
XII. Mathematics, Grade 6

Grade 6 Mathematics Test

The spring 2019 grade 6 Mathematics test was a next-generation assessment that was administered in two primary formats: a computer-based version and a paper-based version. The vast majority of students took the computer-based test. The paper-based test was offered as an accommodation for students with disabilities who are unable to use a computer, as well as for English learners who are new to the country and are unfamiliar with technology.

Most of the operational items on the grade 6 Mathematics test were the same, regardless of whether a student took the computer-based version or the paper-based version. In places where a technology-enhanced item was used on the computer-based test, an adapted version of the item was created for use on the paper test. These adapted paper items were multiple-choice, multiple-select, or short-answer items that tested the same Mathematics content and assessed the same standard as the technology-enhanced item.

This document displays released items from the paper-based test. Released items from the computer-based test are available on the MCAS Resource Center website at mcas.pearsonsupport.com/released-items.

Test Sessions and Content Overview

The grade 6 Mathematics test was made up of two separate test sessions. Each session included selected-response, short-answer, and constructed-response questions. On the paper-based test, the selected-response questions were multiple-choice items and multiple-select items, in which students select the correct answer(s) from among several answer options.

Standards and Reporting Categories

The grade 6 Mathematics test was based on standards in the five domains for grade 6 in the *Massachusetts Curriculum Framework for Mathematics* (2017). The five domains are listed below.

- Ratios and Proportional Relationships
- The Number System
- Expressions and Equations
- Geometry
- Statistics and Probability

The *Massachusetts Curriculum Framework for Mathematics* is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Mathematics test results are reported under five MCAS reporting categories, which are identical to the five framework domains listed above.

The tables at the conclusion of this chapter provide the following information about each released and unreleased operational item: reporting category, standard(s) covered, item type, and item description. The correct answers for released selected-response and short-answer questions are also displayed in the released item table.

Reference Materials and Tools

Each student taking the paper-based version of the grade 6 Mathematics test was provided with a plastic ruler and a grade 6 Mathematics Reference Sheet. A copy of the reference sheet follows the final question in this chapter. An image of the ruler is not reproduced in this publication.

During both Mathematics test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English learner students only. No calculators, other reference tools, or materials were allowed.

Grade 6 Mathematics

SESSION 1

This session contains 9 questions.

*You may use your reference sheet during this session.
You may **not** use a calculator during this session.*



Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Test & Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

For other questions, you will need to fill in an answer grid. Directions for completing questions with answer grids are provided on the next page.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided in this Test & Answer Booklet. Only responses written within the provided space will be scored.

Directions for Completing Questions with Answer Grids

1. Work the question and find an answer.
2. Enter your answer in the answer boxes at the top of the answer grid.
3. Print only one number or symbol in each box. Do not leave a blank box in the middle of an answer.
4. Under each answer box, fill in the circle that matches the number or symbol you wrote above. Make a solid mark that completely fills the circle.
5. Do not fill in a circle under an unused answer box.
6. Fractions cannot be entered into an answer grid and will not be scored. Enter fractions as decimals.
7. If you need to change an answer, be sure to erase your first answer completely.
8. See below for examples of how to correctly complete an answer grid.

EXAMPLES

-	1	4				
●						
○	○	○	○	○	○	○
0	0	0	0	0	0	0
1	●	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	●	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

	4	8	3	1	6	
○						
○	○	○	○	○	○	○
0	0	0	0	0	0	0
1	1	1	1	●	1	1
2	2	2	2	2	2	2
3	3	3	●	3	3	3
4	●	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	●	6
7	7	7	7	7	7	7
8	8	●	8	8	8	8
9	9	9	9	9	9	9

			6	5	.	3
○						
○	○	○	○	○	○	○
0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	●
4	4	4	4	4	4	4
5	5	5	5	●	5	5
6	6	6	●	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

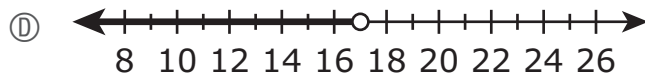
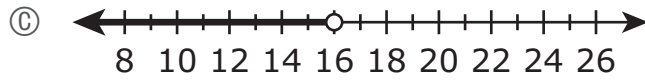
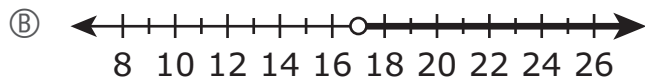
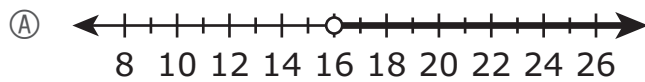
	9	.	5	5	5	5
○						
○	○	○	○	○	○	○
0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	●	●	●	●
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	●	9	9	9	9	9

