

# Massachusetts MCAS 2021 Grade 6 Math

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## Massachusetts Comprehensive Assessment System Grade 6 Mathematics Reference Sheet

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### 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)



MASSACHUSETTS DEPARTMENT OF  
ELEMENTARY AND SECONDARY  
**EDUCATION**

*Release of Spring 2021  
MCAS Test Items*

*from the*

*Grade 6 Mathematics  
Paper-Based Test*

**June 2021**

**Massachusetts Department of  
Elementary and Secondary Education**

# Grade 6 Mathematics

## SESSION 1

This session contains 10 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. 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				
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9	9	9	9	9	9	9

	4	8	3	1	6	
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4	<input checked="" type="radio"/>	4	4	4	4	4
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6	6	6	6	6	<input checked="" type="radio"/>	6
7	7	7	7	7	7	7
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9	9	9	9	9	9	9

			6	5	.	3
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2	2	2	2	2	2	2
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5	5	5	5	<input checked="" type="radio"/>	5	5
6	6	6	<input checked="" type="radio"/>	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
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	<input checked="" type="radio"/>	9	9	9	9	9

- 1 What is the value of this expression when  $n = 5$ ?

$$\frac{45}{n} + 10$$

- Ⓐ 9
- Ⓑ 11
- Ⓒ 15
- Ⓓ 19

- 2 Which of the following inequalities are true?

Select the **two** correct answers.

- Ⓐ  $|4| > 7$
- Ⓑ  $|-4| < 4$
- Ⓒ  $|-7| > |4|$
- Ⓓ  $|7| > |-7|$
- Ⓔ  $|-4| < |-7|$

3 Consider this expression.

$7110 \div 90$

What is the value of this expression?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

−							
•	•	•	•	•	•	•	•
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

4 An electrician will use the following wires for a project:

- 4 red wires that are each 36 inches in length
- 2 blue wires that are each 84 inches in length

The electrician wants to cut all the wires into equal-sized pieces of the greatest possible length.

Which of the following is true?

- Ⓐ The greatest length the electrician can cut the wires into is 6 inches. The total number of pieces the electrician will have after the wires are cut is 26.
- Ⓑ The greatest length the electrician can cut the wires into is 6 inches. The total number of pieces the electrician will have after the wires are cut is 51.
- Ⓒ The greatest length the electrician can cut the wires into is 12 inches. The total number of pieces the electrician will have after the wires are cut is 26.
- Ⓓ The greatest length the electrician can cut the wires into is 12 inches. The total number of pieces the electrician will have after the wires are cut is 51.



- 5 A new office building will have 640 workers. A construction code requires that new buildings have 2 restrooms for every 80 workers in the building.

Based on the construction code, what is the total number of restrooms the new office building must have?

- Ⓐ 4
- Ⓑ 8
- Ⓒ 12
- Ⓓ 16

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

**6** A city planner is creating designs for two dog parks.

A. The city planner is using a coordinate plane to create the design for the first park. The park will be in the shape of a rectangle. These four points represent the corners of the park.

- point  $A$ :  $(4, 1)$
- point  $B$ :  $(4, -3)$
- point  $C$ :  $(-2, -3)$
- point  $D$ :  $(-2, 1)$

On the coordinate plane provided in your answer space, plot the four points and then connect them to create the rectangle.

B. What are the length and the width, in units, of the rectangle you created in Part A to represent the park? Show or explain how you got your answer.

C. The city planner is using another coordinate plane to create the design for the second park.

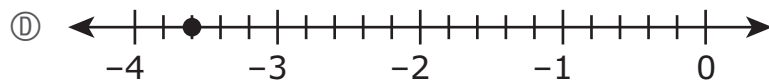
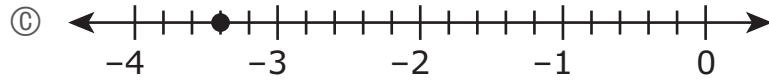
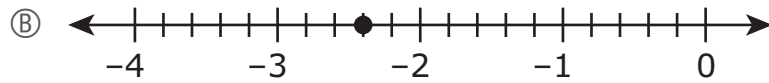
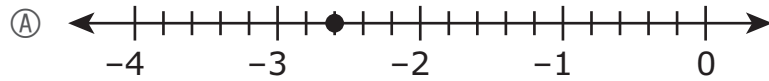
- The perimeter of the second park will be the same as the perimeter of the first park.
- One corner of the second park is represented by the point  $(1, -2)$ .
- The second park is in the shape of a square.

