

Pennsylvania PSSA 2024  
Grade 5 Math

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# Grade 5 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.

2024  
Grade 5

## Standard Conversions

1 mile (mi) = 1,760 yards (yd)  
1 mile = 5,280 feet (ft)  
1 yard (yd) = 3 feet (ft)  
1 foot = 12 inches (in.)

1 ton (T) = 2,000 pounds (lb)  
1 pound = 16 ounces (oz.)

1 gallon (gal) = 4 quarts (qt)  
1 quart = 2 pints (pt)  
1 pint = 2 cups (c)  
1 cup = 8 fluid ounces (fl oz.)

## Metric Conversions

1 kilometer (km) = 1,000 meters (m)  
1 meter = 100 centimeters (cm)  
1 centimeter = 10 millimeters (mm)

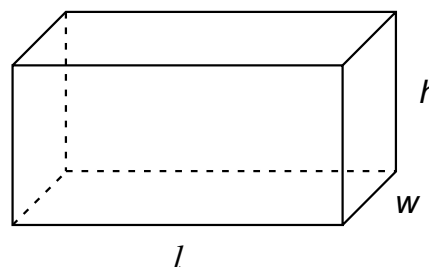
1 kilogram (kg) = 1,000 grams (g)  
1 gram = 1,000 milligrams (mg)

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

## Time Conversions

1 century = 10 decades  
1 decade = 10 years (yr)  
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)

## Rectangular Prism



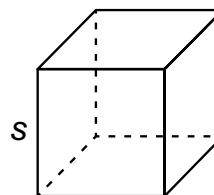
Volume = length  $\times$  width  $\times$  height  
 $V = l \times w \times h$

Volume = area of the base  $\times$  height  
 $V = B \times h$

Volume = area of the base  $\times$  width  
 $V = B \times w$

Volume = area of the base  $\times$  length  
 $V = B \times l$

## Cube



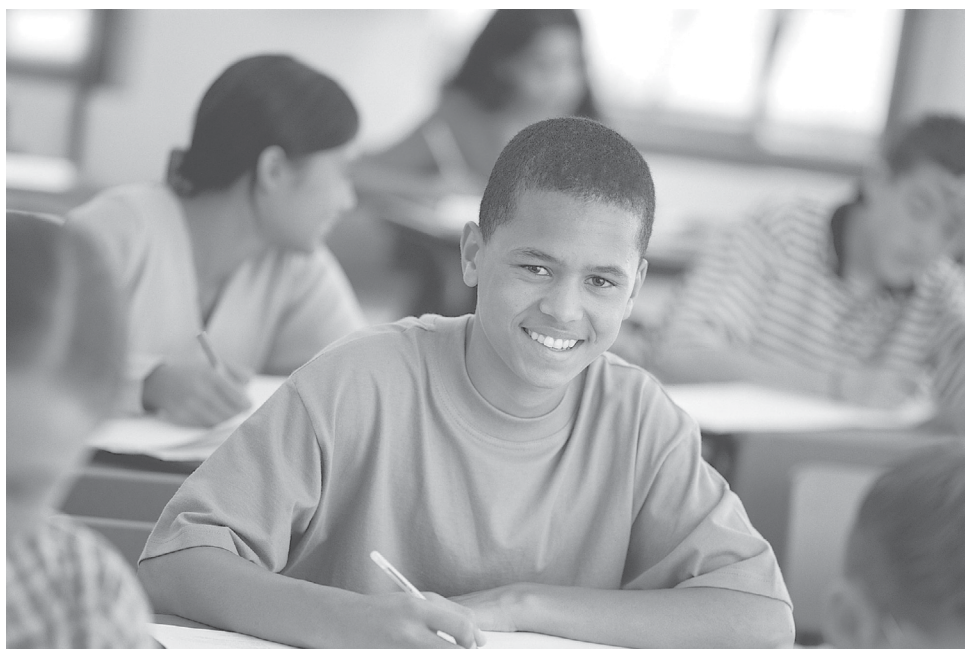
Volume = side edge  $\times$  side edge  $\times$  side edge  
 $V = s \times s \times s$



**pennsylvania**  
DEPARTMENT OF EDUCATION

# **The Pennsylvania System of School Assessment**

## **Mathematics Item and Scoring Sampler**



**2024–2025  
Grade 5**

Question 1 in this Item and Scoring Sampler is to be solved without the use of a calculator.

### Multiple-Choice Items

1. Add:  $\frac{7}{8} + \frac{11}{5}$

Ⓐ  $1\frac{5}{13}$

Ⓑ  $1\frac{37}{40}$

Ⓒ  $2\frac{31}{40}$

Ⓓ  $3\frac{3}{40}$

Category	Item-Specific Information
Alignment	A-F.1.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	26%
p-value B	13%
p-value C	13%
p-value D	48% (correct answer)
Option Annotations	<p>A. adds the numerators (<math>7 + 11 = 18</math>) and adds the denominators (<math>8 + 5 = 13</math>) before correctly converting <math>\frac{18}{13}</math> to a mixed number</p> <p>B. multiplies the numerators (<math>7 \times 11 = 77</math>) and the denominators (<math>8 \times 5 = 40</math>) before correctly converting <math>\frac{77}{40}</math> to a mixed number</p> <p>C. uses 40 as the common denominator but then uses the sum of the products of <math>7 \times 8</math> and <math>11 \times 5</math> (<math>56 + 55 = 111</math>) as the numerator before correctly converting <math>\frac{111}{40}</math> to a mixed number</p> <p>D. Correct: identifies 40 as a common denominator since <math>8 \times 5 = 40</math>, converts <math>\frac{7}{8}</math> to <math>\frac{35}{40}</math> by multiplying both the 7 and the 8 by 5, converts <math>\frac{11}{5}</math> to <math>\frac{88}{40}</math> by multiplying both the 11 and the 5 by 8, adds the two fractions by adding the numerators (<math>35 + 88 = 123</math>) and leaving the common denominator (40), and then converts <math>\frac{123}{40}</math> to a mixed number by dividing 123 by 40, resulting in 3 R3, which is changed to a mixed number by using the remainder (3) as the numerator and the divisor (40) as the denominator</p>