1 A mail carrier delivered mail to 84 houses in 3 hours. At what rate did the mail carrier deliver the mail?

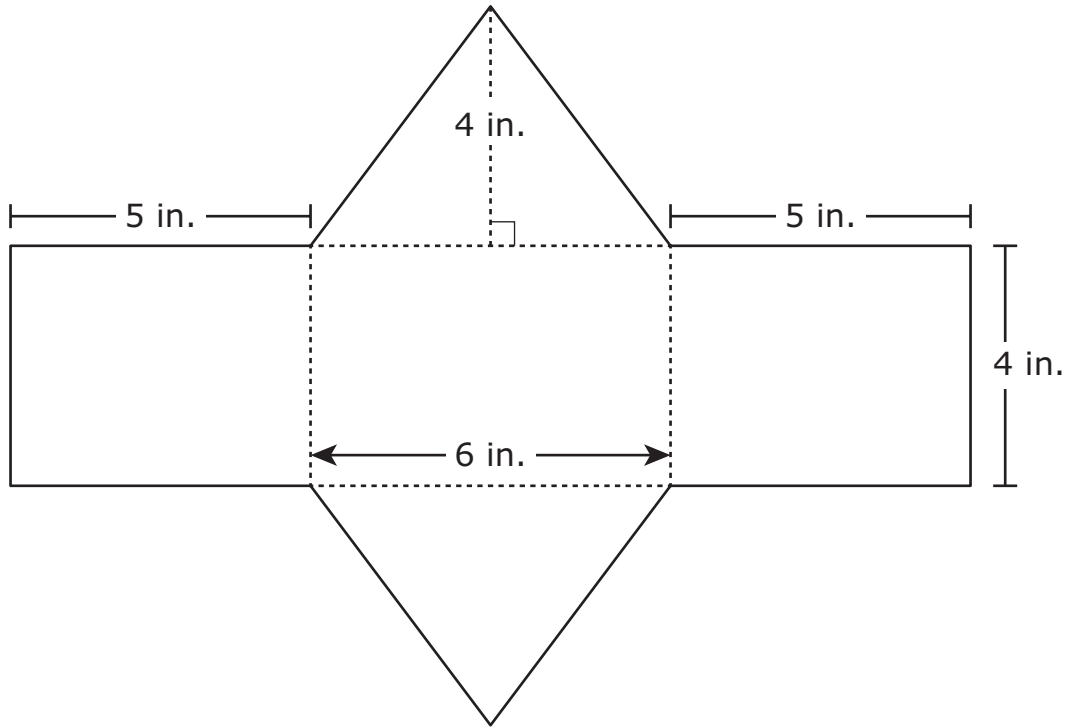
- (A) 24 houses per hour
- (B) 28 houses per hour
- (C) 81 houses per hour
- (D) 87 houses per hour

2 A student ate more than 16 ounces of cereal last week.

Which number line best represents the number of ounces of cereal the student could have eaten last week?



- 3 A gift box is in the shape of a right triangular prism. The net of the gift box is shown.



Which of the following expressions represents the total surface area, in square inches, of the gift box?

- Ⓐ $(4 \times 4) + (4 \times 5) + (4 \times 6) + \frac{1}{2}(4 \times 4) + \frac{1}{2}(4 \times 4)$
- Ⓑ $(4 \times 5) + (4 \times 5) + (4 \times 6) + \frac{1}{2}(4 \times 6) + \frac{1}{2}(4 \times 6)$
- Ⓒ $(4 \times 4) + (4 \times 5) + (4 \times 6) + \frac{1}{2}(4 \times 5) + \frac{1}{2}(4 \times 5)$
- Ⓓ $(4 \times 5) + (4 \times 6) + (4 \times 6) + \frac{1}{2}(4 \times 6) + \frac{1}{2}(4 \times 6)$