What could be the coordinates of the other three corners of the second park? Show or explain how you got your answer.

A.



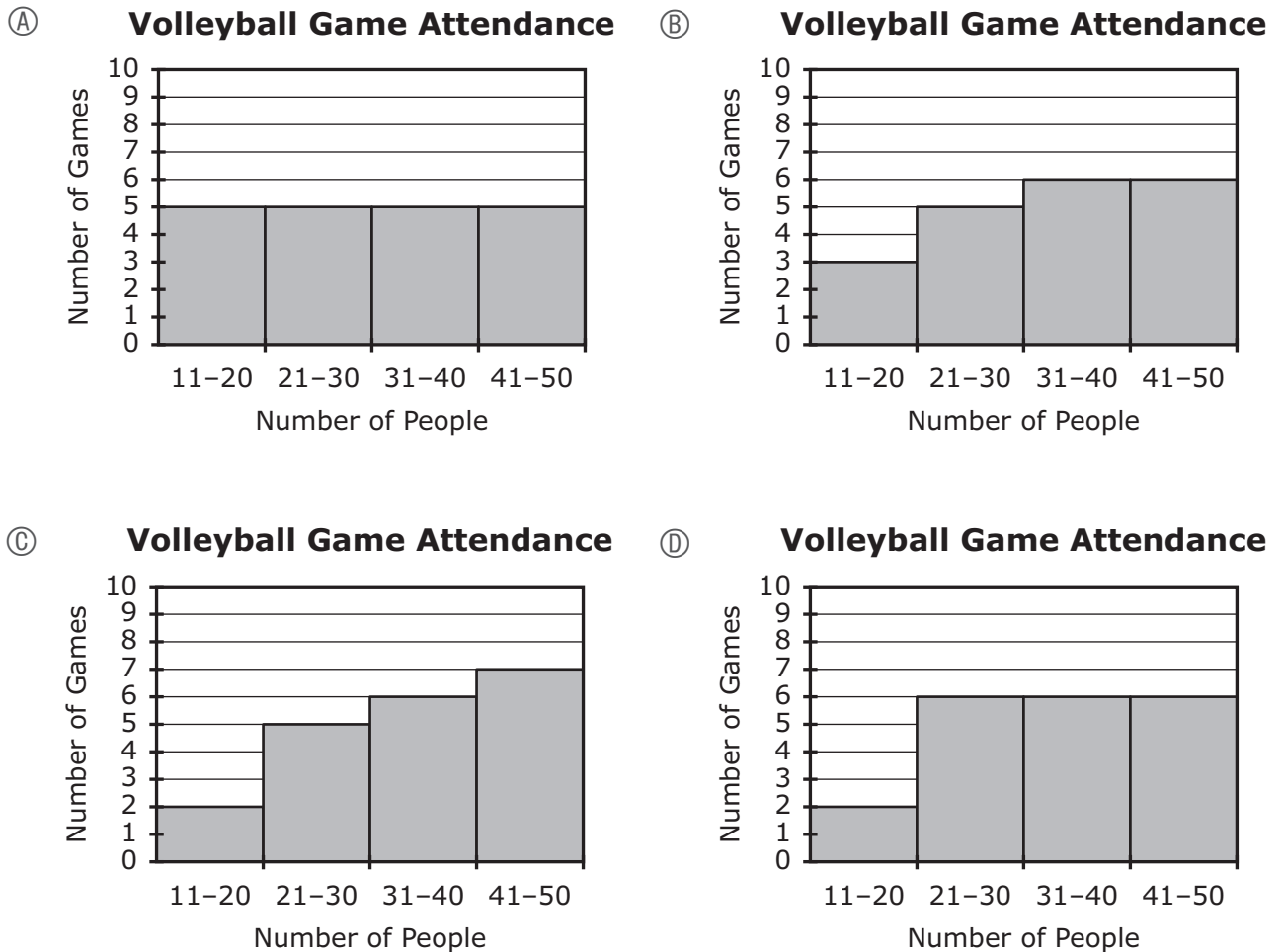
- 7 Which of the following number lines shows a point that represents  $-3.6$ ?