**A calculator is permitted for use in solving questions 2–16 in this Item and Scoring Sampler.**

2. The mass of a rock is 52.17 grams. The mass of a bolt, in grams, includes a digit that is  $\frac{1}{10}$  the value of the 1 in the mass of the rock. Which value could be the mass, in grams, of the bolt?
- Ⓐ 11.27
  - Ⓑ 18.27
  - Ⓒ 18.71
  - Ⓓ 20.17

Category	Item-Specific Information
Alignment	A-T.1.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	22%
p-value B	19%
p-value C	34% (correct answer)
p-value D	25%
Option Annotations	<p>A. does not consider the mass of the rock and selects a number with two 1s, such that the value of one of the 1s is <math>\frac{1}{10}</math> the value of the other 1 (i.e., the 1 in the ones place is <math>\frac{1}{10}</math> the value of the 1 in the tens place)</p> <p>B. uses the digit in the ones place (2) rather than the 1 in the mass of the rock and selects a number with a 2 in the tenths place, which is <math>\frac{1}{10}</math> the value of the 2 in the mass of the rock</p> <p>C. Correct: either identifies that the 1 in the mass of the rock is in the tenths place, determines that a 1 in the next place to the right (the hundredths place) would have a value that is <math>\frac{1}{10}</math> the value of the 1 in the mass of the rock, and then identifies a number with a 1 in the hundredths place OR identifies that the value of the 1 in the mass of the rock is 0.1, multiplies this value by <math>\frac{1}{10}</math>, resulting in a product of 0.01, and then selects a number for which the value of the 1 is equal to 0.01</p> <p>D. selects a number for which the value of the 1 is the same as the value of the 1 in the mass of the rock</p>

3. A scientist records the diameter of a strand of hair as 0.00754 centimeters. To the nearest thousandth, what is the rounded diameter of this strand of hair?
- Ⓐ 0.007 cm
  - Ⓑ 0.0075 cm
  - Ⓒ 0.008 cm
  - Ⓓ 0.01 cm



Category	Item-Specific Information
Alignment	A-T.1.1.5
Answer Key	C
Depth of Knowledge	1
p-value A	14%
p-value B	27%
p-value C	51% (correct answer)
p-value D	8%
Option Annotations	<p>A. identifies the 7 as the digit in the thousandths place but rounds down rather than up by considering the rightmost digit (the 4) rather than the digit to the immediate right of the 7 (the 5)</p> <p>B. identifies the 5 as the digit in the thousandths place rather than the ten-thousandths place</p> <p>C. Correct: identifies the 7 as the digit in the thousandths place and then either looks at the next digit to the right (the digit in the ten-thousandths place) before applying the rule “5 or greater, round up” to round the 7 up to an 8 OR recognizes that 754 is closer to 800 than to 700</p> <p>D. identifies the second 0 to the right of the decimal point as the digit in the thousandths place rather than the hundredths place</p>

4. Two deli workers cut a 9-kilogram block of cheese in half. The first worker divides his half into 15 equal packages. The second worker divides the other half into 18 equal packages. What is the difference in the mass, in kilograms, of the two sizes of packages?
- Ⓐ 0.05
  - Ⓑ 0.10
  - Ⓒ 0.17
  - Ⓓ 0.22

Category	Item-Specific Information
Alignment	A-T.2.1
Answer Key	A
Depth of Knowledge	2
p-value A	40% (correct answer)
p-value B	22%
p-value C	18%
p-value D	20%
Option Annotations	<p>A. Correct: divides the product of <math>\frac{1}{2} \times 9</math> by 15 and by 18, resulting in quotients of 0.3 and 0.25, and then subtracts 0.25 from 0.3 by first converting 0.3 to 0.30, resulting in a difference of 0.05</p> <p>B. divides 9 by 15 and by 18, resulting in quotients of 0.6 and 0.5, and then subtracts 0.5 from 0.6, resulting in a difference of 0.1, which is equivalent to 0.10 (i.e., does not consider that each deli worker uses only half of the 9-kilogram block and uses a full 9-kilogram block for each deli worker)</p> <p>C. divides 18 and 15 by 9, resulting in quotients of 2 and 1.666 . . . , multiplies both quotients by <math>\frac{1}{2}</math>, resulting in products of 1 and 0.8333 . . . , and then subtracts 0.8333 . . . from 1, resulting in a difference of 0.1666 . . . , which rounds to 0.17</p> <p>D. divides the product of <math>\frac{1}{2} \times 9</math> by 15 and by 18, resulting in quotients of 0.3 and 0.25, but then subtracts the digits to the right of the decimal point as <math>25 - 3 = 22</math>, resulting in a final answer of 0.22</p>

5. The multiplication problem below shows the partial products with two digits missing.

$$\begin{array}{r} 164 \\ \times 23 \\ \hline 4m2 \\ n,280 \\ \hline \end{array}$$

What values of the two missing digits would make the partial products correct?