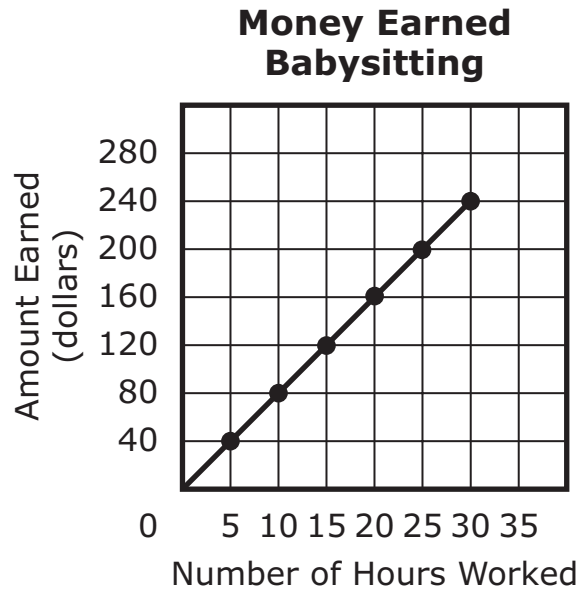
- 4 A student drew a triangle on a coordinate plane. The coordinates of each vertex of the triangle are shown.

- $E(-2, -3)$
- $F(1, 5)$
- $G(4, -3)$

What is the length, in units, of side EG of the triangle?

- Ⓐ 2
- Ⓑ 3
- Ⓒ 6
- Ⓓ 7

- 5 This graph represents the relationship between the number of hours a babysitter worked and the amount of money, in dollars, she earned.



What is the amount of money, in dollars, the babysitter earned for each hour she worked?

- (A) \$5
- (B) \$8
- (C) \$30
- (D) \$40

- 6 A farmer picked oranges and put them all into 9 boxes. Each box had the same number of oranges.

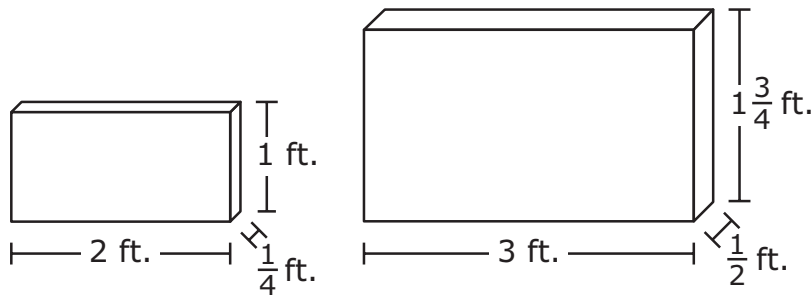
Which of the following could be the number of oranges the farmer picked?

- Ⓐ 299
- Ⓑ 281
- Ⓒ 273
- Ⓓ 261

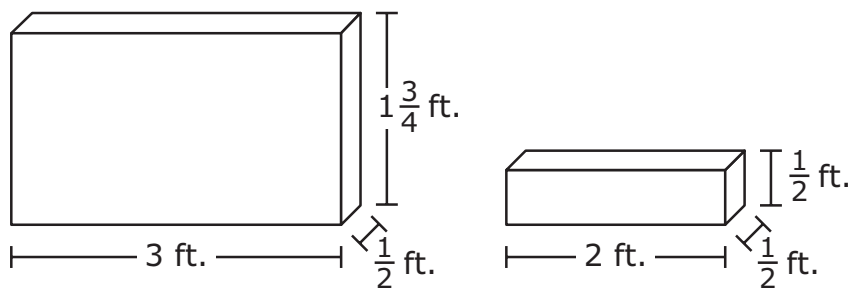
- 7 A science teacher has 32 cubes. Each cube has an edge length of $\frac{1}{4}$ foot. The teacher will use the cubes to find the volumes of right rectangular prisms by filling them with the cubes.

In which of the following groups of prisms can each prism be **completely** filled with the 32 cubes?

