Pennsylvania PSSA 2016 Grade 3 Math

Exam & Answer Key Materials
Pages 2 - 36

pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics
Item and Scoring Sampler

2016–2017
Grade 3

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

MATHEMATICS TEST DIRECTIONS

Directions: On the following pages are the Mathematics questions.

- You may not use a calculator on this test.
- You may need a ruler for question(s) 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 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 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 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:

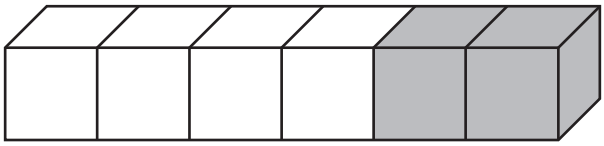
BLK (blank).....Blank, entirely erased, or written refusal to respond
OT.....Off task
LOE .....Response in a language other than English
IL .....Illegible

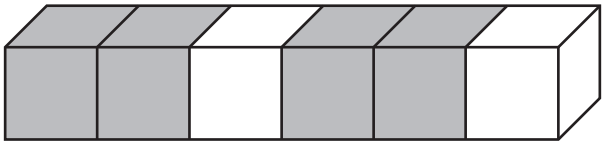
MULTIPLE-CHOICE ITEMS

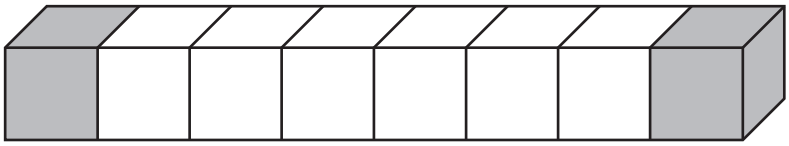
1. Joel is putting gray and white cubes together into a group.

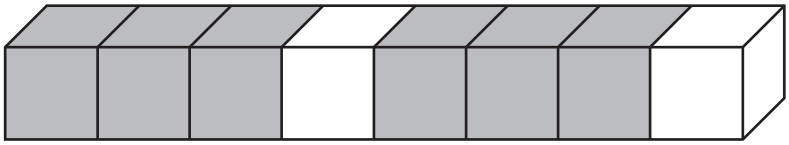
In his group, $\frac{2}{6}$ of the cubes are **white**.

Which could be the group Joel put together?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

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

***p*-values**			
A	**B**	**C**	**D**
38%	49%	7%	6%

Option Annotations

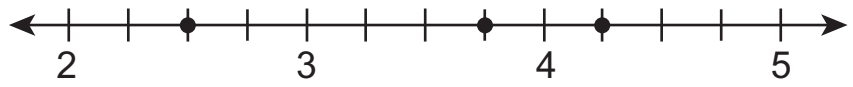
A. 4/6 (2/6 are gray)
B. correct
C. 6/8 (ratio of 6 to 2)
D. 2/8 (ratio of 2 to 6)

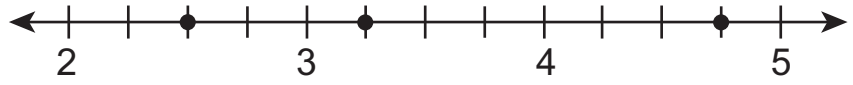
2. Roger has a box that is $3\frac{3}{4}$ inches wide.

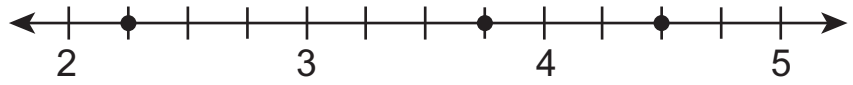
The length of the box is $4\frac{1}{4}$ inches.

The height of the box is $2\frac{2}{4}$ inches.

Which number line shows each measurement of Roger's box?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Item Information	
Alignment	A-F.1.1.2 A-F.1.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
49%	15%	16%	20%

Option Annotations

A. correct
B. switches fractional parts for width and length
C. switches fractional parts for length and height
D. switches fractional parts for width and height

3. Which comparison is true?

Ⓐ $\frac{2}{8} > \frac{5}{8}$

Ⓑ $\frac{2}{8} > \frac{7}{8}$

Ⓒ $\frac{5}{8} < \frac{2}{8}$

Ⓓ $\frac{5}{8} < \frac{7}{8}$

Item Information	
Alignment	A-F.1.1.5
Answer Key	D
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
10%	7%	9%	74%

Option Annotations

A. incorrectly reads symbol
B. incorrectly reads symbol
C. incorrectly reads symbol
D. correct

4. Katie earns $5 for each lawn she mows.

Last week she earned $25 mowing lawns.