- 8 A volleyball team played twenty games this season. This list of data shows the number of people in attendance at each game.

36,	37,	18,	20,	42,
43,	37,	41,	45,	27,
38,	29,	30,	27,	46,
47,	40,	19,	35,	23

Which of the following histograms represents the data?



- 9 Consider this inequality.

$$5c > 10$$

Which of the following is a solution to the inequality?

- Ⓐ 0
- Ⓑ 1
- Ⓒ 2
- Ⓓ 3

- 10 A student collects data by asking students in his math class some questions. Which of the following questions are statistical questions?

Select the **two** statistical questions.

- Ⓐ Who is your math teacher?
- Ⓑ What is your favorite subject?
- Ⓒ How many minutes long is math class?
- Ⓓ Did the teacher give a math quiz today?
- Ⓔ How many minutes do you spend on math homework each week?

# Grade 6 Mathematics

## SESSION 2

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-	1	4					
●							
○	○	○	○	○	○	○	○
0	0	0	0	0	0	0	0
1	●	1	1	1	1	1	1
2	2	2	2	2	2	2	2
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4	4	●	4	4	4	4	4
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6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	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)	(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)	(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)

				6	5	.	3
⊖							
⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
0	0	0	0	0	0	0	0
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5	5	5	5	⊙	5	5	5
6	6	6	⊙	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	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)	(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)



- 11** A family drank 4 gallons of juice over 5 weeks. During this time period, at what rate did the family drink juice?
- Ⓐ  $\frac{4}{5}$  gallon per week
  - Ⓑ  $\frac{5}{4}$  gallons per week
  - Ⓒ 1 gallon per week
  - Ⓓ 9 gallons per week

- 12** Consider this expression.

$$6x + 24$$

Which of the following are equivalent to the expression?

Select the **three** equivalent expressions.

- Ⓐ  $6(x + 4)$
- Ⓑ  $6(x + 24)$
- Ⓒ  $3(12 + 2x)$
- Ⓓ  $2(3x + 12)$
- Ⓔ  $3x + 3 + 20 + 4x$
- Ⓕ  $4x + 12 + 2x + 12$

- 13** Consider this expression.

$$\frac{5}{6} \div \frac{2}{3}$$

Which of the following is the quotient of the expression?

Ⓐ  $\frac{10}{18}$

Ⓑ  $\frac{12}{15}$

Ⓒ  $\frac{15}{12}$

Ⓓ  $\frac{18}{10}$

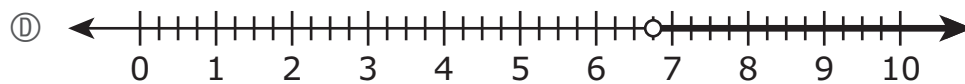
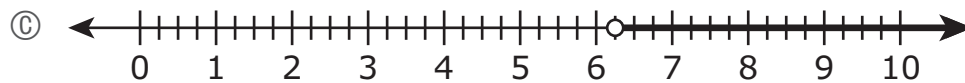
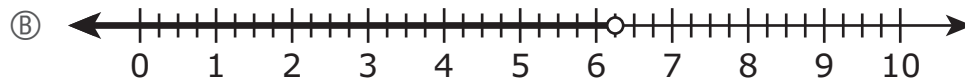
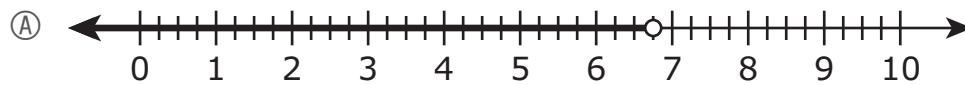
**This question has four parts. Be sure to label each part of your response.**

- 14** On Monday, there were 18 chickens and 12 sheep in a field. There were no other animals in the field.
- A. What was the ratio of chickens to sheep in the field on Monday?
  - B. For every 2 sheep in the field on Monday, how many chickens were in the field? Show or explain how you got your answer.
  - C. The ratio 3:5 can also be used to describe a relationship between the animals in the field on Monday. What relationship could this ratio describe? Show or explain how you got your answer.
  - D. On Tuesday, there were 4 more sheep in the field. Write a ratio to show the relationship between the number of sheep and the total number of animals in the field on Tuesday. Show or explain how you got your answer.