- Ⓐ  $m = 8$  and  $n = 2$
- Ⓑ  $m = 8$  and  $n = 3$
- Ⓒ  $m = 9$  and  $n = 2$
- Ⓓ  $m = 9$  and  $n = 3$

Category	Item-Specific Information
Alignment	A-T.2.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	15%
p-value B	19%
p-value C	15%
p-value D	51% (correct answer)
Option Annotations	<p>A. multiplies 164 by 3 without regrouping to the tens place, resulting in the partial product 482, multiplies 164 by 20 without regrouping to the hundreds place, resulting in the partial product 2,280, and then identifies the 8 as the value of <math>m</math> and the 2 as the value of <math>n</math></p> <p>B. multiplies 164 by 3 without regrouping to the tens place, resulting in the partial product 482, multiplies 164 by 20 with correct regrouping, resulting in the partial product 3,280, and then identifies the 8 as the value of <math>m</math> and the 3 as the value of <math>n</math></p> <p>C. multiplies 164 by 3 with correct regrouping, resulting in the partial product 492, multiplies 164 by 20 without regrouping to the hundreds place, resulting in the partial product 2,280, and then identifies the 9 as the value of <math>m</math> and the 2 as the value of <math>n</math></p> <p>D. Correct: multiplies 164 by 3 by regrouping to both the tens place and the hundreds place, resulting in the partial product 492, multiplies 164 by 20 by regrouping to the thousands place, resulting in the partial product 3,280, and then identifies the 9 as the value of <math>m</math> and the 3 as the value of <math>n</math></p>

6. Jody earned \$648 for walking a neighbor's dog for 18 weeks. She earned the same amount of money each week. How much money did Jody earn each week?
- Ⓐ \$30
  - Ⓑ \$31
  - Ⓒ \$36
  - Ⓓ \$37

Category	Item-Specific Information
Alignment	A-T.2.1.2
Answer Key	C
Depth of Knowledge	1
p-value A	5%
p-value B	5%
p-value C	83% (correct answer)
p-value D	7%
Option Annotations	<p>A. places a 3 in the tens place of the quotient, uses <math>30 \times 18 = 640</math> rather than 540, subtracts 640 from 648, resulting in a difference of 8, and places a 0 in the ones place of the quotient, resulting in a quotient of 30 R8, but does not account for the remainder</p> <p>B. places a 3 in the tens place of the quotient, uses <math>30 \times 18 = 540</math>, subtracts 540 from 648, incorrectly using a difference of 18 rather than 108, places a 1 in the ones place of the quotient, uses <math>1 \times 18 = 18</math>, and subtracts 18 from 18, resulting in a difference of 0 and a quotient of 31</p> <p>C. Correct: places a 3 in the tens place of the quotient, uses <math>30 \times 18 = 540</math>, subtracts 540 from 648, resulting in a difference of 108, places a 6 in the ones place of the quotient, uses <math>6 \times 18 = 108</math>, and subtracts 108 from 108, resulting in a difference of 0 and a quotient of 36</p> <p>D. places a 3 in the tens place of the quotient, uses <math>30 \times 18 = 540</math>, subtracts 540 from 648, resulting in a difference of 108, places a 7 rather than a 6 in the ones place of the quotient, uses <math>7 \times 18 = 108</math> rather than <math>6 \times 18 = 108</math>, and subtracts 108 from 108, resulting in a difference of 0 and a quotient of 37</p>

7. A deli has 10 pounds of turkey and 7 pounds of cheese. Each sandwich the deli makes has both turkey and cheese. For each turkey-and-cheese sandwich, the deli uses  $\frac{1}{4}$  pound of turkey and  $\frac{1}{6}$  pound of cheese. Which phrase describes the **greatest** number of turkey-and-cheese sandwiches the deli can make and whether there is any turkey or cheese remaining?
- Ⓐ 40 sandwiches, with some cheese remaining
  - Ⓑ 42 sandwiches, with some turkey remaining
  - Ⓒ 82 sandwiches, with no turkey or cheese remaining
  - Ⓓ 85 sandwiches, with no turkey or cheese remaining



Category	Item-Specific Information
Alignment	A-F.2.1
Answer Key	A
Depth of Knowledge	2
p-value A	37% (correct answer)
p-value B	29%
p-value C	23%
p-value D	11%
Option Annotations	<p>A. Correct: divides 10 by <math>\frac{1}{4}</math>, resulting in 40 sandwiches, divides 7 by <math>\frac{1}{6}</math>, resulting in 42 sandwiches, and then recognizes that there is enough turkey and cheese to make 40 sandwiches with some cheese remaining (since <math>42 &gt; 40</math>)</p> <p>B. determines there was enough turkey for 40 sandwiches and enough cheese for 42 sandwiches but selects the greater number and identifies the part of the sandwiches for which more is needed</p> <p>C. determines there was enough turkey for 40 sandwiches and enough cheese for 42 sandwiches but then adds these numbers (i.e., 40 turkey sandwiches + 42 cheese sandwiches = 82 sandwiches)</p> <p>D. finds the total weight of the turkey and cheese (<math>10 + 7 = 17</math>), adds the fractions by adding the numerators and denominators separately, resulting in a “sum” of <math>\frac{2}{10}</math>, and then divides 17 by <math>\frac{2}{10}</math>, resulting in a quotient of 85</p>

8. Mr. Brown drives  $6\frac{1}{5}$  miles from his home to work. By 8:30 A.M., he has driven  $\frac{1}{3}$  of this distance.