This week she earned $15 mowing lawns.

Which statement correctly explains how many more lawns Katie mowed last week than this week?

Ⓐ Katie mowed 2 more lawns because 25 ÷ 5 is 2 more than 15 ÷ 5.

Ⓑ Katie mowed 10 more lawns because 25 – 5 is 10 more than 15 – 5.

Ⓒ Katie mowed 10 more lawns because 25 + 5 is 10 more than 15 + 5.

Ⓓ Katie mowed 50 more lawns because 25 × 5 is 50 more than 15 × 5.

Item Information				Option Annotations
Alignment	B-O.1 B-O.3.1.1			A. correct B. uses wrong operation C. uses wrong operation D. uses wrong operation
Answer Key	A			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
44%	23%	21%	12%	

5. Amar puts all of his crayons into boxes.

There are exactly 8 crayons in each box.

Which expression shows how Amar could have found the number of crayons to put into each box?

Ⓐ 28 ÷ 4

Ⓑ 32 ÷ 4

Ⓒ 36 ÷ 4

Ⓓ 40 ÷ 4

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

***p*-values**			
A	**B**	**C**	**D**
28%	51%	10%	11%

Option Annotations
A. 7 crayons per box B. correct C. 9 crayons per box D. 10 crayons per box

6. A company orders 40 cases of paper for 8 stores.

A worker wrote the equation shown below.

$$40 \div 8 = \square$$

Which statement could explain what the missing number ($\square$) in the equation represents?

Ⓐ The company ordered 5 extra cases of paper.

Ⓑ The company ordered 32 extra cases of paper.

Ⓒ The company will send 5 cases of paper to each of its 8 stores.

Ⓓ The company will send 6 cases of paper to each of its 8 stores.

Item Information	
Alignment	B-O.1.2.2 B-O.1.1.2
Answer Key	C
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
28%	11%	51%	10%

Option Annotations

A. gets the correct number but the wrong interpretation, thinking of remainders
B. 40 – 8 and gets the incorrect interpretation, thinking of remainders
C. correct
D. thinks 40 ÷ 8 = 6

7. There are 8 rows of computers in a classroom.

There are 3 computers in each row.

At each computer, 2 students are working together.

The expression 8 × 3 × 2 represents how many students are in the classroom.

Which expression also represents how many students there are in the classroom?

Ⓐ 3 × 10

Ⓑ 3 × 16

Ⓒ 11 × 2

Ⓓ 21 × 2

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

***p*-values**			
A	**B**	**C**	**D**
20%	50%	16%	14%

Option Annotations

A. adds 8 and 2 instead of multiplying
B. correct
C. adds 8 and 3 instead of multiplying
D. makes an error in multiplication

8. Mr. Randall is starting a tree farm.

He has planted 72 trees in 9 equal rows.

Mr. Randall used an equation to find the number of trees (☐) he planted in each row.

The equation he used was 9 × ☐ = 72.

Which equation shows another way to find the number of trees (☐) Mr. Randall planted in each row?

Ⓐ 72 + 9 = ☐
Ⓑ 72 ÷ 9 = ☐
Ⓒ 72 × 9 = ☐
Ⓓ 72 – 9 = ☐

Item Information	
Alignment	B-O.2.2.1
Answer Key	B
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
4%	73%	20%	3%

Option Annotations

A. uses wrong operation
B. correct
C. uses wrong operation
D. uses wrong operation

9. Nate bought two 50-pound bags of birdseed.

He used 30 pounds in one week.

Which equation shows how many pounds of birdseed (☐) Nate still has?

Ⓐ $2 + 50 - 30 = \square$

Ⓑ $50 + 50 - 30 = \square$

Ⓒ $2 \times 50 + 30 = \square$

Ⓓ $50 + 50 + 30 = \square$

Item Information	
Alignment	B-O.3.1.2
Answer Key	B
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
25%	54%	13%	8%

Option Annotations

A. adds 2 instead of multiplying
B. correct
C. correctly multiplies by 2 but adds 30
D. correctly adds second 50 but adds 30

10. Marshawn wants to buy a bike that costs $180.

He has saved $60 from babysitting.

