pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics
Item and Scoring Sampler

2018–2019
Grade 4

Mathematics Test Directions

On the following pages are the mathematics questions.

- You may <u>not</u> use a calculator for question 1. You may use a calculator for all other questions on this test.
- You may need a protractor for 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.**

Special Categories within zero reported separately:

Blank................................Blank, entirely erased, entirely crossed out, or consists entirely of whitespace

Refusal.............................Refusal to respond to the task

Off Task............................Makes no reference to the item but is not an intentional refusal

Foreign Language............Written entirely in a language other than English

Illegible ....Illegible or incoherent

Grade 4 Formula Sheet

Formulas and conversions that you may need on this test are found below.
You may refer back to this page at any time during the mathematics test.

2018
Grade 4

Standard Conversions
1 yard (yd) = 3 feet (ft)
1 foot = 12 inches (in.)

1 pound (lb) = 16 ounces (oz.)

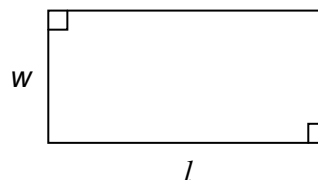1 gallon (gal) = 4 quarts (qt)
1 quart = 2 pints (pt)
1 pint = 2 cups (c)

Metric Conversions
1 kilometer (km) = 1,000 meters (m)
1 meter = 100 centimeters (cm)

1 kilogram (kg) = 1,000 grams (g)

1 liter (L) = 1,000 milliliters (mL)

Time Conversions
1 year (yr) = 12 months (mo)
1 year = 52 weeks (wk)
1 year = 365 days
1 week = 7 days
1 day = 24 hours (hr)
1 hour = 60 minutes (min)
1 minute = 60 seconds (sec)

Rectangle

Area = length × width
$A = l \times w$

Perimeter = length + length + width + width
$P = l + l + w + w$

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

MULTIPLE-CHOICE ITEMS

1. Divide: 5,917 ÷ 4

    A.   1,201

    B.   1,254 R1

    C.   1,319 R1

    D.   1,479 R1

Item Information	
Alignment	A-T.2.1.3
Answer Key	D
Depth of Knowledge	1
p-value A	11%
p-value B	13%
p-value C	11%
p-value D	65% (correct answer)
Option Annotations	A. divides straight across without subtracting B. subtracts 49 from the dividend instead of 4 in the first step C. incorrectly divides 19 by 4 in the second step and skips bringing down the 1 from the tens place D. correct

A calculator is permitted for use in solving questions 2–16 in this sampler.

2. Angie has a box that is $\frac{3}{4}$ foot long. Which fraction is equal to the length, in feet, of the box?

    A. $\frac{6}{12}$

    B. $\frac{8}{12}$

    C. $\frac{9}{12}$

    D. $\frac{11}{12}$

Item Information	
Alignment	A-F.1.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	25%
p-value B	11%
p-value C	55% (correct answer)
p-value D	9%
Option Annotations	A. divides to find the conversion factor of 3, but adds 3 to numerator B. uses change in the denominator (8) as the numerator C. correct D. adds 8 to both numerator and denominator

3. In a mixture of paint, $\frac{2}{6}$ of the paint is red. The mixture contains 5 gallons of paint. How many gallons of red paint are in the mixture?

A. $\frac{2}{30}$

B. $\frac{2}{11}$

C. $\frac{7}{6}$

D. $\frac{10}{6}$

Item Information	
Alignment	A-F.2.1.6 A-F.2.1.7
Answer Key	D
Depth of Knowledge	2
p-value A	21%
p-value B	17%
p-value C	25%
p-value D	37% (correct answer)
Option Annotations	A. multiplies the denominator by 5 B. adds 5 to the denominator C. adds 5 to the numerator D. correct

4. Kim has a ribbon that is 0.45 meter long. Which expression is equal to the length, in meters, of Kim's ribbon?

A. $\dfrac{4}{100} + \dfrac{5}{100}$

B. $\dfrac{4}{10} + \dfrac{5}{100}$

C. $\dfrac{4}{10} + \dfrac{5}{10}$

D. $\dfrac{4}{100} + \dfrac{5}{10}$

Item Information	
Alignment	A-F.3.1
Answer Key	B
Depth of Knowledge	2
p-value A	26%
p-value B	49% (correct answer)
p-value C	15%
p-value D	10%
Option Annotations	A. uses one hundred for both denominators B. correct C. uses ten for both denominators D. switches denominators

5. Kate walks 0.65 kilometer to school each day. Jane walks 0.47 kilometer to school each day. Which statement comparing the distance each girl walks to school is true?