How far, in miles, has Mr. Brown driven by 8:30 A.M.?

Ⓐ  $2\frac{1}{15}$

Ⓑ  $2\frac{1}{8}$

Ⓒ  $2\frac{1}{5}$

Ⓓ  $2\frac{1}{4}$

Category	Item-Specific Information
Alignment	A-F.2.1.2
Answer Key	A
Depth of Knowledge	1
p-value A	55% (correct answer)
p-value B	16%
p-value C	19%
p-value D	10%
Option Annotations	<p>A. Correct: multiplies 6 by <math>\frac{1}{3}</math>, resulting in a partial product of 2, multiplies the <math>\frac{1}{5}</math> by <math>\frac{1}{3}</math>, resulting in a partial product of <math>\frac{1}{15}</math>, and then adds the partial products <math>\left(2 + \frac{1}{15} = 2\frac{1}{15}\right)</math></p> <p>B. multiplies 6 by <math>\frac{1}{3}</math>, resulting in a partial product of 2, adds the denominators of the fractions <math>(5 + 3)</math> while keeping the common numerator (1), resulting in a “sum” of <math>\frac{1}{8}</math>, and then adds the partial results <math>\left(2 + \frac{1}{8} = 2\frac{1}{8}\right)</math></p> <p>C. multiplies only the 6 by <math>\frac{1}{3}</math>, resulting in a partial product of 2, and adds <math>\frac{1}{5}</math> to the partial product</p> <p>D. multiplies 6 by <math>\frac{1}{3}</math>, resulting in a partial product of 2, adds the fractions by adding the numerators and denominators separately, resulting in a “sum” of <math>\frac{2}{8}</math>, which simplifies to <math>\frac{1}{4}</math>, and then adds the partial results <math>\left(2 + \frac{1}{4} = 2\frac{1}{4}\right)</math></p>

9. Tamaya earned \$88 last week at her part-time job. Lucius earned more money at his part-time job last week than Tamaya earned. Which statement could be true?
- Ⓐ Lucius earned  $\frac{6}{5}$  of the amount of money Tamaya earned last week.
  - Ⓑ Lucius earned  $\frac{7}{8}$  of the amount of money Tamaya earned last week.
  - Ⓒ Lucius earned  $\frac{8}{15}$  of the amount of money Tamaya earned last week.
  - Ⓓ Lucius earned  $\frac{5}{16}$  of the amount of money Tamaya earned last week.

Category	Item-Specific Information
Alignment	A-F.2.1.3
Answer Key	A
Depth of Knowledge	2
p-value A	53% (correct answer)
p-value B	20%
p-value C	18%
p-value D	9%
Option Annotations	<p>A. Correct: recognizes that multiplying \$88 by a number greater than 1 would result in a product that is greater than \$88  <math>\left(\frac{6}{5} \times \\$88 = \\$105.60\right)</math></p> <p>B. selects the fraction that, when multiplied by \$88, would result in a whole-number product <math>\left(\frac{7}{8} \times \\$88 = \\$77\right)</math></p> <p>C. thinks multiplying \$88 by the fraction with the greatest numerator would result in a product that is greater than \$88</p> <p>D. thinks multiplying \$88 by the fraction with the greatest denominator would result in a product that is greater than \$88</p>

10. A cook used  $\frac{1}{4}$  pound of flour to make 5 dumplings of equal size. How many pounds of flour were used in each dumpling?

Ⓐ  $\frac{1}{20}$

Ⓑ  $\frac{4}{5}$

Ⓒ  $1\frac{1}{4}$

Ⓓ 20

Category	Item-Specific Information
Alignment	A-F.2.1.4
Answer Key	A
Depth of Knowledge	1
p-value A	48% (correct answer)
p-value B	9%
p-value C	35%
p-value D	8%
Option Annotations	<p>A. Correct: divides <math>\frac{1}{4}</math> by 5 by identifying the reciprocal of 5 as <math>\frac{1}{5}</math> and then multiplying <math>\frac{1}{4}</math> by <math>\frac{1}{5}</math>, resulting in a product of <math>\frac{1}{20}</math></p> <p>B. divides <math>\frac{1}{4}</math> by 5 by identifying the reciprocal of <math>\frac{1}{4}</math> as <math>\frac{4}{1}</math> and the reciprocal of 5 as <math>\frac{1}{5}</math> and then multiplying <math>\frac{4}{1}</math> by <math>\frac{1}{5}</math>, resulting in a product of <math>\frac{4}{5}</math></p> <p>C. multiplies <math>\frac{1}{4}</math> by 5 rather than dividing <math>\frac{1}{4}</math> by 5</p> <p>D. divides <math>\frac{1}{4}</math> by 5 by identifying the reciprocal of <math>\frac{1}{4}</math> as <math>\frac{4}{1}</math> rather than identifying the reciprocal of 5 as <math>\frac{1}{5}</math> and then multiplying <math>\frac{4}{1}</math> by <math>\frac{5}{1}</math>, resulting in a product of 20</p>