He has saved $130 from doing yard work.

Which number sentence correctly shows whether Marshawn has saved enough money to buy the bike?

Ⓐ $130 < 180 + 60$

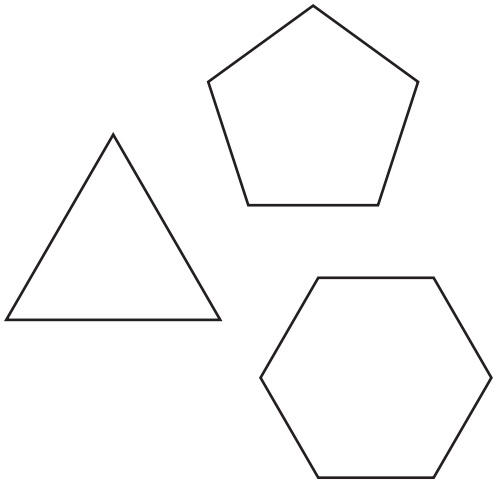
Ⓑ $180 > 130 - 60$

Ⓒ $60 + 130 > 180$

Ⓓ $180 - 130 < 60$

Item Information				Option Annotations
Alignment	B-O.3.1.7 B-O.3.1.6			A. correct inequality but does not represent the story B. correct inequality but does not represent the story C. correct D. correct inequality but does not represent the story
Answer Key	C			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
22%	10%	63%	5%	

11. The shapes below are all in a group because their sides have equal lengths.



A quadrilateral is added to the group.

Which term **best** describes the quadrilateral that is added to the group?

Ⓐ octagon
Ⓑ pentagon
Ⓒ rhombus
Ⓓ triangle

Item Information	
Alignment	C-G.1.1.1 C-G.1.1.2
Answer Key	C
Depth of Knowledge	1

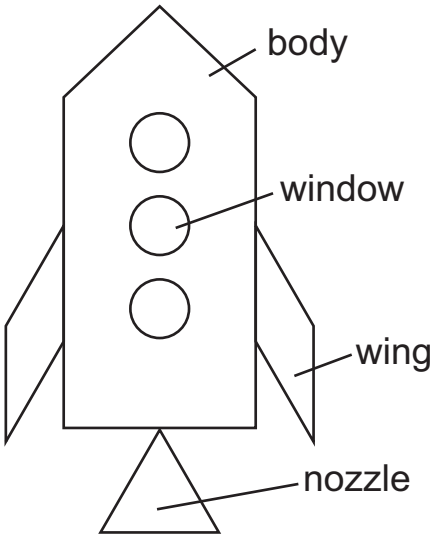
***p*-values**			
A	**B**	**C**	**D**
17%	22%	43%	18%

Option Annotations

A. not a quadrilateral, but octagon would belong in the group
B. not a quadrilateral, and pentagon already in the group
C. correct
D. not a quadrilateral, and equilateral triangle already in the group

12. Hernando used different shapes to create the diagram of his rocket as shown below.

Hernando's Rocket



Which part of Hernando's diagram is a quadrilateral?

Ⓐ body
Ⓑ window
Ⓒ wing
Ⓓ nozzle

Item Information	
Alignment	C-G.1.1.2
Answer Key	C
Depth of Knowledge	1

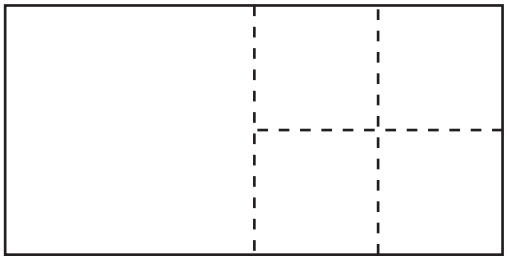
***p*-values**			
A	**B**	**C**	**D**
21%	3%	66%	10%