A. Kate walks a longer distance to school than Jane walks because 0.05 > 0.07.

B. Kate walks a longer distance to school than Jane walks because 0.6 > 0.4.

C. Kate walks a shorter distance to school than Jane walks because 0.05 < 0.07.

D. Kate walks a shorter distance to school than Jane walks because 0.6 < 0.4.

Item Information	
Alignment	A-F.3.1.3
Answer Key	B
Depth of Knowledge	1
p-value A	9%
p-value B	69% (correct answer)
p-value C	16%
p-value D	6%
Option Annotations	A. compares hundredths and confuses symbols B. correct C. compares hundredths D. confuses symbols

6. Jordan and Sara are reading different books. Jordan's book has 70 pages. The number of pages in Sara's book is a factor of the number of pages in Jordan's book. How many pages could be in Sara's book?

   A. 17

   B. 35

   C. 140

   D. 170

Item Information	
Alignment	B-O.2
Answer Key	B
Depth of Knowledge	1
p-value A	7%
p-value B	52% (correct answer)
p-value C	28%
p-value D	13%
Option Annotations	A. chooses the number because it has a 7 in it B. correct C. confuses a multiple with a factor D. confuses a multiple with a factor, and thinks 170 is a multiple

7. Kelly made a number pattern. Each number in her pattern is a multiple of 3. Which rule could describe Kelly's pattern?

    A.   start at 0 and add 6

    B.   start at 1 and add 3

    C.   start at 2 and add 1

    D.   start at 3 and add 10

Item Information	
Alignment	B-O.3.1
Answer Key	A
Depth of Knowledge	2
p-value A	36% (correct answer)
p-value B	35%
p-value C	15%
p-value D	14%
Option Annotations	A. correct B. thinks the +3 will result in multiples of 3 C. chooses option with the first number in the pattern of 3 D. thinks numbers ending in 3 are multiples of 3

8. The table below shows the amounts of oats, in tablespoons, in different numbers of servings of granola bars.

Oats in Granola Bars

Number of Servings	Oats (tablespoons)
4	32
6	48
10	80
18	144

The pattern continues. Which rule describes the amount of oats, in tablespoons, in any number of servings of granola bars?

A. Multiply the number of servings of granola bars by 2.
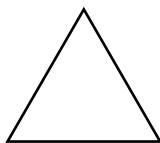
B. Multiply the number of servings of granola bars by 4.

C. Multiply the number of servings of granola bars by 8.

D. Multiply the number of servings of granola bars by 16.

Item Information	
Alignment	B-O.3.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	15%
p-value B	12%
p-value C	60% (correct answer)
p-value D	13%
Option Annotations	A. finds the difference in the number of servings B. uses the first number in the number of servings column C. correct D. finds the difference between the numbers in the oats column

9. Reed draws a straight line. He then draws a ray starting from a point on the straight line. Drawing the ray creates two separate angles. One of the angles is an obtuse angle. Which term describes the other angle?

    A.   acute

    B.   obtuse

    C.   right
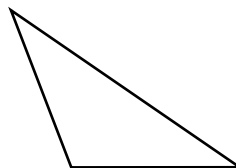
    D.   straight

Item Information	
Alignment	C-G.1.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	49% (correct answer)
p-value B	11%
p-value C	18%
p-value D	22%
Option Annotations	A. correct B. assumes the two angles are the same type C. picks a common angle type D. picks based on the straight line

10. A city park is in the shape of a right triangle. A path runs through the middle of the park, creating two symmetrical halves. Which picture could be the shape of the park?
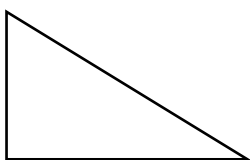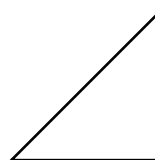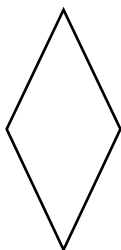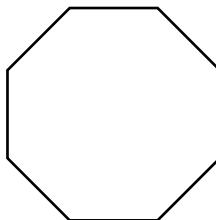
A.

B.

C.

D.