14

- 15** The length of a yellow ribbon is 6.75 inches. The length of a green ribbon is greater than the length of the yellow ribbon.

Which of the following number lines shows the graph of an inequality that represents all the possible lengths, in inches, of the green ribbon?



**16** A teenager is saving money to buy a snowboard.

- The snowboard costs \$132, including sales tax.
- The teenager has already saved \$23.

Which of the following equations could be used to find  $m$ , the remaining amount of money, in dollars, the teenager must save to buy the snowboard?

- Ⓐ  $\frac{m}{23} = 132$
- Ⓑ  $23m = 132$
- Ⓒ  $m - 23 = 132$
- Ⓓ  $m + 23 = 132$

- 17** A plumber charges a rate of \$45 for each hour of work.

Which of the following is true?

- Ⓐ An expression that represents the amount, in dollars, that the plumber will charge for  $x$  hours of work is  $45x$ . At this rate, for 2 hours of work the plumber will charge \$47.
- Ⓑ An expression that represents the amount, in dollars, that the plumber will charge for  $x$  hours of work is  $45x$ . At this rate, for 2 hours of work the plumber will charge \$90.
- Ⓒ An expression that represents the amount, in dollars, that the plumber will charge for  $x$  hours of work is  $45 + x$ . At this rate, for 2 hours of work the plumber will charge \$47.
- Ⓓ An expression that represents the amount, in dollars, that the plumber will charge for  $x$  hours of work is  $45 + x$ . At this rate, for 2 hours of work the plumber will charge \$90.



This question has two parts.

- 18 This list shows the number of countries outside the United States that 12 students in Mr. Miller’s class have visited.

3, 1, 9, 5, 2, 0, 0, 2, 6, 1, 6, 1
------------------------------------

Part A

Based on the list, what is the median number of countries outside the United States that Mr. Miller’s students have visited?

- A 1
- B 2
- C 3
- D 9

Part B

Based on the list, what is the mean number of countries outside the United States that Mr. Miller’s students have visited?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

⊖							
•	•	•	•	•	•	•	•
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

- 19** The owner of a furniture store orders 6 chairs for every table she orders.

Which of the following equations can be used to find  $c$ , the total number of chairs she will order when she orders  $t$  tables?

