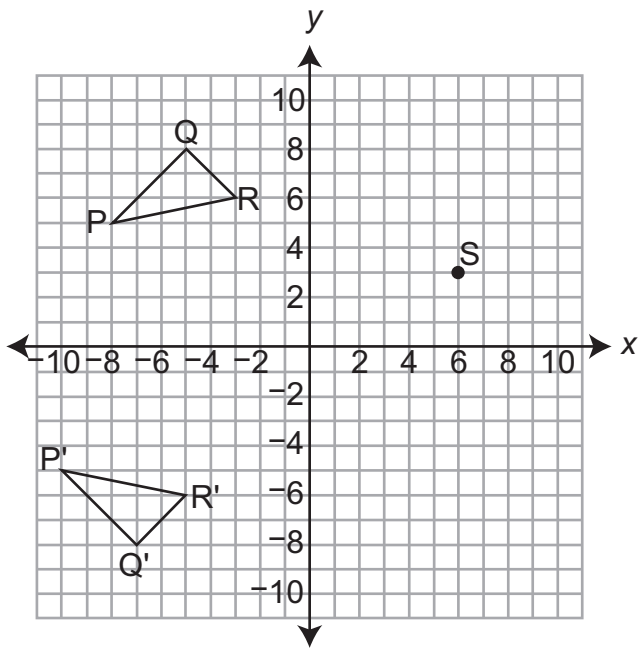
Item Information	
Alignment	C-G.1.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
49%	20%	7%	24%

Option Annotations

A. correct
B. uses reflection across *x*-axis
C. uses a translation, but thinks 90 degrees because of shifting from one quadrant to another
D. uses 180-degree rotation

11. In the figure shown below, triangle PQR is transformed to create triangle P'Q'R'.



Point S will be transformed the same way as triangle PQR. Which sentence could describe how point S will be transformed?

A. Point S will be translated to (6, 0) and then rotated to (0, 6).

B. Point S will be translated to (6, 0) and then rotated to (0, −6).

C. Point S will be translated to (4, 3) and then reflected to (−4, 3).

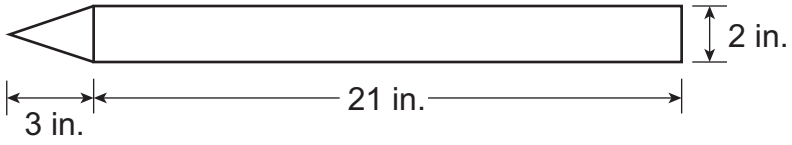
D. Point S will be translated to (4, 3) and then reflected to (4, −3).

Item Information		Option Annotations
Alignment	C-G.1.1.2 C-G.1.1.3	A. picks an option that includes the axes B. thinks the two triangles are rotations of one another C. reflects the point across the wrong axis D. correct
Answer Key	D	
Depth of Knowledge	2	

***p*-values**			
A	**B**	**C**	**D**
15%	20%	22%	43%

12. A balloon in the shape of a crayon is shown below.

Crayon Balloon



The crayon balloon is made up of a cone and a cylinder. What is the volume, in cubic inches, of the crayon balloon?

A. 69.12

B. 75.40

C. 138.23

D. 276.46

Item Information	
Alignment	C-G.3.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
49%	19%	18%	14%

Option Annotations
A. correct B. uses formula for volume of a cylinder instead of a cone C. calculates 1 squared as 1 times 2 D. uses 2 inches as the radius

13. Part of a sculpture is a stone sphere with a volume of 36π cubic feet. What is the radius, in feet, of the stone sphere?