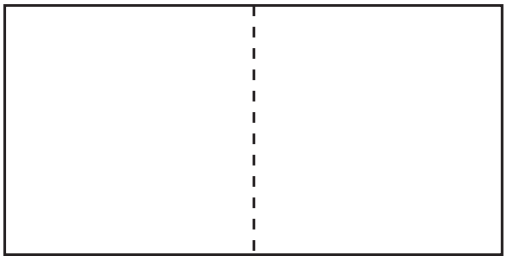
Option Annotations

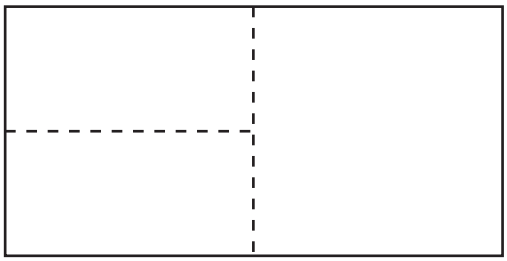
A. incorrect definition of quadrilateral; body is a pentagon
B. incorrect definition of quadrilateral; window is not a polygon
C. correct
D. incorrect definition of quadrilateral; nozzle is an equilateral triangle

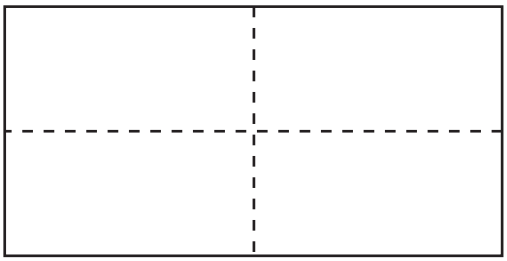
13. When Mr. Phan finished dividing a candy bar, all parts were squares with equal areas.

Which could be Mr. Phan's candy bar after he finished dividing it?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Item Information	
Alignment	C-G.1.1.3 C-G.1.1.2
Answer Key	B
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
7%	49%	2%	42%

Option Annotations

A. identifies all the shapes as squares but does not identify them as having unequal areas
B. correct
C. identifies one of the shapes as a square but does not pay attention to the areas of each partition
D. identifies the partitions as having equal area but misidentifies the rectangles as squares

14. Kira started riding her bike at the time shown on the clock.

She stopped riding her bike at 3:27.

How long did Kira ride her bike?

Ⓐ 17 minutes
Ⓑ 25 minutes
Ⓒ 35 minutes
Ⓓ 37 minutes

Item Information		Option Annotations
Alignment	D-M.1.1.1 D-M.1.1.2	A. subtracts 10 (where minute hand is pointing) from 27 B. 52 – 27 C. correct D. 27 + 10
Answer Key	C	
Depth of Knowledge	2	

***p*-values**			
A	**B**	**C**	**D**
12%	21%	45%	22%

15. Gwen bought a milkshake for $3.52.

She paid for the milkshake with $5.00.

Which amount of money shows the correct change Gwen should receive?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Item Information	
Alignment	D-M.1.3.2
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
50%	8%	11%	31%

Option Annotations

A. correct
B. confuses dimes and nickels ($1.38)
C. does not regroup while subtracting ($1.58)
D. subtracts smaller digit from larger digit in each place value ($2.52)

16. A picture of a garden is shown below.

Garden

10 feet

?

The perimeter of the garden is 32 feet.

What is the missing length of the side of the garden?

Ⓐ 6 feet
Ⓑ 10 feet
Ⓒ 12 feet
Ⓓ 22 feet

Item Information	
Alignment	D-M.4.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
57%	7%	10%	26%