11. Which expression represents 6 times the product of 4 and the difference of 12 and 8?

Ⓐ  $6 \times [4 \times (12 - 8)]$

Ⓑ  $6 \times 4 + (12 - 8)$

Ⓒ  $6 \times [4 - (12 - 8)]$

Ⓓ  $6 \times (4 \times 12 - 8)$



Category	Item-Specific Information
Alignment	B-O.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	35% (correct answer)
p-value B	34%
p-value C	18%
p-value D	13%
Option Annotations	<p>A. Correct: recognizes “the difference of 12 and 8” to be <math>12 - 8</math>, “the product of 4 and the difference” to be <math>4 \times (12 - 8)</math>, placing grouping symbols around the difference, and “6 times the product” to be <math>6 \times [4 \times (12 - 8)]</math>, placing grouping symbols around the product</p> <p>B. applies “the product” to the first calculation, interpreting the word “and” as addition rather than identifying the two factors of the product</p> <p>C. misreads “4 and the difference of 12 and 8” as subtracting <math>(12 - 8)</math> from 4</p> <p>D. does not place grouping symbols around the <math>12 - 8</math> to represent “the difference of 12 and 8”</p>

12. D'Angelo sells paintings for \$15 each. He pays \$6 for supplies for each painting. Which expression could be used to find the amount of money D'Angelo makes by selling 25 paintings?
- Ⓐ  $25 \times (15 + 6)$
  - Ⓑ  $25 \times (15 - 6)$
  - Ⓒ  $(25 \times 15) + 6$
  - Ⓓ  $(25 \times 15) - 6$

Category	Item-Specific Information
Alignment	B-O.1.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	21%
p-value B	44% (correct answer)
p-value C	12%
p-value D	23%
Option Annotations	<p>A. adds the amount paid for supplies (\$6) to the selling price for each painting (\$15) and then multiplies the sum (<math>15 + 6</math>) by the number of paintings (25)</p> <p>B. Correct: subtracts the amount paid for supplies (\$6) from the selling price for each painting (\$15) and then multiplies the difference (<math>15 - 6</math>) by the number of paintings (25)</p> <p>C. uses addition rather than subtraction and places the parentheses around the product rather than around the sum, resulting in adding the amount paid for supplies for one painting to the total amount collected from selling 25 paintings (<math>25 \times \\$15</math>)</p> <p>D. places the parentheses around the product rather than around the difference, resulting in subtracting the amount paid for supplies for one painting to the total amount collected from selling 25 paintings (<math>25 \times \\$15</math>)</p>

13. Sarah creates two different number patterns. She uses the numbers in her patterns as ordered pairs on a graph. The two rules are described below.

x-coordinate rule: start at 2 and follow the pattern “add 2”

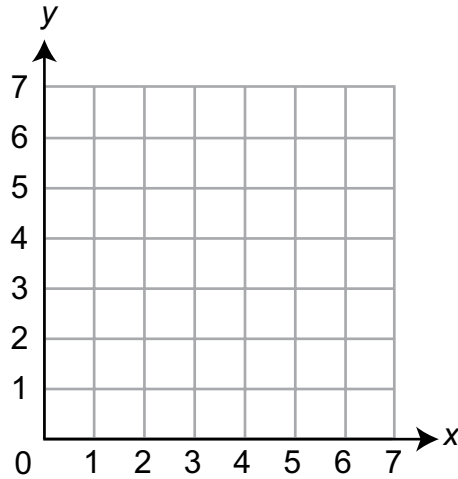
y-coordinate rule: start at 6 and follow the pattern “add 4”

The patterns continue. What is the ordered pair of the 4th point on Sarah’s graph?

- Ⓐ (6, 18)
- Ⓑ (6, 24)
- Ⓒ (8, 18)
- Ⓓ (8, 24)

Category	Item-Specific Information
Alignment	B-O.2.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	18%
p-value B	17%
p-value C	42% (correct answer)
p-value D	23%
Option Annotations	<p>A. adds 4 to the starting x-coordinate (<math>2 + 4 = 6</math>) to find an incorrect x-coordinate but then identifies the correct y-coordinate (18)</p> <p>B. adds 4 to the starting x-coordinate (<math>2 + 4 = 6</math>) and multiplies the starting y-coordinate by 4 (<math>6 \times 4 = 24</math>)</p> <p>C. Correct: recognizes that the 4th point is found by applying each rule three times, so applies “add 2” three times to the starting x-coordinate (<math>2 + 2 \times 3 = 8</math>) and applies “add 4” three times to the starting y-coordinate (<math>6 + 4 \times 3 = 18</math>)</p> <p>D. multiplies the starting x-coordinate by 4 (<math>2 \times 4 = 8</math>) and the starting y-coordinate by 4 (<math>6 \times 4 = 24</math>)</p>

14. A coordinate grid is shown below.

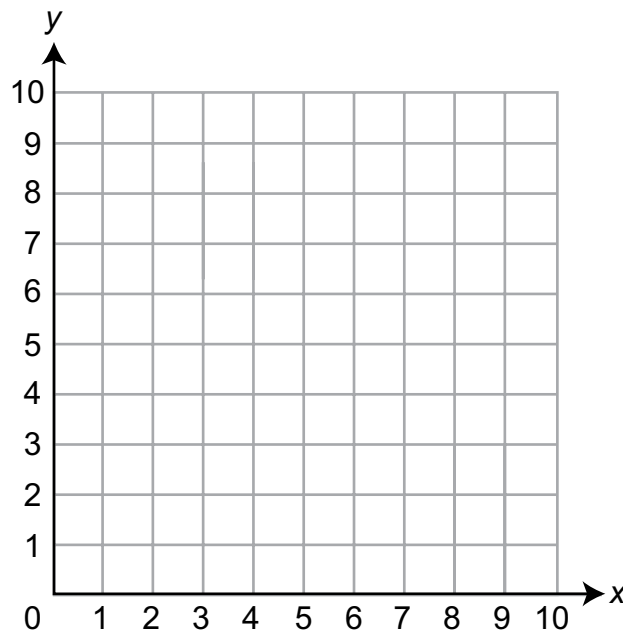


Based on distances along the grid lines, which location is **closest** to the point (2, 3) on the coordinate grid?