A. 3

B. 6

C. 9

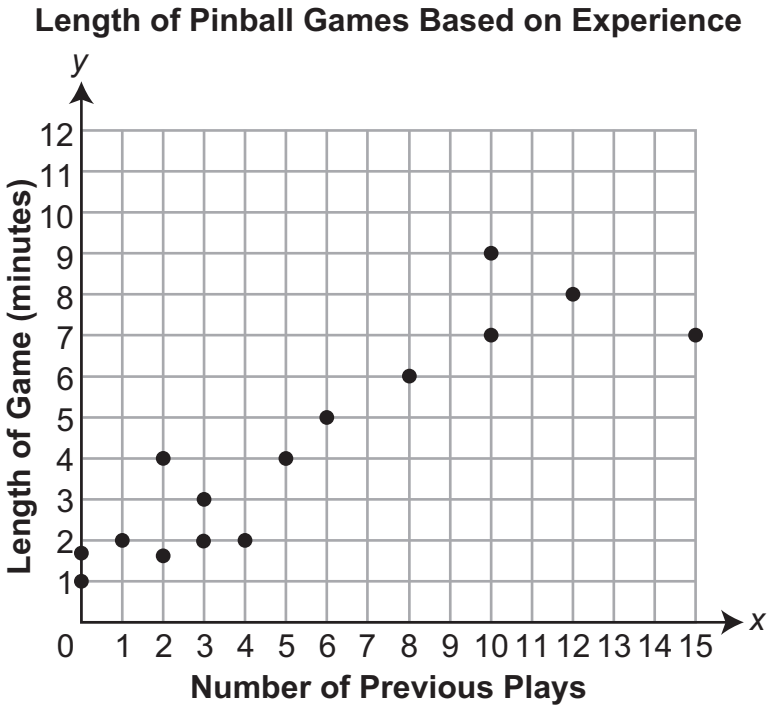
D. 12

Item Information	
Alignment	C-G.3.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
40%	26%	15%	19%

Option Annotations
A. correct B. finds square root of 36 C. finds value of *r* cubed and then divides by 3 D. divides 36 by 3

14. Christy created the scatter plot shown below.



Christy finds that the line of best fit for the data has the equation $y = 0.51x + 1.48$. Which statement **best** explains how removing the point (15, 7) would affect the slope of the line of best fit?

A. The slope of the line of best fit would decrease because the point lies below the original line of best fit.

B. The slope of the line of best fit would decrease because the point lies above the original line of best fit.

C. The slope of the line of best fit would increase because the point lies below the original line of best fit.

D. The slope of the line of best fit would increase because the point lies above the original line of best fit.

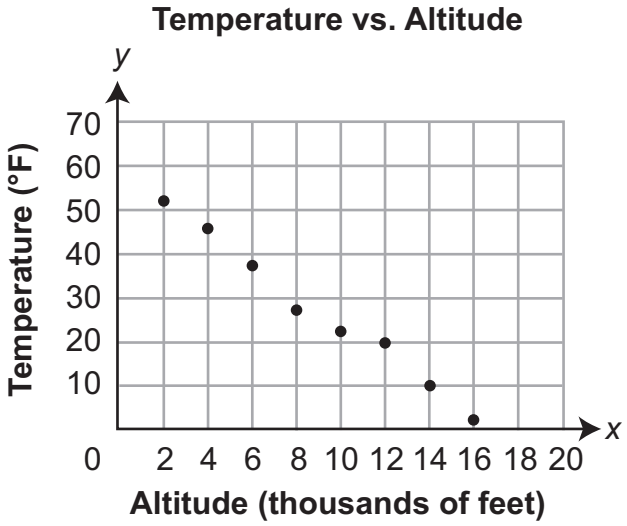
Item Information	
Alignment	D-S.1.1.1
Answer Key	C
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
20%	9%	56%	15%

Option Annotations

A. identifies where the point lies but thinks removing it would cause the line to move further down
B. gets the correct relationship between the location of the point and the slope but the wrong location of the point
C. correct
D. gets the location of the line incorrect and thinks that removing a point above the line will cause the slope of the line to increase

15. The scatter plot below shows the temperatures (y), in degrees Fahrenheit (°F), that were recorded at different altitudes (x), in thousands of feet.



Which equation could represent the line of best fit for the temperatures, in degrees Fahrenheit, based on the altitudes, in thousands of feet?