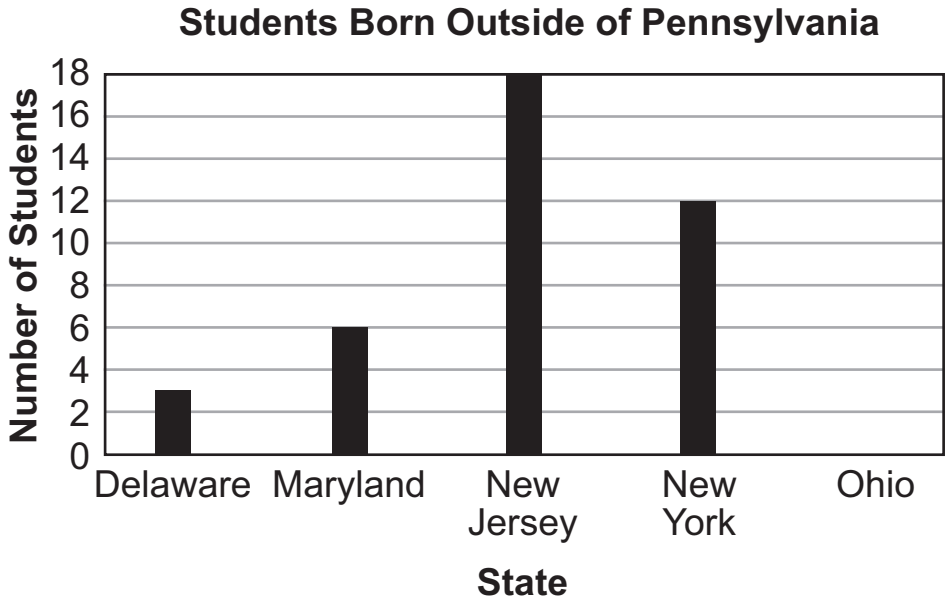
Option Annotations

A. correct
B. confuses with other side
C. 32 – 20, forgot to divide by 2
D. 32 – 10

OPEN-ENDED QUESTION

17. The bar graph below shows the number of students at Abigail's school who were born outside of Pennsylvania.

The information for Ohio is not included in the bar graph.



The number of students who were born in New Jersey is the same as the number of students who were born in two other states combined.

A. What are the two other states?

PUT your answers in the **BLANKS BELOW**.

State 1: _____

State 2: _____

Go to the next page to finish question 17.

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

There are more students at Abigail's school who were born in Maryland than were born in Ohio.

Also, there are more students who were born in Ohio than were born in Delaware.

B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

Answer: _____

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

Item-Specific Scoring Guideline

#17 Item Information

Alignment	D-M.2	**Depth of Knowledge**	3	**Mean Score**	1.27

Assessment Anchor this item will be reported under:

M03.D-M.2—Represent and interpret data.

Specific Anchor Descriptor addressed by this item:

M03.D-M.2.1—Organize, display, and answer questions based on data.

Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of representing and interpreting data by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of representing and interpreting data by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of representing and interpreting data by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of representing and interpreting data.
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 representing and interpreting data.
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):

1 point for correct answer

What?	Why?
State 1: Maryland State 2: New York [Note: Order does not matter]	

Part B (2 points):

1 point for correct answer
1 point for complete explanation

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

What?	Why?
4 or 5 [Note: student must include both numbers]	**Sample Explanation:** Since there were 3 students who were born in Delaware and 6 students born in Maryland, the number of students who were born in Ohio must be a whole number between 3 and 6. So the only possible numbers are 4 and 5.

Part C (1 point):

1 point for complete explanation

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

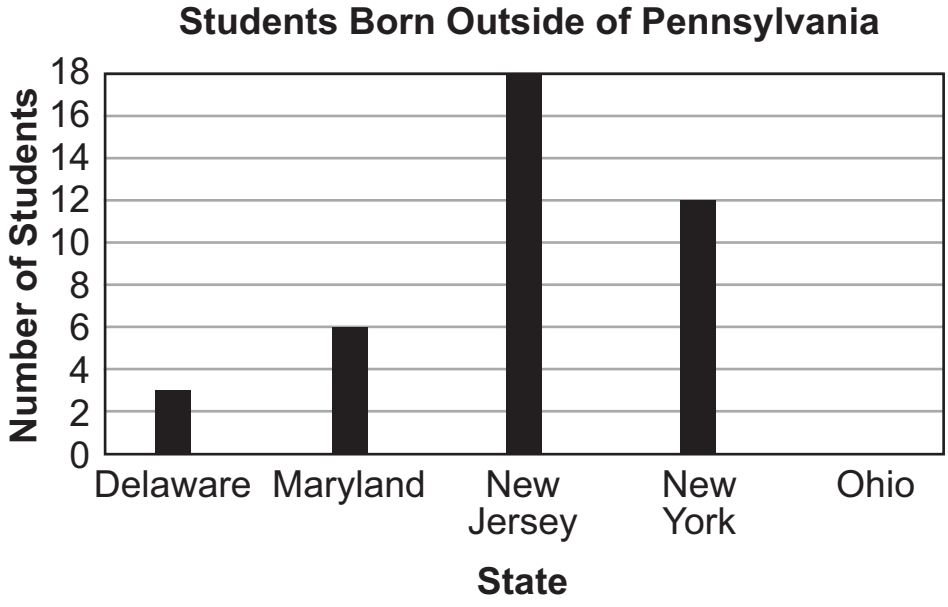
What?	Why?
	Sample Explanation: Although only even numbers appear on the left side of the graph, an odd number can be represented by placing a bar halfway between the even-numbered lines.