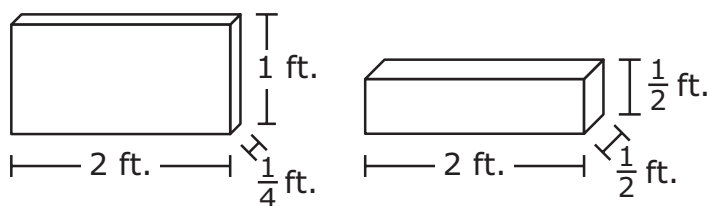
Ⓐ



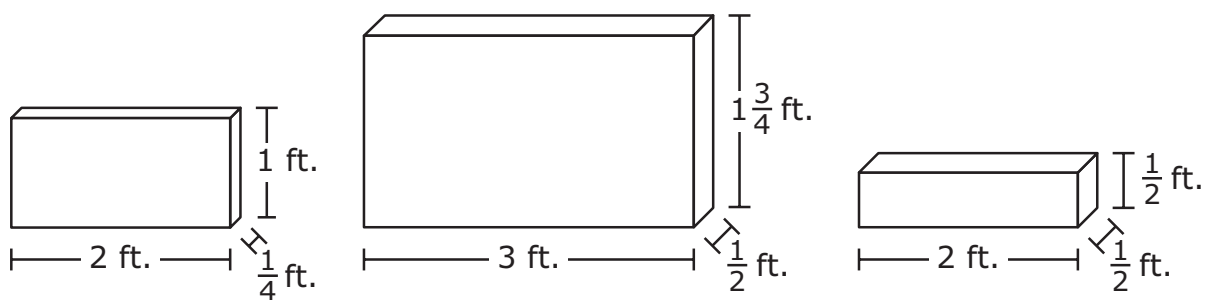
Ⓑ



Ⓒ



Ⓓ



This question has four parts. Be sure to label each part of your response.

- 8 A student had 30 tickets to use at a carnival. The numbers of tickets needed to go on some rides and play some games at the carnival are shown in this table.

Carnival Tickets

Ride or Game	Tickets Needed
ball throw	3
bumper cars	t
Ferris wheel	5
ring toss	2
roller coaster	8

- A. The student played one game of ball throw and rode the bumper cars one time. She used a total of 9 tickets for these two activities.

Write an equation that can be used to find t , the number of tickets needed to ride the bumper cars.

- B. Solve the equation you wrote in Part A to find t , the number of tickets needed to ride the bumper cars. Show or explain how you got your answer.

- C. The student used a total of 15 tickets for rides on the Ferris wheel. How many times did she ride the Ferris wheel?

Write and solve an equation that can be used to find r , the number of times the student rode the Ferris wheel.

- D. The student used 24 of her 30 tickets. In order to play one ring toss game and ride the roller coaster one time, she needed to purchase additional tickets to use with the tickets she had left. The student spent \$2.60 on the additional tickets she needed.

What was the cost, in dollars, of each additional ticket? Show or explain how you got your answer.

- 9 Robin reads 5 pages of a book in 4 minutes. Based on this rate, what is the total number of minutes it will take Robin to read 200 pages?
- (A) 100 minutes
 - (B) 160 minutes
 - (C) 200 minutes
 - (D) 250 minutes

Grade 6 Mathematics

SESSION 2

This session contains 11 questions.

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Directions

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- 10 Which of the following is less than $\frac{20}{3}$?
- Ⓐ $\frac{20}{4}$
 - Ⓑ $\frac{21}{3}$
 - Ⓒ 6.75
 - Ⓓ 20.3
- 11 A basket of fruit contains 6 apples, 5 oranges, 3 bananas, and 2 limes. Which of the following statements about the fruits in the basket are true? Select the **two** correct statements.
- Ⓐ The ratio of oranges to limes is 5:2.
 - Ⓑ The ratio of apples to bananas is 3:6.
 - Ⓒ The ratio of bananas to the total number of fruits in the basket is 3:16.
 - Ⓓ The ratio of limes to apples is 1:4 because there are 4 more apples than limes.
 - Ⓔ The ratio of bananas to limes is 2:3 because $\frac{2}{3}$ of the fruits in the basket are bananas.

- 12 On Saturday, a gymnast walked a distance of x miles. On Sunday, the gymnast walked half the distance that he walked on Saturday.

Which expression represents the total number of miles the gymnast walked on Saturday **and** Sunday?

(A) $x - \frac{x}{2}$

(B) $x + \frac{x}{2}$

(C) $\frac{x-x}{2}$

(D) $\frac{x+x}{2}$

- 13 A book club has 36 members. There are 24 boys and 12 girls in the club. What is the ratio of the number of boys in the club to the number of girls in the club?

(A) 12:24

(B) 24:12

(C) 24:36

(D) 36:24

This question has four parts. Be sure to label each part of your response.