A. $y = -\frac{9}{4}x + 47$

B. $y = -\frac{7}{2}x + 59$

C. $y = -5x + 69$

D. $y = -5x + 80$

Item Information	
Alignment	D-S.1.1.2
Answer Key	B
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
20%	46%	21%	13%

Option Annotations
A. chooses line that passes through data points (8, 29) and (12, 20) B. correct C. chooses line that passes through data points (6, 39) and (8, 29) D. chooses line that passes through data points (12, 20) and (14, 10)

16. Blake interviewed 24 students to see whether they collected sports cards and whether they participated in sports. The table below shows his data.

Sports-Card Collecting and Sports Participation

	Participates in Sports	**Does Not Participate in Sports**
Collects Sports Cards	6	3
Does Not Collect Sports Cards	*x*	7

How many of the students Blake interviewed participate in sports?

A. 4

B. 10

C. 14

D. 15

Item Information	
Alignment	D-S.1.2.1
Answer Key	C
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
16%	17%	63%	4%

Option Annotations

A. thinks both columns should be equal ($6 + x = 3 + 7$)
B. finds how many do not participate in sports
C. correct
D. finds how many do not collect sports cards

OPEN-ENDED QUESTION

17. Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The rain fell at the same rate throughout the first 180 minutes of the rainfall.

A. Complete the table below with the number of minutes it took for 9 centimeters of rain to fall and the number of centimeters of rain that fell through 150 minutes.

Rainfall

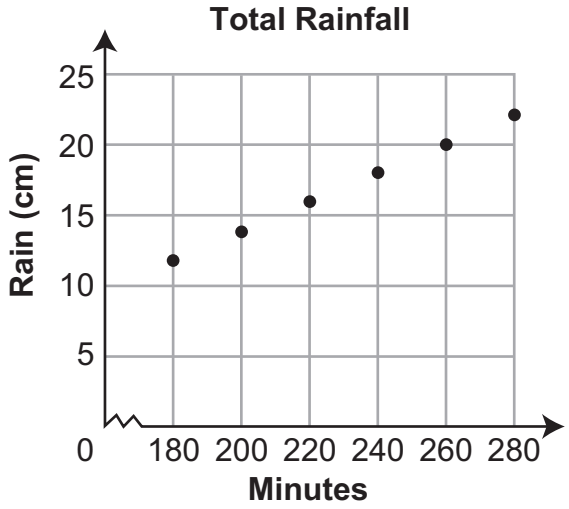
Time (minutes)	30	45	60	90	_____	150	180
Rain (cm)	2	3	4	6	9	_____	12

B. Write an equation to describe the relationship between the time (t), in minutes, and the amount of rain (r), in centimeters.

Go to the next page to finish question 17.

17. ***Continued.*** Please refer to the previous page for task explanation.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.



C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

Item-Specific Scoring Guideline

#17 Item Information

Alignment	B-E.2	**Depth of Knowledge**	2	**Mean Score**	1.73

Assessment Anchor this item will be reported under:

M08.B-E.2—Understand the connections between proportional relationships, lines, and linear equations.

Specific Anchor Descriptor addressed by this item:

M08.B-E.2.1—Analyze and describe linear relationships between two variables, using slope.

Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of connections between proportional relationships, lines, and linear equations by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of connections between proportional relationships, lines, and linear equations by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of connections between proportional relationships, lines, and linear equations by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of connections between proportional relationships, lines, and linear equations.
0	The response has no correct answer and insufficient evidence to demonstrate any understanding of the mathematical concepts and procedures as required by the task. Response may show only information copied from the question.

Top-Scoring Student Response and Training Notes

Score	Description
4	Student earns 4 points.
3	Student earns 3.0–3.5 points.
2	Student earns 2.0–2.5 points.
1	Student earns 0.5–1.5 points. OR Student demonstrates minimal understanding of connections between proportional relationships, lines, and linear equations.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Top-Scoring Response

Part A (1 point):

$\frac{1}{2}$ point for each correct answer

What?	Why?
Rainfall **Time (minutes)** 30 45 60 90 135 150 180 **Rain (cm)** 2 3 4 6 9 10 12	

Part B (1 point):

1 point for correct equation

What?	Why?
$t = 15r$ **OR** $r = \frac{1}{15}t$ **OR equivalent**	

Part C (1 point):

1 point for complete explanation

OR $\frac{1}{2}$ point for correct but incomplete explanation

What?	Why?
	Sample Explanation: The slope is steeper for the second part. This means it is raining more during that time.