STUDENT RESPONSE

Response Score: 4 points

17. The bar graph below shows the number of students at Abigail's school who were born outside of Pennsylvania.

The information for Ohio is not included in the bar graph.



The number of students who were born in New Jersey is the same as the number of students who were born in two other states combined.

A. What are the two other states?

PUT your answers in the **BLANKS BELOW**.

The student has given a correct answer (order does not matter).

State 1: New York

State 2: Maryland

Go to the next page to finish question 17.

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

There are more students at Abigail's school who were born in Maryland than were born in Ohio.

Also, there are more students who were born in Ohio than were born in Delaware.

B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

4 and 5 are less than 6. 4 and 5 are more than 3.

The student has given a correct answer and complete explanation.

Answer: 4-5

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

Her reasoning is not correct because you ~~cannot~~ Can put your bar in between two even numbers ~~like~~ and get a odd number in Deleware.

The student has given a complete explanation.

STUDENT RESPONSE

Response Score: 3 points

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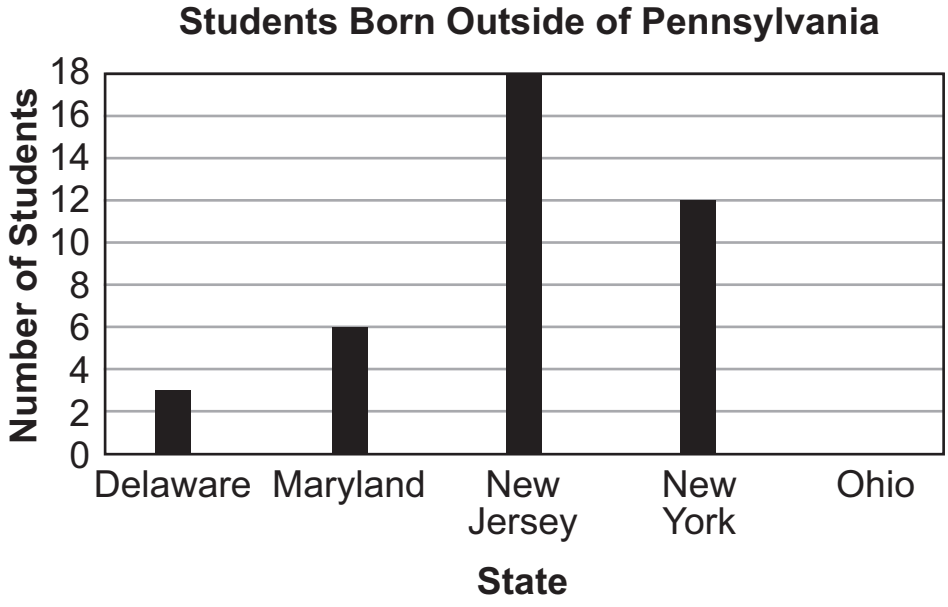

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B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

4 children because less than MaryLand but more than Delaware.

Answer: 4 children

The student has given an incorrect answer (both numbers must be listed) and a complete explanation.

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

She is not correct because Delaware is odd it has [3]!

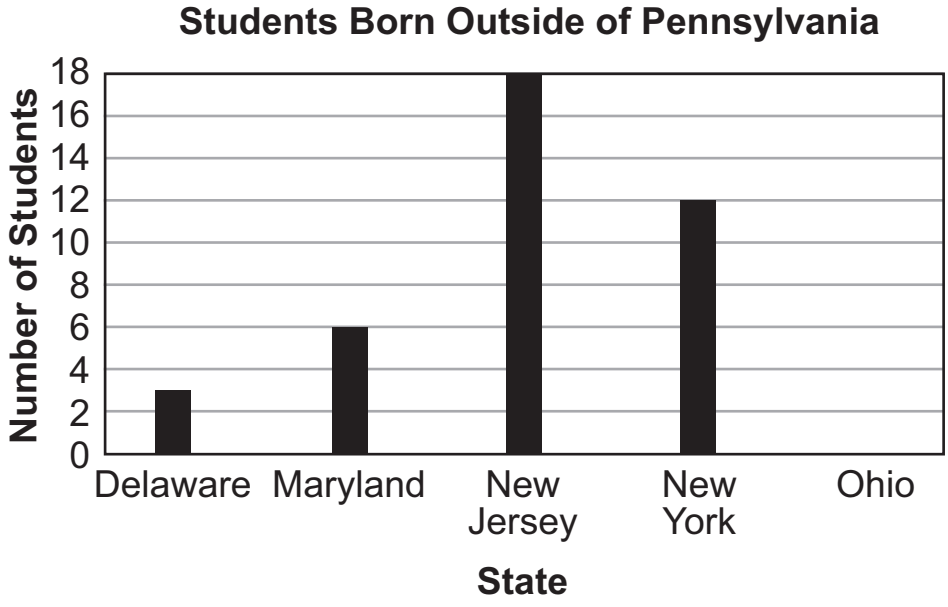
The student has given a complete explanation.