- Ⓐ (5, 3)
- Ⓑ origin
- Ⓒ x-axis
- Ⓓ y-axis

Category	Item-Specific Information
Alignment	C-G.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	26%
p-value B	17%
p-value C	16%
p-value D	41% (correct answer)
Option Annotations	<p>A. identifies a point with the same <math>y</math>-coordinate as <math>(2, 3)</math> but does not consider that this point is 3 units from the given point</p> <p>B. recognizes that the origin is at <math>(0, 0)</math>, which contains the smallest <math>x</math>-coordinate and <math>y</math>-coordinate, but does not consider how far this point is from <math>(2, 3)</math></p> <p>C. either plots the given point at <math>(3, 2)</math> rather than at <math>(2, 3)</math> and compares the distance to each axis OR plots <math>(2, 3)</math> correctly but then switches the axes</p> <p>D. Correct: identifies the point <math>(2, 3)</math> as 2 units to the right of the <math>y</math>-axis and 3 units up from the <math>x</math>-axis, meaning the point is closer to the <math>y</math>-axis (2 units) than to the <math>x</math>-axis (3 units), to the point <math>(5, 3)</math>, which is 3 units away, or to the origin, which is more than 3 units away</p>

15. The coordinate grid shown below is used to determine the locations of future buildings on a plot of land.



The four corners of the plot of land are  $(0, 0)$ ,  $(0, 10)$ ,  $(10, 10)$ , and  $(10, 0)$ . Because of spacing regulations, any buildings represented by points with the same  $y$ -coordinate must be at least 2 units apart. The location of the first building will be represented by point  $(3, 7)$ . What is the **greatest** number of buildings that can have a  $y$ -coordinate of 7?

- (A) 5
- (B) 6
- (C) 8
- (D) 9




















Category	Item-Specific Information
Alignment	C-G.1.1.2
Answer Key	A
Depth of Knowledge	2
p-value A	39% (correct answer)
p-value B	18%
p-value C	17%
p-value D	26%
Option Annotations	<p>A. Correct: recognizes that there is only 1 available point between <math>(3, 7)</math> and the <math>y</math>-axis <math>[(1, 7)]</math> and that there are at most 3 available points between <math>(3, 7)</math> and the right side of the coordinate grid <math>[(5, 7), (7, 7), \text{ and } (9, 7)]</math>, for a total of 5 available points, which represents 5 buildings</p> <p>B. identifies the greatest number of points with a common <math>y</math>-coordinate that could appear on the grid with a minimum distance of 2 units (i.e., counts all the even <math>x</math>-coordinates) but does not consider that the given point of <math>(3, 7)</math> has an odd <math>x</math>-coordinate</p> <p>C. considers the 10 points with positive whole-number <math>x</math>-coordinates when <math>y = 7</math> and eliminates only the points <math>(2, 7)</math> and <math>(4, 7)</math> from this set since they are each only 1 unit from the given point of <math>(3, 7)</math></p> <p>D. considers all 11 points with whole-number <math>x</math>-coordinates when <math>y = 7</math> and eliminates only the points <math>(2, 7)</math> and <math>(4, 7)</math> from this set since they are each only 1 unit from the given point of <math>(3, 7)</math></p>

## Open-Ended Item

16. Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	     
June	

Key:  = 4 days

- A. How many days was the Sun visible at noon in March?

- B. How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.

Go to the next page to finish question 16.

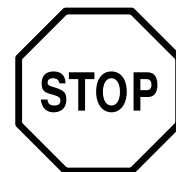
GO ON 

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

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

- C. Explain how you know Gabriela made a mistake when she finished the pictograph.

After you have finished your work, close this booklet so your teacher will know you are finished.



**Item-Specific Scoring Guideline****#16 Item Information**

Category	Item-Specific Information
Alignment	D-M.2.1
Depth of Knowledge	2
Mean Score	1.97

**Assessment Anchor this item will be reported under:**

**M05.D-M.2** Represent and interpret data.

**Specific Anchor Descriptor addressed by this item:**

**M05.D-M.2.1** Organize, display, and answer questions based on data.

**Item-Specific Scoring Guideline**

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

24 (days)

**Part B (2 points):**

1 point for correct answer

1 point for correct and complete support

**OR** 1/2 point for correct but incomplete support

**What?**

6 (days)

**Why?****Sample Work:**

$$\text{May: } 5\frac{1}{2} \times 4 = 22$$

$$\text{April: } 4 \times 4 = 16$$

$$22 - 16 = 6$$

**OR**

**Sample Explanation:**

May has 5 full suns and one half-sun. April has 4 full suns. So, May has  $1\frac{1}{2}$  more full suns than April, which means Gabriela could see the Sun at noon  $1\frac{1}{2} \times 4 = 6$  more days in May than in April.