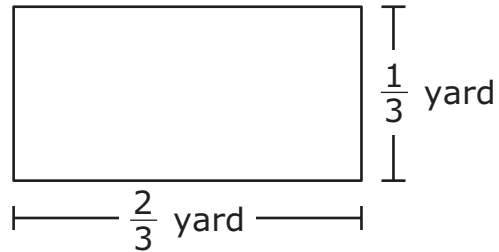
- 14 This table shows the number of minutes a student spent drawing each day for 6 days.

Time Spent Drawing

Day	Number of Minutes
1	20
2	8
3	16
4	40
5	15
6	45

- A. Based on the table, what is the median number of minutes the student spent drawing each day for the 6 days? Show or explain how you got your answer.
- B. Based on the table, what is the mode of the numbers of minutes the student spent drawing each day for the 6 days? Show or explain how you got your answer.
- C. Based on the table, what is the mean number of minutes the student spent drawing each day for the 6 days? Show or explain how you got your answer.
- D. The student also spent time drawing on Day 7. The mean number of minutes the student spent drawing each day for all 7 days is 30 minutes. How many minutes did the student spend drawing on Day 7? Show or explain how you got your answer.

- 15 A kitchen cabinet is in the shape of a rectangular prism. The height of the cabinet is 2 yards. The dimensions of the base of the cabinet are shown in this diagram.



What is the **volume**, in cubic yards, of the kitchen cabinet?

- (A) $\frac{2}{9}$
- (B) $\frac{4}{9}$
- (C) 2
- (D) 3

- 16 A student wrote this expression.

$$2(5x + 3)$$

Which of the following expressions are equivalent to the student's expression?

Select the **two** equivalent expressions.

- Ⓐ $10x + 3$
- Ⓑ $10x + 6$
- Ⓒ $25x + 3$
- Ⓓ $(5x + 3)(5x + 3)$
- Ⓔ $(5x + 3) + (5x + 3)$

- 17 Which expressions each have a value of 64?

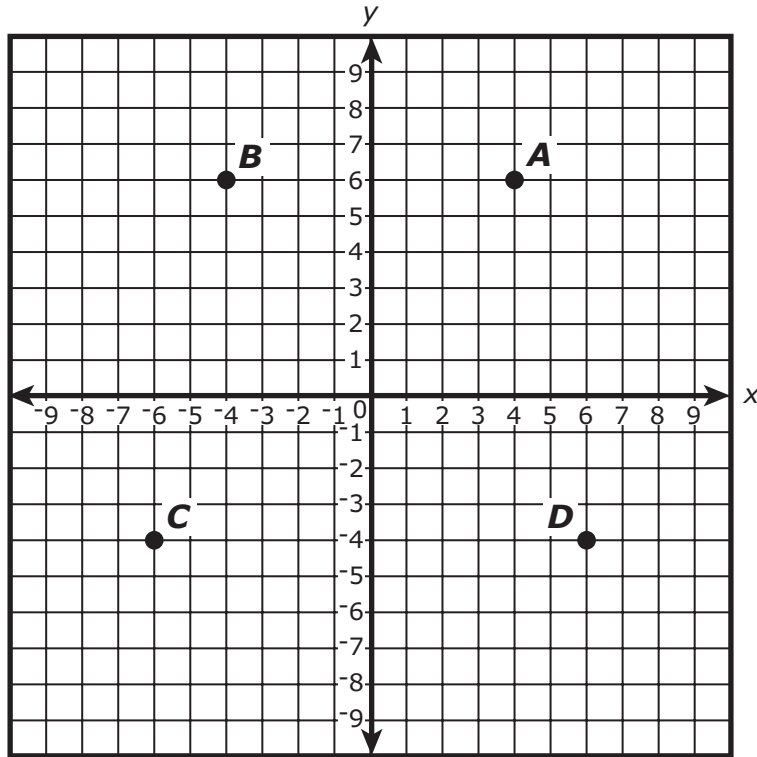
Select the **three** correct answers.

- Ⓐ 2^6
- Ⓑ 3^4
- Ⓒ 4^3
- Ⓓ 6^2
- Ⓔ 8^2

This question has two parts.

18 Part A

Four points are shown on this coordinate plane.



Which ordered pair represents the location of point A on the coordinate plane?

- Ⓐ $(-6, -4)$
- Ⓑ $(-4, 6)$
- Ⓒ $(4, 6)$
- Ⓓ $(6, -4)$

Part B

Point E is represented by the ordered pair $(-8, 5)$. A student will reflect the point over the x -axis.