STUDENT RESPONSE

Response Score: 2 points

17. The bar graph below shows the number of students at Abigail's school who were born outside of Pennsylvania.

The information for Ohio is not included in the bar graph.



The number of students who were born in New Jersey is the same as the number of students who were born in two other states combined.

A. What are the two other states?

PUT your answers in the **BLANKS BELOW**.

The student has given a correct answer.

State 1: Maryland

State 2: New York

Go to the next page to finish question 17.

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

There are more students at Abigail's school who were born in Maryland than were born in Ohio.

Also, there are more students who were born in Ohio than were born in Delaware.

B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

I found my answer because I looked at the bar graph.

Answer: 4,5

The student has given a correct answer, but the explanation is insufficient for any credit.

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

She is not right because inbetween the even numbers there are odd ones.

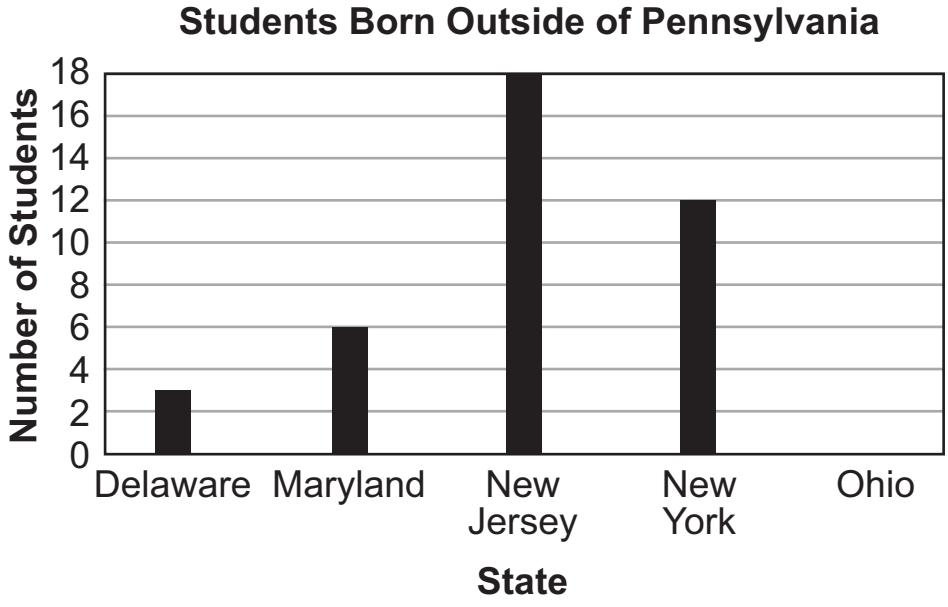
The student has given a correct but incomplete explanation (no reference to the bars or the states).

STUDENT RESPONSE

Response Score: 1 point

17. The bar graph below shows the number of students at Abigail's school who were born outside of Pennsylvania.

The information for Ohio is not included in the bar graph.



The number of students who were born in New Jersey is the same as the number of students who were born in two other states combined.

A. What are the two other states?

PUT your answers in the **BLANKS BELOW**.

The student has given a correct answer.

State 1: New York

State 2: Maryland

Go to the next page to finish question 17.

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

There are more students at Abigail's school who were born in Maryland than were born in Ohio.

Also, there are more students who were born in Ohio than were born in Delaware.

B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

I found this answer because Delaware can be 20 and Mrayland can be 40

Answer: 30

The student has given an incorrect answer and incorrect explanation.

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

It is not correct because Ohio c be one off.