Part D (1 point):

1 point for complete explanation

What?	Why?
	Sample Explanation: A slope of 0 means it stopped raining.

STUDENT RESPONSE

Response Score: 4 points

17. Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The rain fell at the same rate throughout the first 180 minutes of the rainfall.

A. Complete the table below with the number of minutes it took for 9 centimeters of rain to fall and the number of centimeters of rain that fell through 150 minutes.

Rainfall

Time (minutes)	30	45	60	90	135	150	180
Rain (cm)	2	3	4	6	9	10	12

The student has given two correct answers.

B. Write an equation to describe the relationship between the time (t), in minutes, and the amount of rain (r), in centimeters.

$t = 15r$

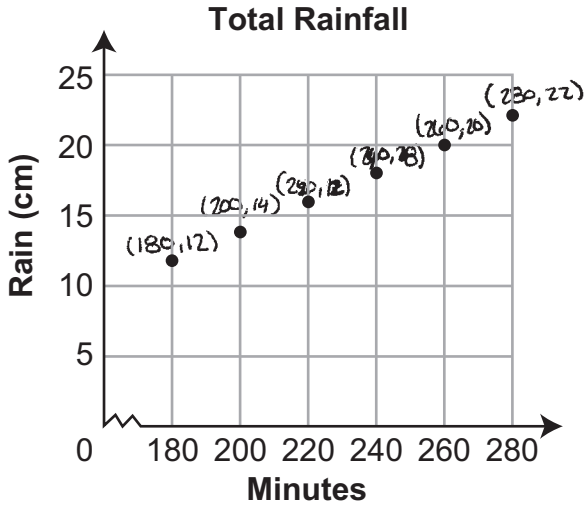
The student has given a correct equation.

Go to the next page to finish question 17.

17. ***Continued.*** Please refer to the previous page for task explanation.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.

$m = \frac{1}{10}$



C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

In this scatter plot it takes 10 minutes to get a cm of rain compaired to the previoos 15 minutes. This means it is steadily increasing and will yeild a larger amount of rain faster.

The student has given a complete description.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

