



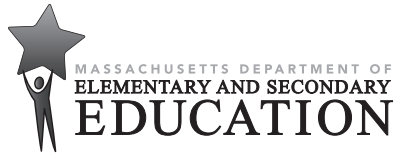
MASSACHUSETTS DEPARTMENT OF  
ELEMENTARY AND SECONDARY  
**EDUCATION**

*Release of Spring 2022  
MCAS Test Items*

*from the*

*Grade 5 Mathematics  
Paper-Based Test*

**June 2022**  
**Massachusetts Department of  
Elementary and Secondary Education**



This document was prepared by the  
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Jeffrey C. Riley  
Commissioner

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# Overview of Grade 5 Mathematics Test

The spring 2022 grade 5 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 5 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](https://mcas.pearsonsupport.com/released-items).

## Test Sessions and Content Overview

The grade 5 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 5 Mathematics test was based on standards in the five major domains for grade 5 in the *Massachusetts Curriculum Framework for Mathematics* (2017). The five major domains are listed below.

- Operations and Algebraic Thinking
- Number and Operations in Base Ten
- Number and Operations—Fractions
- Measurement and Data
- Geometry

The *Massachusetts Curriculum Framework for Mathematics* is available on the Department website at [www.doe.mass.edu/frameworks/current.html](https://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 document 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 5 Mathematics test was provided with a plastic ruler and a grade 5 Mathematics Reference Sheet. A copy of the reference sheet follows the final question in this document. An image of the ruler is not reproduced in the document.

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 5 Mathematics

## SESSION 1

This session contains 7 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. If you need to change an answer, be sure to erase your first answer completely.
7. See below for examples of how to correctly complete an answer grid.

## EXAMPLES

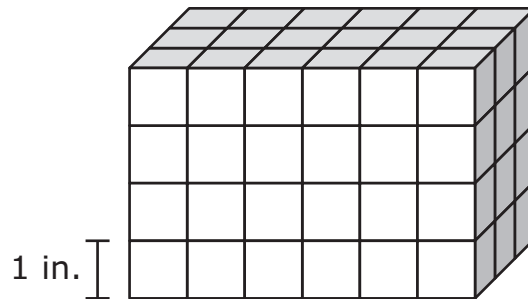
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8	8	8	8	8	8
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			4	3	8
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5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
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9	9	9	9	9	9

6	8	1	9		
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2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
<input checked="" type="radio"/>	6	6	6	6	6
7	7	7	7	7	7
8	<input checked="" type="radio"/>	8	8	8	8
9	9	9	<input checked="" type="radio"/>	9	9

- 1 A right rectangular prism is made of cubes, with no gaps or overlaps. Each cube has an edge length of 1 inch, as shown.



Which of the following expressions can be used to find the volume, in cubic inches, of the prism?

- (A)  $6 + 4 + 3$
- (B)  $6 \times 4 \times 3$
- (C)  $(6 \times 4) + 3$
- (D)  $6 \times (4 + 3)$

- 2 What is 18.495 rounded to the nearest **whole number**?

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
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

**3** Which of the following statements is correct?

- Ⓐ The value of  $\frac{6}{7} \times 9$  is less than 9 because  $\frac{6}{7}$  is less than 1.
- Ⓑ The value of  $\frac{6}{7} \times 9$  is greater than  $\frac{6}{7}$  because 9 is less than 1.
- Ⓒ The value of  $\frac{6}{7} \times 9$  is less than  $\frac{6}{7}$  because 9 is greater than 1.
- Ⓓ The value of  $\frac{6}{7} \times 9$  is greater than 9 because  $\frac{6}{7}$  is greater than 1.

**4** A teacher wrote this expression on a board.

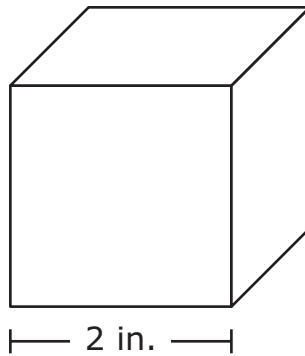
$$64 \div 2 \times 4 - 3$$

The teacher asked the students to add one set of parentheses to the expression so that the value of the new expression is 5.

Which of the following expressions has a value of 5?

- Ⓐ  $64 \div (2 \times 4 - 3)$
- Ⓑ  $(64 \div 2) \times 4 - 3$
- Ⓒ  $64 \div (2 \times 4) - 3$
- Ⓓ  $64 \div 2 \times (4 - 3)$

- 5 A student has a set of cubes. Each cube has an edge length of 2 inches, as shown.



The student used the cubes to build a figure that has a volume of 24 cubic inches.

What is the total number of cubes the student used to make the figure?