Which ordered pair will represent point E after it has been reflected over the x -axis?

- Ⓐ $(-8, -5)$
- Ⓑ $(-5, -8)$
- Ⓒ $(5, -8)$
- Ⓓ $(8, -5)$

- 19** The ratio of mass to volume for a type of metal is 27 grams to 10 cubic centimeters. A sample of the metal has a mass of 81 grams.

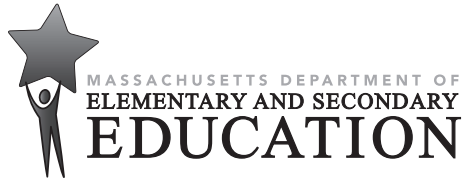
What is the volume, in cubic centimeters, of the sample of metal?

- Ⓐ 30
- Ⓑ 64
- Ⓒ 118
- Ⓓ 810

- 20 A parent needs $\frac{1}{4}$ cup of lemonade mix to make one pitcher of lemonade. She has $\frac{1}{3}$ cup of lemonade mix.

Which of the following expressions represents the number of pitchers of lemonade that the parent can make with $\frac{1}{3}$ cup of lemonade mix?

- Ⓐ $\frac{1}{3} \times \frac{1}{4}$
- Ⓑ $\frac{1}{3} \div \frac{1}{4}$
- Ⓒ $\frac{1}{4} + \frac{1}{3}$
- Ⓓ $\frac{1}{4} \div \frac{1}{3}$



Massachusetts Comprehensive Assessment System Grade 6 Mathematics Reference Sheet

CONVERSIONS

1 cup = 8 fluid ounces

1 pint = 2 cups

1 quart = 2 pints

1 gallon = 4 quarts

1 gallon \approx 3.785 liters

1 liter \approx 0.264 gallon

1 liter = 1000 cubic centimeters

1 inch = 2.54 centimeters

1 meter \approx 39.37 inches

1 mile = 5280 feet

1 mile = 1760 yards

1 mile \approx 1.609 kilometers

1 kilometer \approx 0.62 mile

1 pound = 16 ounces

1 pound \approx 0.454 kilogram

1 kilogram \approx 2.2 pounds

1 ton = 2000 pounds

AREA (A) FORMULAS

square $A = s^2$

rectangle $A = bh$

OR

$A = lw$

parallelogram $A = bh$

triangle $A = \frac{1}{2}bh$

(b = length of base; h = height)

VOLUME (V) FORMULAS

right rectangular prism $V = lwh$

(l = length; w = width; h = height)

OR

$V = Bh$

(B = area of base; h = height)

Grade 6 Mathematics
Spring 2019 Released Operational Items

PBT Item No.	Page No.	Reporting Category	Standard	Item Type*	Item Description	Correct Answer**
1	270	<i>Ratios and Proportional Relationships</i>	6.RP.A.2	SR	Given a real-world context, determine the unit rate.	B
2	270	<i>Expressions and Equations</i>	6.EE.B.8	SR	Choose the graph of the solution set of an inequality on a number line.	A
3	271	<i>Geometry</i>	6.G.A.4	SR	Identify an expression that can be used to find the surface area of a net consisting of rectangles and triangles.	B
4	272	<i>Geometry</i>	6.G.A.3	SR	Given the coordinates of the vertices of a triangle, determine the length of a side.	C
5	273	<i>Expressions and Equations</i>	6.EE.C.9	SR	Analyze a graph to determine the unit rate in a real-world context.	B
6	274	<i>The Number System</i>	6.NS.B.4	SR	Given one factor, determine a possible product by using common factors and common multiples in a real-world context.	D
7	275	<i>Geometry</i>	6.G.A.2	SR	Determine which group of right rectangular prisms with fractional edge lengths can be completely filled with unit cubes.	C
8	276	<i>Expressions and Equations</i>	6.EE.B.7	CR	Create and solve equations that represent a given real-world context.	
9	278	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Use ratios to solve a real-world problem involving a given rate.	B
10	281	<i>The Number System</i>	6.NS.C.7	SR	Using the context of improper fractions and decimals, determine which rational number is less than a given rational number.	A
11	281	<i>Ratios and Proportional Relationships</i>	6.RP.A.1	SR	Select ratios that correctly describe given ratio relationships in a real-world context.	A,C
12	282	<i>Expressions and Equations</i>	6.EE.B.6	SR	Determine which expression can be used to represent a given situation with real-world context.	B
13	282	<i>Ratios and Proportional Relationships</i>	6.RP.A.1	SR	Determine which ratio represents a given real-world context.	B
14	283	<i>Statistics and Probability</i>	6.SP.B.5	CR	Find and describe the median, mode, and mean of a data set; then given the mean, determine the value of an unknown number in another data set.	
15	285	<i>Geometry</i>	6.G.A.2	SR	Given a diagram and a verbal description, determine the volume of a rectangular prism.	B
16	286	<i>Expressions and Equations</i>	6.EE.A.3	SR	Identify equivalent expressions by using the Distributive Property.	B,E
17	286	<i>Expressions and Equations</i>	6.EE.A.1	SR	Determine if expressions with exponents are equivalent to a given value.	A,C,E
18	287–288	<i>The Number System</i>	6.NS.C.6	SR	Determine which ordered pair represents a point's location on a coordinate plane and which ordered pair represents the image of a point after a reflection.	C;A
19	288	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Determine the volume of a solid by using rate and ratio reasoning within a real-world context.	A
20	289	<i>The Number System</i>	6.NS.A.1	SR	Determine which expression represents a real-world problem involving division of a fraction by a fraction.	B