Item Information	
Alignment	C-G.1.1.2 C-G.1.1.3
Answer Key	D
Depth of Knowledge	2
p-value A	25%
p-value B	10%
p-value C	19%
p-value D	46% (correct answer)
Option Annotations	A. chooses a triangle with multiple lines of symmetry B. chooses a symmetric but non-right triangle C. chooses a right triangle but one without symmetry D. correct

11. Dina drew a figure that has at least one line of symmetry and at least one right angle. Which shape could be the figure Dina drew?
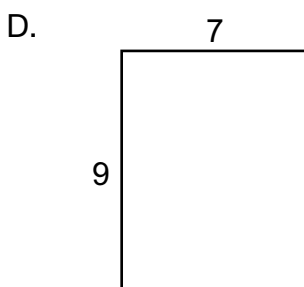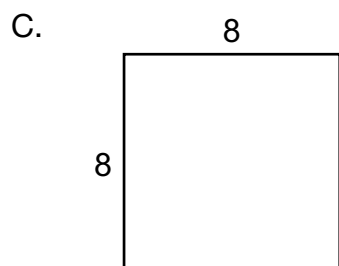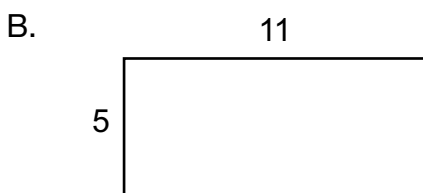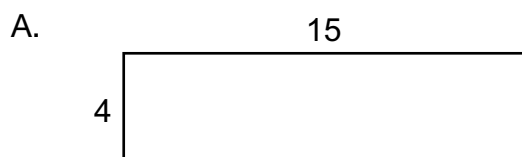
A.

B.

C.

D.

Item Information	
Alignment	C-G.1.1.3
	C-G.1.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	8%
p-value B	8%
p-value C	72% (correct answer)
p-value D	12%
Option Annotations	A. chooses option where lines of symmetry cross at right angles
	B. chooses option where lines of symmetry create right angles with edges of shape
	C. correct
	D. chooses option with right angles, but no lines of symmetry

12. Paul had 3 **pints** of vegetable oil. He used 1 **cup** of the vegetable oil in a recipe. How many **cups** of vegetable oil does Paul still have?

    A.   1 cup

    B.   2 cups

    C.   4 cups

    D.   5 cups

Item Information	
Alignment	D-M.1.1.2
Answer Key	D
Depth of Knowledge	1
p-value A	10%
p-value B	25%
p-value C	17%
p-value D	48% (correct answer)
Option Annotations	A. uses 1 from the stem B. does not convert the 3 pints to cups before subtracting C. adds the 3 and 1 from the stem D. correct

13. Which rectangle has the **greatest** area?

A.

15

4 [rectangle]

B.

11

5 [rectangle]

C.

8

8 [square]

D.

7

9 [rectangle]

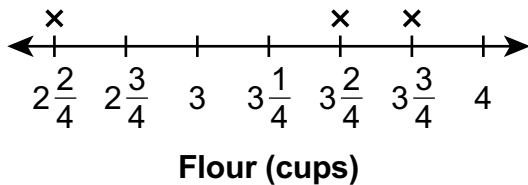| Item Information	
Alignment	D-M.1.1.3
Answer Key	C
Depth of Knowledge	1
p-value A	34%
p-value B	5%
p-value C	54% (correct answer)
p-value D	7%
Option Annotations	A. chooses option with the greatest length/perimeter B. chooses option with the least area C. correct D. chooses option with the greatest width

14. The table below shows the numbers of batches of different types of muffins made at a bakery and the amount of flour, in cups, used per batch for each type of muffin.
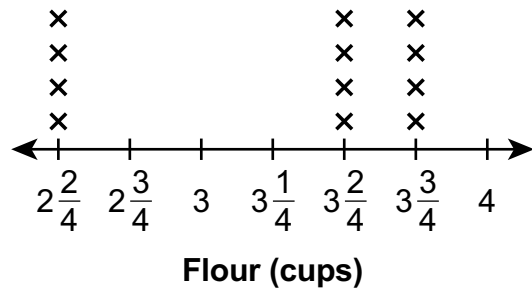
Muffin Batches

Type of Muffin	Number of Batches Made	Flour Used per Batch (cups)
blueberry	4	$3\frac{3}{4}$
chocolate chip	3	$2\frac{2}{4}$
poppy seed	5	$3\frac{2}{4}$

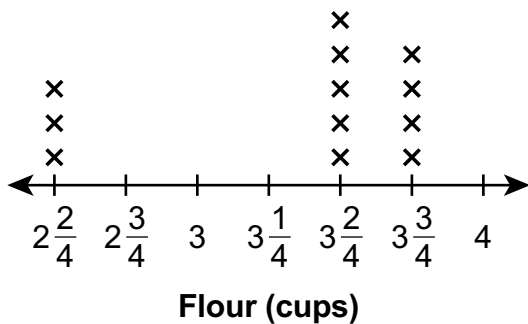Which line plot represents the information in the table?
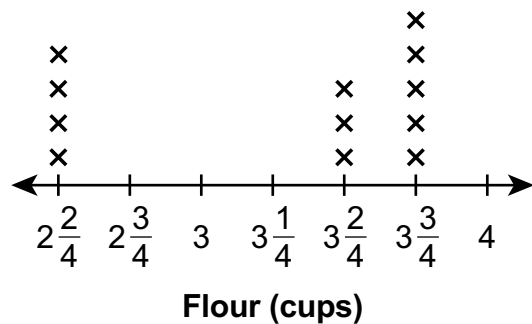
A.