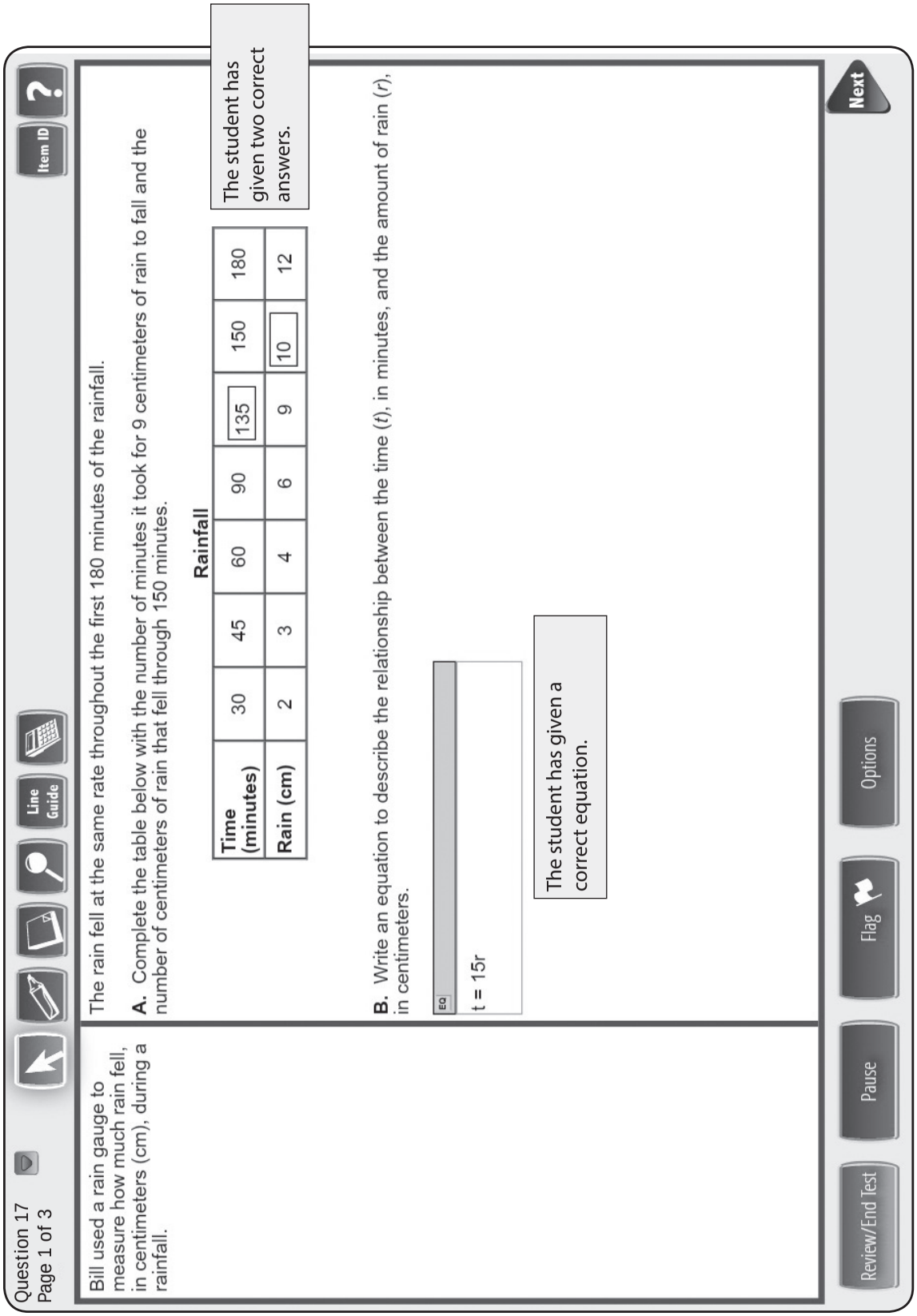
It means the rain has stopped.

The student has given a complete explanation.

STUDENT RESPONSE

Response Score: 3 points

PARTS A AND B



Question 17
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Line Guide | Item ID | ?

Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.

C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

EQ

the slope is going at the same rate. For every 15 minutes it is 1 centimeter of rainfall.

The student has given an incorrect explanation.

89 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

Question 17
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Line Guide

Item ID

Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

EQ

When it goes down to 0, that means that it has stopped raining.

The student has given a complete explanation.

63 / 1000

Review/End Test | Pause | Flag | Options | Back

STUDENT RESPONSE

Response Score: 2 points

17. Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The rain fell at the same rate throughout the first 180 minutes of the rainfall.

A. Complete the table below with the number of minutes it took for 9 centimeters of rain to fall and the number of centimeters of rain that fell through 150 minutes.

Rainfall

Time (minutes)	30	45	60	90	135	150	180
Rain (cm)	2	3	4	6	9	10	12

The student has given two correct answers.

B. Write an equation to describe the relationship between the time (t), in minutes, and the amount of rain (r), in centimeters.

$15r = T$

Time = T

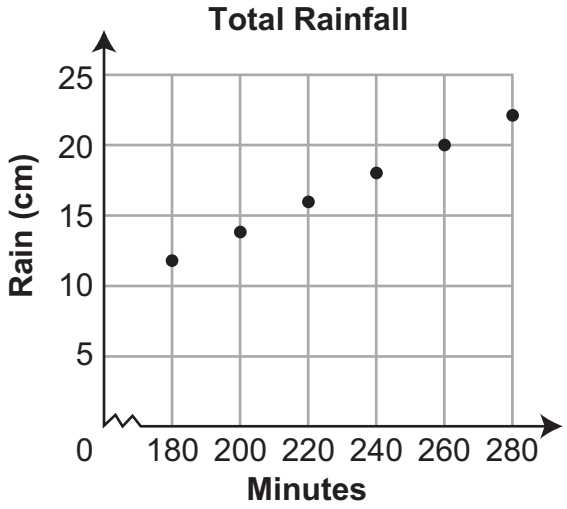
Rain =

The student has given a correct equation.