**OR equivalent**

**Part C (1 point):**

1 point for correct and complete explanation

**OR** 1/2 point for correct but incomplete explanation

**Why?****Sample Explanations:**

I know Gabriela made a mistake when she finished the pictograph since 9 sun pictures would be 36 days and June has only 30 days.

**OR**

I know Gabriela made a mistake when she finished the pictograph since 9 sun pictures would be 36 days and no month has more than 31 days.

















**OR equivalent**


STUDENT RESPONSE

Response Score: 4 points

16. Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	     
June	

Key:  = 4 days

- A. How many days was the Sun visible at noon in March?

The sun was visible at noon for 24 days.

- B. How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.

There were 6 more days that the Sun was visible in May than April. I multiplied four times four for April because there are four suns in April and each sun equals for days. For May, I multiplied five and a half times four and got 22 days. Then I subtracted and got 6 days.

Go to the next page to finish question 16.

GO ON 



**Part A:** The student provided the correct answer (*24 days*). While support is not required for Part A, the student likely counted the number of sun pictures for March (6) and multiplied the number of sun pictures by 4, since each sun picture represents 4 days ( $6 \times 4 = 24$ ). [1 point]

**Part B:** The student provided the correct answer (*6 more days*) with a correct and complete explanation of how the answer was found (*I multiplied four times four for April because there are four suns in April and each sun equals for days. For May, I multiplied five and a half times four and got 22 days. Then I subtracted and got 6 days*). [2 points]

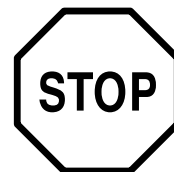
16. **Continued.** Please refer to the previous page for task explanation.

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

- C. Explain how you know Gabriela made a mistake when she finished the pictograph.

Nine times Four equals 36 days,  
but there isn't 36 days in June or  
any other month.

After you have finished your work, close this booklet so your teacher will know you are finished.



**Part C:** The student provided a correct and complete explanation of how Gabriela made a mistake putting 9 sun pictures in June (*Nine times four equals 36 days, but there isn't 36 days in June or any other month*). [1 point]





STUDENT RESPONSE

 Computer Response Score: 3 points


PARTS A and B

Question 16

Page 1 of 2

Line Guide




















Item ID

?

Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

**Days the Sun Was Visible at Noon**

March	     
April	   
May	     
June	

**Key:**  = 4 days

**A.** How many days was the Sun visible at noon in March?

EQ

22 days

**B.** How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.

EQ

First I saw may equals 22 because  $4+4+4+4+4+2=22$ . then I knew I needed to find april because in the question it says How many "more" days. So I found that april equals 16 because  $4+4+4+4=16$ . I calculated my answer as  $22-16$  and got 6.

233 / 1000

Review/End Test

Pause

Flag

Options

Next

**Part A:** The student provided an incorrect answer (22 days). No support (work or explanation) is required, so it is unclear where an error was made. The student may have looked at the line for May, where  $5\frac{1}{2}$  sun pictures would equal 22 days. [0 points]

**Part B:** The student provided the correct answer (6) with correct and complete support on how the answer was found (I saw may equals 22 because  $4+4+4+4+4+2=22$  . . . I found that april equals 16 because  $4+4+4+4=16$ . I calculated my answer as  $22-16$  and got 6). [2 points]

## PART C

Question 16

Page 2 of 2




















Item ID



Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	     
June	

Key:  = 4 days

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

C. Explain how you know Gabriela made a mistake when she finished the pictograph.

EQ

Gabriela made a mistake because there are only 31 days in a month at the most. But she did 9 suns, and every sun equals 4 so what you would have to do is  $9 \times 4 = 36$ . The problem with that is there arnt 36 days in a month. so gabrielas mistak was she added too many suns.

267 / 1000

Review/End Test

Pause

Flag



Options

Back

Next

















**Part C:** The student provided a correct and complete explanation of how Gabriela made a mistake putting 9 sun pictures in June (*because there are only 31 days in a month at the most. But she did 9 suns, and every sun equals 4 . . .  $9 \times 4 = 36$ . The problem with that is there arnt 36 days in a month*). [1 point]


STUDENT RESPONSE

Response Score: 2 points

16. Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	     
June	

Key:  = 4 days

- A. How many days was the Sun visible at noon in March?

24 days

- B. How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.

I first found my answer by looking at the chart. Then I realized that I needed to subtract. Finally I got my answer of  $1\frac{1}{2}$ .

Go to the next page to finish question 16.

GO ON 


**Part A:** The student provided the correct answer (*24 days*). While support is not required for Part A, the student likely counted the number of sun pictures for March (6) and multiplied the number of sun pictures by 4, since each sun picture represents 4 days ( $6 \times 4 = 24$ ). [1 point]

**Part B:** The student provided an incorrect answer ( $1\frac{1}{2}$ ) with no support on how the answer was found (*looking at the chart . . . I needed to subtract*) since the student did not state what needed to be subtracted. The student likely subtracted the number of sun pictures for April from the number of sun pictures for May ( $5\frac{1}{2} - 4 = 1\frac{1}{2}$ ). However, to earn any credit for support (work or explanation), the student needed to apply the key for the pictograph by multiplying the difference of  $1\frac{1}{2}$  sun pictures by 4 days. [0 points]

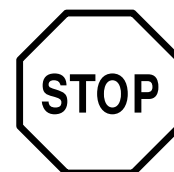
16. **Continued.** Please refer to the previous page for task explanation.

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

- C. Explain how you know Gabriela made a mistake when she finished the pictograph.