- Ⓐ  $6c = t$
- Ⓑ  $t + 6 = c$
- Ⓒ  $6t = c$
- Ⓓ  $c + 6 = t$

**20** Which of the following equations is true?

Ⓐ  $8 = 2^3$

Ⓑ  $9^2 = 18$

Ⓒ  $12 = 6^2$

Ⓓ  $7^3 = 21$

**Grade 6 Mathematics**  
**Spring 2021 Released Operational Items**

<b>PBT Item No.</b>	<b>Page No.</b>	<b>Reporting Category</b>	<b>Standard</b>	<b>Item Type*</b>	<b>Item Description</b>	<b>Correct Answer**</b>
1	4	<i>Expressions and Equations</i>	6.EE.A.2	SR	Determine the value of an expression given the value of a variable.	D
2	4	<i>The Number System</i>	6.NS.C.7	SR	Interpret inequalities using absolute values of integers.	C,E
3	5	<i>The Number System</i>	6.NS.B.2	SA	Find the quotient of two multi-digit numbers.	79
4	6	<i>The Number System</i>	6.NS.B.4	SR	Find the greatest common factor of two numbers to solve a real-world problem.	C
5	7	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Solve a ratio problem based on a given real-world context.	D
6	8	<i>Geometry</i>	6.G.A.3	CR	Solve problems on a coordinate plane by plotting points, finding the distance between points, and finding the coordinates of points given the distance between them.	
7	10	<i>The Number System</i>	6.NS.C.6	SR	Determine which number line shows a point that represents a given negative decimal.	D
8	11	<i>Statistics and Probability</i>	6.SP.B.4	SR	Choose a histogram to represent a given set of data.	B
9	12	<i>Expressions and Equations</i>	6.EE.B.5	SR	Determine the value of the variable in an inequality.	D
10	12	<i>Statistics and Probability</i>	6.SP.A.1	SR	Identify multiple statistical questions.	B,E
11	15	<i>Ratios and Proportional Relationships</i>	6.RP.A.2	SR	Solve a unit-rate problem based on a given real-world context.	A
12	16	<i>Expressions and Equations</i>	6.EE.A.4	SR	Identify expressions that are equivalent to a given variable expression.	A,D,F
13	17	<i>The Number System</i>	6.NS.A.1	SR	Calculate the quotient of two fractions.	C
14	18	<i>Ratios and Proportional Relationships</i>	6.RP.A.1	CR	Solve a real-world problem by interpreting and finding ratios based on a given ratio relationship.	
15	20	<i>Expressions and Equations</i>	6.EE.B.8	SR	Determine which number line shows the graph of an inequality that represents a constraint in a given real-world context.	D
16	21	<i>Expressions and Equations</i>	6.EE.B.7	SR	Determine which equation represents a given real-world context.	D
17	22	<i>Expressions and Equations</i>	6.EE.B.6	SR	Determine which sentences about a given real-world context include an expression and information that represent the context.	B
18	23	<i>Statistics and Probability</i>	6.SP.B.5	SA	Determine the median and mean of a set of data.	B;3
19	24	<i>Expressions and Equations</i>	6.EE.C.9	SR	Choose a two-variable equation that best represents a given real-world context.	C
20	25	<i>Expressions and Equations</i>	6.EE.A.1	SR	Evaluate numerical expressions involving whole-number exponents.	A

\* 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 2021 Unreleased Operational Items**

<b>PBT Item No.</b>	<b>Reporting Category</b>	<b>Standard</b>	<b>Item Type*</b>	<b>Item Description</b>
21	<i>The Number System</i>	6.NS.B.3	SR	Add and subtract decimals within a real-world context.
22	<i>Ratios and Proportional Relationships</i>	6.RP.A.2	SA	Determine the unit rate within a real-world context.
23	<i>Statistics and Probability</i>	6.SP.B.5	SR	Calculate the mean of a given set of data.
24	<i>Expressions and Equations</i>	6.EE.B.7	CR	Write and solve equations that model a real-world problem.
25	<i>Ratios and Proportional Relationships</i>	6.RP.A.1	SR	Determine which relationship can be represented by a given ratio.
26	<i>Expressions and Equations</i>	6.EE.A.3	SR	Use the distributive property to identify an equivalent expression within a real-world context.
27	<i>Expressions and Equations</i>	6.EE.B.8	SR	Identify the inequality which represents a constraint within a real-world context.
28	<i>Expressions and Equations</i>	6.EE.A.3	SR	Use the distributive property to determine equivalent expressions given a variable expression.
29	<i>Geometry</i>	6.G.A.1	SA	Find the area of a right triangle and decompose a polygon into triangles to choose the sentence that best describes its area.
30	<i>Ratios and Proportional Relationships</i>	6.RP.A.1	SR	Determine which statement describes a given ratio relationship in a real-world context.
31	<i>Statistics and Probability</i>	6.SP.A.2	SR	Determine the interquartile range of data displayed in a box plot.
32	<i>Expressions and Equations</i>	6.EE.A.3	SR	Use properties of operations to identify an equivalent equation.
33	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Determine the volume of a liquid by using rate and ratio reasoning within a real-world context.
34	<i>Statistics and Probability</i>	6.SP.A.1	SR	Identify multiple statistical questions.
35	<i>The Number System</i>	6.NS.C.8	CR	Solve problems on a coordinate plane by finding the distance between points, plotting points, and finding the coordinates of a point given its distance from a different point.
36	<i>The Number System</i>	6.NS.C.5	SR	Determine which real-world situation can be best represented by a negative number.
37	<i>Geometry</i>	6.G.A.4	SA	Use the net of a square pyramid to find its surface area.
38	<i>Ratios and Proportional Relationships</i>	6.RP.A.3	SR	Compare unit rates given a ratio in a real-world context involving money.
39	<i>Statistics and Probability</i>	6.SP.B.5	SR	Determine which statements correctly describe data represented in a dot plot.
40	<i>Geometry</i>	6.G.A.2	SR	Determine the number of cubes with fractional edge lengths that would fit in a given right rectangular prism in a real-world context.

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