Go to the next page to finish question 17.

17. ***Continued.*** Please refer to the previous page for task explanation.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.



C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

The change in slope is because instead of the minutes increasing by 10 they are increasing by 20. This would make the slope decrease

The student has given an incorrect explanation.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

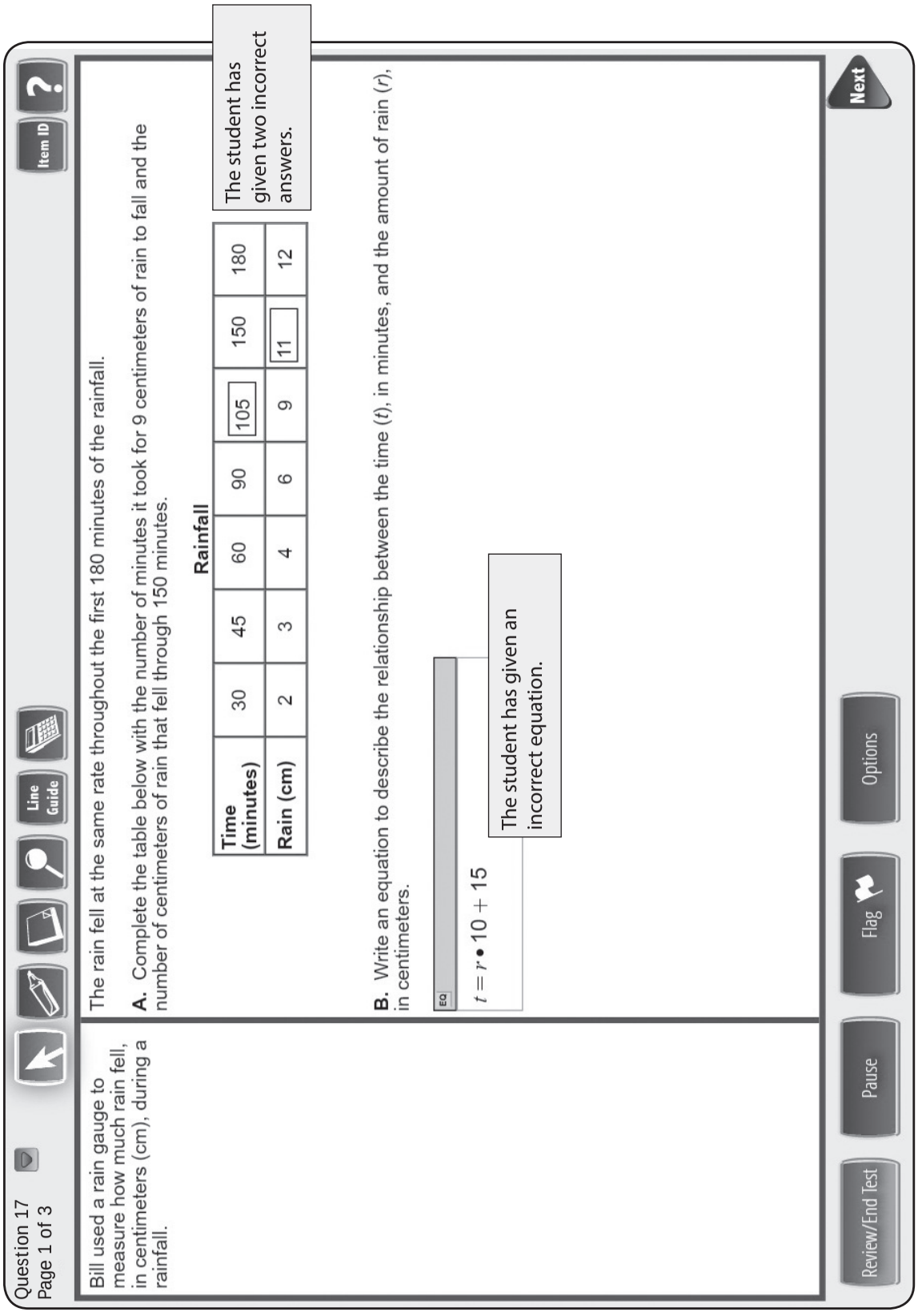
A slope of 0 means the line doesn't move.