Muffin Batches

Flour (cups)

B.

Muffin Batches

Flour (cups)

C.

Muffin Batches

Flour (cups)

D.

Muffin Batches

Flour (cups)

Item Information	
Alignment	D-M.2.1.1 D-M.2.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	11%
p-value B	8%
p-value C	69% (correct answer)
p-value D	12%
Option Annotations	A. marks only 1 'x' per measurement B. marks the correct total, but the incorrect average for each measurement C. correct D. marks the line plot to match the table

15. Jillian drew the angle shown below.
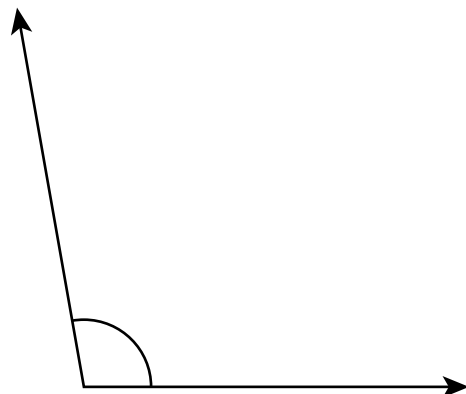
Using your protractor, what is the measure of Jillian's angle?

A. 80°

B. 90°

C. 100°

D. 180°

Item Information	
Alignment	D-M.3.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	25%
p-value B	8%
p-value C	58% (correct answer)
p-value D	9%
Option Annotations	A. reads the measurement for an acute angle B. estimates the angle without looking at the protractor C. correct D. reads the measurement of the horizontal ray

OPEN-ENDED QUESTION

16. Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

Go to the next page to finish question 16.

GO ON ⟩

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

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols +, −, ×, or ÷ to make the equation true.

$$7 \_\_\_ 3 \_\_\_ 25 = 82$$

After you have checked your work, close your answer booklet and test booklet so your teacher will know you are finished.

STOP
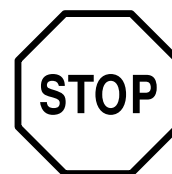
Item-Specific Scoring Guideline

#16 Item Information

Alignment	B-O.1	Depth of Knowledge	2	Mean Score	2.39

Assessment Anchor this item will be reported under:

M04.B-O.1—Use the four operations with whole numbers to solve problems.

Specific Assessment Anchor Descriptor addressed by this item:

M04.B-O.1.1—Use numbers and symbols to model the concepts of expressions and equations.

Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of using the four operations with whole numbers by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of using the four operations with whole numbers by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of using the four operations with whole numbers by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of using the four operations with whole numbers.
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 points.
2	Student earns 2 points.
1	Student earns 1 point. OR Student demonstrates minimal understanding of using the four operations with whole numbers.
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?
76 (coins)	

Part B (1 point):

    1 point for correct answer

What?	Why?
63 (coins)	

Part C (1 point):

    1 point for correct answer

What?	Why?
29 (coins)	

Part D (1 point):

    1 point for correct answer

What?	Why?
7 <u>+</u> 3 <u>×</u> 25 = 82	

Question 16
Page 1 of 2

Item ID

Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

EQ

76 coins

The response provides a correct answer.

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

EQ

63 coins

The response provides a correct answer.

Review/End Test | Pause | Flag | Options

Next

| Line Guide | Item ID | ? |

Sergio, Tina, Jong, David, and Beth collect coins.

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

EQ

29 coins

> The response provides a correct answer.

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols **+**, **−**, **×**, or **÷** to make the equation true.

$$7 \boxed{+} 3 \boxed{\times} 25 = 82$$

> The response provides a correct answer.

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

STUDENT RESPONSE

Response Score: 3 points

16. Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

$$19 \times 4 = 76 \text{ coins}$$

> The response provides a correct answer.

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

$$315 \div 5 = 63 \text{ coins}$$

> The response provides a correct answer.

Go to the next page to finish question 16.