First I was confused until I looked at the key which said  = 4 days. Then I did the math and realized 9 suns times 4 days in each sun equals 36 day. You can see were I'm going with this. Finally its wrong becquse you can't have 36 days in a month.

After you have finished your work, close this booklet so your teacher will know you are finished.





**Part C:** The student provided a correct and complete explanation of how Gabriela made a mistake putting 9 sun pictures in June (*9 suns times 4 days in each sun equals 36 day . . . its wrong because you can't have 36 days in a month*). [1 point]





STUDENT RESPONSE

 Computer Response Score: 1 point


PARTS A and B

Question 16

Page 1 of 2

Line Guide




















Item ID

?

Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

**Days the Sun Was Visible at Noon**

March	     
April	   
May	     
June	

Key:  = 4 days

**A.** How many days was the Sun visible at noon in March?

EQ

24 days

**B.** How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.


EQ

1 1/2, because in April there is only 4 days of sun and in May there are 5 1/2.


79 / 1000

Review/End Test

Pause

Flag 

Options

Next 

**Part A:** The student provided the correct answer (24 days). While support is not required for Part A, the student likely counted the number of sun pictures for March (6) and multiplied the number of sun pictures by 4, since each sun picture represents 4 days ( $6 \times 4 = 24$ ). [1 point]

**Part B:** The student provided an incorrect answer (1 1/2) with incorrect support on how the answer was found (*because in April there is only 4 days of sun and in May there are 5 1/2*). To earn any credit for support (work or explanation), the student needed to apply the key for the pictograph by multiplying the numbers of sun pictures by 4 days. [0 points]

## PART C

Question 16

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




Item ID



Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	      
June	

Key:  = 4 days

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

C. Explain how you know Gabriela made a mistake when she finished the pictograph.


EQ

It should go up one at a time... Because in April there was 4 days and in May there was 5 1/2.

92 / 1000

Review/End Test

Pause

Flag 

Options

Back

Next

















**Part C:** The student provided an incorrect explanation of how Gabriela made a mistake putting 9 sun pictures in June (*April there was 4 days and in May there was 5 1/2*). The student incorrectly attempted to find a pattern in the number of sun pictures for each month (*It should go up one at a time*); however, the increase between April and May was  $1\frac{1}{2}$  sun pictures, not 1. [0 points]


STUDENT RESPONSE

Response Score: 0 points

16. Each month for four months, Gabriela recorded the number of days the Sun was visible at noon. She started the pictograph below but has not yet completed the row for June.

Days the Sun Was Visible at Noon

March	     
April	   
May	     
June	

Key:  = 4 days

- A. How many days was the Sun visible at noon in March?

6 days

- B. How many more days was the Sun visible at noon in May than in April? Explain how you found your answer.

$\frac{1}{2}$  more days

Go to the next page to finish question 16.



**Part A:** The student provided an incorrect answer (*6 days*). No support (work or explanation) is required, so it is unclear where an error was made. The student may have counted the 6 sun pictures for March but not applied the key for the pictograph by multiplying 6 sun pictures by 4 days. [0 points]

**Part B:** The student provided an incorrect answer ( $\frac{1}{2}$  more dayys) with no support (work or explanation) for how the answer was found. The student may have found the difference between the number of sun pictures for March and May ( $6 - 5\frac{1}{2} = \frac{1}{2}$ ) while also not applying the key for the pictograph by multiplying the numbers of sun pictures by 4 days. [0 points]

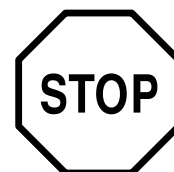
16. **Continued.** Please refer to the previous page for task explanation.

To finish the pictograph, Gabriela put 9 complete sun pictures in the row for June.

- C. Explain how you know Gabriela made a mistake when she finished the pictograph.

Gabriela did not put  
9 suns in June like  
he said he would.

After you have finished your work, close this booklet so your teacher will know you are finished.



**Part C:** The student provided an incorrect explanation of how Gabriela made a mistake putting 9 sun pictures in June (*Gabriela did not put 9 suns in June like he said he would*). The student incorrectly interpreted the empty row for June as the mistake rather than applying the key to explain that 9 sun pictures would be equivalent to 36 days the Sun was visible at noon in June. [0 points]

# **Mathematics—Summary Data**

## **Multiple-Choice**

An asterisk (\*) indicates the key.

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
1	A-F.1.1.1	D	1	26%	13%	13%	48%*
2	A-T.1.1.1	C	1	22%	19%	34%*	25%
3	A-T.1.1.5	C	1	14%	27%	51%*	8%
4	A-T.2.1	A	2	40%*	22%	18%	20%
5	A-T.2.1.1	D	1	15%	19%	15%	51%*
6	A-T.2.1.2	C	1	5%	5%	83%*	7%
7	A-F.2.1	A	2	37%*	29%	23%	11%
8	A-F.2.1.2	A	1	55%*	16%	19%	10%
9	A-F.2.1.3	A	2	53%*	20%	18%	9%
10	A-F.2.1.4	A	1	48%*	9%	35%	8%
11	B-O.1.1	A	2	35%*	34%	18%	13%
12	B-O.1.1.2	B	2	21%	44%*	12%	23%
13	B-O.2.1.1	C	2	18%	17%	42%*	23%
14	C-G.1.1	D	2	26%	17%	16%	41%*
15	C-G.1.1.2	A	2	39%*	18%	17%	26%

## **Open-Ended**

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
16	D-M.2.1	4	2	1.97