The student has given an incorrect explanation.

STUDENT RESPONSE

Response Score: 1 point

PARTS A AND B



Question 17
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Line Guide

Item ID

Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.

C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

EQ

the slope goes strait up meaning the rainfall was concistant

The student has given an incorrect explanation.

60 / 1000

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Question 17
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Line Guide | Item ID | ?

Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

EQ

the rain stopped falling

The student has given a complete explanation.

24 / 1000

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STUDENT RESPONSE

Response Score: 0 points

17. Bill used a rain gauge to measure how much rain fell, in centimeters (cm), during a rainfall.

The rain fell at the same rate throughout the first 180 minutes of the rainfall.

A. Complete the table below with the number of minutes it took for 9 centimeters of rain to fall and the number of centimeters of rain that fell through 150 minutes.

Rainfall

Time (minutes)	30	45	60	90	120	150	180
Rain (cm)	2	3	4	6	9	11	12

The student has given two incorrect answers.

B. Write an equation to describe the relationship between the time (t), in minutes, and the amount of rain (r), in centimeters.

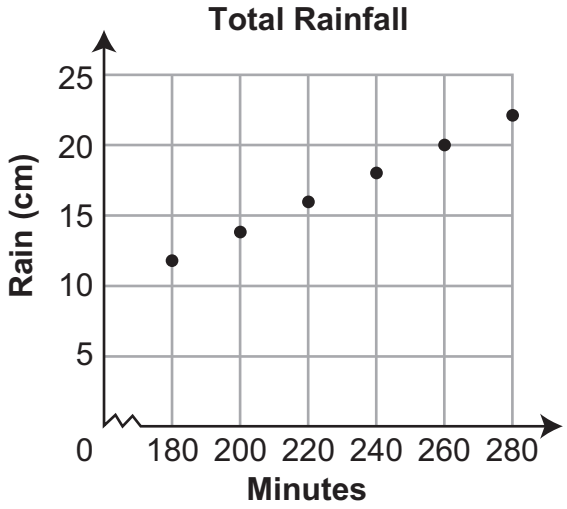
for every every 30 min theres 2cm of rain

The student has not given a correct equation.

Go to the next page to finish question 17.

17. ***Continued.*** Please refer to the previous page for task explanation.

The total amount of rain that fell from 180 minutes through 280 minutes is shown in the scatter plot below.



C. Describe the change in the slope between the first 180 minutes and the following 100 minutes, and explain what it means in terms of the total amount of rainfall.

the amount of rain went up alot

The student has given an incorrect explanation.

After 280 minutes, the slope of the graph is 0.

D. Explain what a slope of 0 means in this situation.

its not going up any more

The student has given an incorrect explanation.

MATHEMATICS—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-values			
				A	B	C	D
1	B-E.1.1.1	A	1	41%	12%	29%	18%
2	B-E.1.1.4	A	1	75%	13%	7%	5%
3	B-E.3.1.4	A	1	46%	19%	22%	13%
4	B-E.3.1.5	B	2	19%	55%	15%	11%
5	B-F.1.1	C	2	28%	9%	48%	15%
6	B-F.1.1.1 C-G.1.1.1	C	2	14%	22%	48%	16%
7	B-F.1.1.2 B-F.1.1.3	D	2	10%	12%	30%	48%
8	B-F.2.1.1	A	2	70%	8%	17%	5%
9	B-F.2.1.2	C	2	3%	5%	79%	13%
10	C-G.1.1.1	A	2	49%	20%	7%	24%
11	C-G.1.1.2 C-G.1.1.3	D	2	15%	20%	22%	43%
12	C-G.3.1.1	A	2	49%	19%	18%	14%
13	C-G.3.1.1	A	2	40%	26%	15%	19%
14	D-S.1.1.1	C	2	20%	9%	56%	15%
15	D-S.1.1.2	B	2	20%	46%	21%	13%
16	D-S.1.2.1	C	2	16%	17%	63%	4%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	B-E.2	4	2	1.73