* Mathematics item types are: selected-response (SR), short-answer (SA), and constructed-response (CR).

**Answers are provided here for selected-response and short-answer items only. Sample responses and scoring guidelines for any constructed-response items will be posted to the Department's website later this year.

Grade 6 Mathematics
Spring 2019 Unreleased Operational Items

PBT Item No.	Reporting Category	Standard	Item Type*	Item Description
21	<i>The Number System</i>	6.NS.B.2	SR	Determine whether the given division equations are true or false.
22	<i>Expressions and Equations</i>	6.EE.A.2	SA	Evaluate an expression using substitution.
23	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	CR	Using ratio and proportional reasoning, solve real-world problems involving fractions, decimals, percentages, and whole numbers.
24	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Determine which graphical representation does not represent a given ratio.
25	<i>Statistics and Probability</i>	6.SP.A.2	SR	Determine which statement about the mean and the mode of a given data set is true.
26	<i>The Number System</i>	6.NS.C.6	SR	Determine the value of a given point on a number line.
27	<i>Expressions and Equations</i>	6.EE.B.5	SR	Solve a two-step equation for an unknown value.
28	<i>Statistics and Probability</i>	6.SP.B.4	SR	Determine which box plot represents a given set of data and interpret a box plot to solve a real-world problem.
29	<i>The Number System</i>	6.NS.A.1	SA	Solve a word problem with real-world context using division of mixed numbers by mixed numbers.
30	<i>Expressions and Equations</i>	6.EE.B.6	SR	Determine which mathematical expression can be used to represent a given situation with real-world context.
31	<i>The Number System</i>	6.NS.C.7	SR	Determine which list of absolute value expressions is ordered from least to greatest.
32	<i>Expressions and Equations</i>	6.EE.B.5	SR	Solve a two-step equation to find the value of an unknown quantity.
33	<i>The Number System</i>	6.NS.C.8	SR	Determine which points on a coordinate plane have a given distance between them.
34	<i>Geometry</i>	6.G.A.2	CR	Solve a real-world problem involving volumes of right rectangular prisms.
35	<i>Expressions and Equations</i>	6.EE.B.7	SR	Given an equation of the form $px = q$, select the equation that is equivalent to the given equation.
36	<i>Ratios and Proportional Relationships</i>	6.RP.A.2	SR	Determine the unit rate given a real-world context.
37	<i>The Number System</i>	6.NS.B.3	SR	Determine the product of multi-digit decimals to solve a real-world problem.
38	<i>Statistics and Probability</i>	6.SP.A.3	SR	Determine the measures of center associated with a given set of data.
39	<i>Expressions and Equations</i>	6.EE.A.4	SR	Identify expressions that are equivalent to a given expression.
40	<i>Expressions and Equations</i>	6.EE.C.9	SR	Given the value of one variable, determine the value of another variable by analyzing the relationship of data shown on a coordinate plane.

* Mathematics item types are: selected-response (SR), short-answer (SA), and constructed-response (CR).