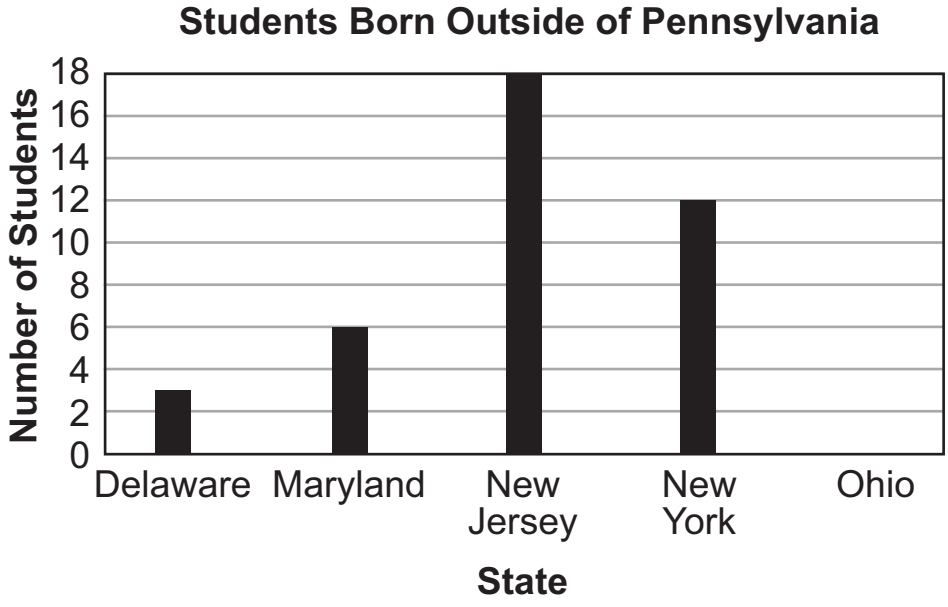
The student has given an incorrect explanation.

STUDENT RESPONSE

Response Score: 0 points

17. The bar graph below shows the number of students at Abigail's school who were born outside of Pennsylvania.

The information for Ohio is not included in the bar graph.



The number of students who were born in New Jersey is the same as the number of students who were born in two other states combined.

A. What are the two other states?

PUT your answers in the **BLANKS BELOW**.

The student has given an incorrect answer (both states must be correct for any credit).

State 1: New Jersey

State 2: New York

Go to the next page to finish question 17.

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

There are more students at Abigail's school who were born in Maryland than were born in Ohio.

Also, there are more students who were born in Ohio than were born in Delaware.

B. List all the possible numbers of students at Abigail's school who could have been born in Ohio.

PUT your answer in the **BLANK BELOW**.

EXPLAIN how you found your answer.

well you see that nobody live there so it could be 2 people was born in Ohio

Answer: 2

The student has given an incorrect answer and incorrect explanation.

Abigail says that the number of students in her school who were actually born in Ohio must be an even number since only even numbers appear on the left side of the graph.

C. **EXPLAIN** why Abigail's reasoning is **not** correct.

because it doesn't have to be even

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	A-F.1.1.1	B	1	38%	49%	7%	6%
2	A-F.1.1.2 A-F.1.1.1	A	2	49%	15%	16%	20%
3	A-F.1.1.5	D	1	10%	7%	9%	74%
4	B-O.1 B-O.3.1.1	A	2	44%	23%	21%	12%
5	B-O.1.1.2	B	2	28%	51%	10%	11%
6	B-O.1.2.2 B-O.1.1.2	C	2	28%	11%	51%	10%
7	B-O.2.1.2	B	2	20%	50%	16%	14%
8	B-O.2.2.1	B	1	4%	73%	20%	3%
9	B-O.3.1.2	B	2	25%	54%	13%	8%
10	B-O.3.1.7 B-O.3.1.6	C	2	22%	10%	63%	5%
11	C-G.1.1.1 C-G.1.1.2	C	1	17%	22%	43%	18%
12	C-G.1.1.2	C	1	21%	3%	66%	10%
13	C-G.1.1.3 C-G.1.1.2	B	1	7%	49%	2%	42%
14	D-M.1.1.1 D-M.1.1.2	C	2	12%	21%	45%	22%
15	D-M.1.3.2	A	2	50%	8%	11%	31%
16	D-M.4.1.1	A	2	57%	7%	10%	26%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	D-M.2	4	3	1.27