GO ON ⟩

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

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

14 + 15 = 29 coins
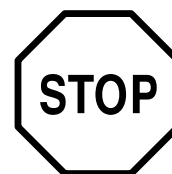
The response provides a correct answer.

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols +, −, ×, or ÷ to make the equation true.

7 _×_ 3 _÷_ 25 = 82

The response provides an incorrect answer.

After you have checked your work, close your answer booklet and test booklet so your teacher will know you are finished.

STOP

Question 16
Page 1 of 2

Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

EQ
76 coins

The response provides a correct answer.

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

EQ
63coins

The response provides a correct answer.

Review/End Test   Pause   Flag   Options   Next

Question 16
Page 2 of 2

Item ID

Sergio, Tina, Jong, David, and Beth collect coins.

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

EQ

54 coins

> The response provides an incorrect answer.

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols +, −, ×, or ÷ to make the equation true.

$$7 \boxed{\times} \ 3 \boxed{+} \ 25 = 82$$

> The response provides an incorrect answer.

Review/End Test   Pause   Flag   Options   Back   Next

STUDENT RESPONSE

Response Score: 1 point

16. Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

$$\begin{array}{r} \overset{3}{1}9 \\ \times 4 \\ \hline 76 \text{ coins} \end{array}$$

Sergio has 76 coins in his collection

> The response provides a correct answer.

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

$$\begin{array}{r} \overset{2}{3}15 \\ \times 5 \\ \hline 375 \end{array}$$

> The response provides an incorrect answer.

Go to the next page to finish question 16.

GO ON ⟶

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

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

19 coins

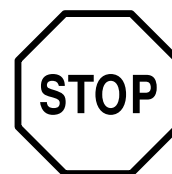> The response provides an incorrect answer.

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols +, −, ×, or ÷ to make the equation true.

$$7 \div 3 \times 25 = 82$$

> The response provides an incorrect answer.

After you have checked your work, close your answer booklet and test booklet so your teacher will know you are finished.

STOP

Question 16
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Sergio, Tina, Jong, David, and Beth collect coins.

Sergio has 4 times as many coins in his collection as Tina has in her collection. Tina has 19 coins in her collection.

A. How many total coins does Sergio have in his collection?

EQ

19+4=23

The response provides an incorrect answer.

Jong has 315 coins. He separates his coins into 5 different piles. Each pile has the same number of coins.

B. How many coins are in each of Jong's piles?

EQ

315x5=1,575

The response provides an incorrect answer.

Review/End Test   Pause   Flag   Options   Next

Question 16
Page 2 of 2

Line Guide

Item ID

?

Sergio, Tina, Jong, David, and Beth collect coins.

David started his coin collection with 14 coins. He added 3 coins to his collection at the end of each month for 5 months.

C. How many coins were in David's collection at the end of the 5 months?

EQ

14+3=17
17x5=85

The response provides an incorrect answer.

Beth determined that the total value of her coins is 82 cents. An equation can be used to determine the value of Beth's coins, but the symbols are missing.

D. Complete the equation below using the symbols **+**, **−**, **×**, or **÷** to make the equation true.

EQ   EQ

7   $\times$ 3 $+$ 25 = 82

The response provides an incorrect answer.

Review/End Test   Pause   Flag   Options

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MATHEMATICS—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-values A	*p*-values B	*p*-values C	*p*-values D
1	A-T.2.1.3	D	1	11%	13%	11%	**65%**
2	A-F.1.1.1	C	1	25%	11%	**55%**	9%
3	A-F.2.1.6 A-F.2.1.7	D	2	21%	17%	25%	**37%**
4	A-F.3.1	B	2	26%	**49%**	15%	10%
5	A-F.3.1.3	B	1	9%	**69%**	16%	6%
6	B-O.2	B	1	7%	**52%**	28%	13%
7	B-O.3.1	A	2	**36%**	35%	15%	14%
8	B-O.3.1.3	C	2	15%	12%	**60%**	13%
9	C-G.1.1.1	A	1	**49%**	11%	18%	22%
10	C-G.1.1.2 C-G.1.1.3	D	2	25%	10%	19%	**46%**
11	C-G.1.1.3 C-G.1.1.1	C	2	8%	8%	**72%**	12%
12	D-M.1.1.2	D	1	10%	25%	17%	**48%**
13	D-M.1.1.3	C	2	34%	5%	**54%**	7%
14	D-M.2.1.1 D-M.2.1.3	C	2	11%	8%	**69%**	12%
15	D-M.3.1.1	C	1	25%	8%	**58%**	9%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
16	B-O.1	4	2	2.39