- Ⓐ 3
- Ⓑ 6
- Ⓒ 8
- Ⓓ 12



- 6 Write this number in standard form.

sixty-three and five hundred forty-six thousandths

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
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

- 7 Which of the following expressions is equivalent to  $5 \times \frac{1}{2}$ ?

- Ⓐ  $5 \times 1 \div 2$
- Ⓑ  $5 \times 2 \div 1$
- Ⓒ  $(5 \times 1) \div (5 \times 2)$
- Ⓓ  $(5 \times 2) \div (5 \times 1)$

# Grade 5 Mathematics

## SESSION 2

This session contains 13 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.

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5. Do not fill in a circle under an unused answer box.
6. If you need to change an answer, be sure to erase your first answer completely.
7. See below for examples of how to correctly complete an answer grid.

## EXAMPLES

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<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3
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- 8 A factory worker packed 1,576 cans of corn into boxes. The worker put 8 cans of corn into each box.

What is the total number of boxes the worker packed?

- Ⓐ 160
- Ⓑ 176
- Ⓒ 192
- Ⓓ 197

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

- 9** The students in a class are selling bracelets and pencils to raise money for a field trip.

- They will raise \$1.50 for each bracelet they sell.
- They will raise \$0.75 for each pencil they sell.

A. Nyla sold 13 bracelets.

What is the total amount of money, in dollars, Nyla raised selling bracelets? Show or explain how you got your answer.

B. Nyla also sold 11 pencils.

What is the total amount of money, in dollars, Nyla raised selling bracelets **and** pencils? Show or explain how you got your answer.

C. The class goal is to raise a total of \$900.

- The class has 25 students.
- Each student will raise the same amount of money.

What is the total amount of money, in dollars, Nyla still needs to raise to meet her part of the class goal? Show or explain how you got your answer.

D. Tomorrow, Nyla will sell more bracelets and pencils to raise enough money to meet her part of the class goal from Part C.

How many bracelets **and** how many pencils could Nyla sell tomorrow to raise the **exact** amount of money she still needs? Give one possible answer. Show or explain how you got your answer.

**Write your answers on the next page.**

9

- 10 Tim wrote this expression.

$$4 \times (5 + 2)$$

Which of the following is equivalent to his expression?

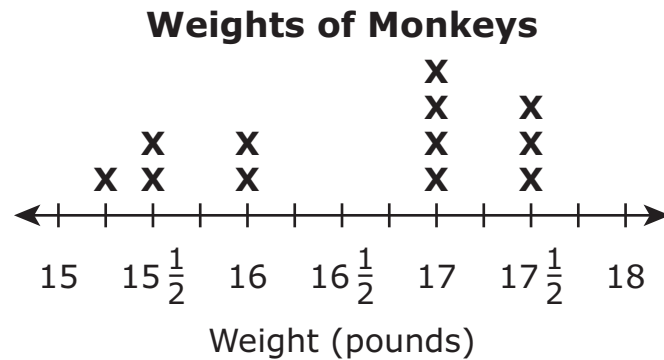
- Ⓐ 11
- Ⓑ 22
- Ⓒ 28
- Ⓓ 40

- 11 Which of the following statements are correct?

Select the **two** correct answers.

- Ⓐ The value of the 3 in 4,358 is ten times the value of the 3 in 6,932.
- Ⓑ The value of the 3 in 4,358 is one-tenth the value of the 3 in 6,932.
- Ⓒ The value of the 3 in 4,358 is one-hundredth the value of the 3 in 6,932.
- Ⓓ The value of the 3 in 1,783 is ten times the value of the 3 in 6,932.
- Ⓔ The value of the 3 in 1,783 is one-tenth the value of the 3 in 6,932.
- Ⓕ The value of the 3 in 1,783 is one-hundredth the value of the 3 in 6,932.

- 12 A zookeeper weighed some monkeys and recorded their weights, in pounds, on this line plot.



What is the difference, in pounds, between the monkey with the greatest weight and the monkey with the least weight?

- Ⓐ  $1\frac{3}{4}$
- Ⓑ  $2\frac{1}{4}$
- Ⓒ  $2\frac{1}{2}$
- Ⓓ 3



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

- 13** A city planner is using the coordinate plane shown in your answer space to design a new playground. She has already plotted the location of the swings.

A. She will locate the slide at the point  $(13, 5)$ .

On the coordinate plane provided in your answer space, plot the point that represents the location of the slide.

B. What is the ordered pair that represents the location of the swings on the coordinate plane?

C. The planner will locate the restroom 9 units from the origin along the  $x$ -axis and 2 units from the origin along the  $y$ -axis.

What is an ordered pair that she can use to represent the location of the restroom?

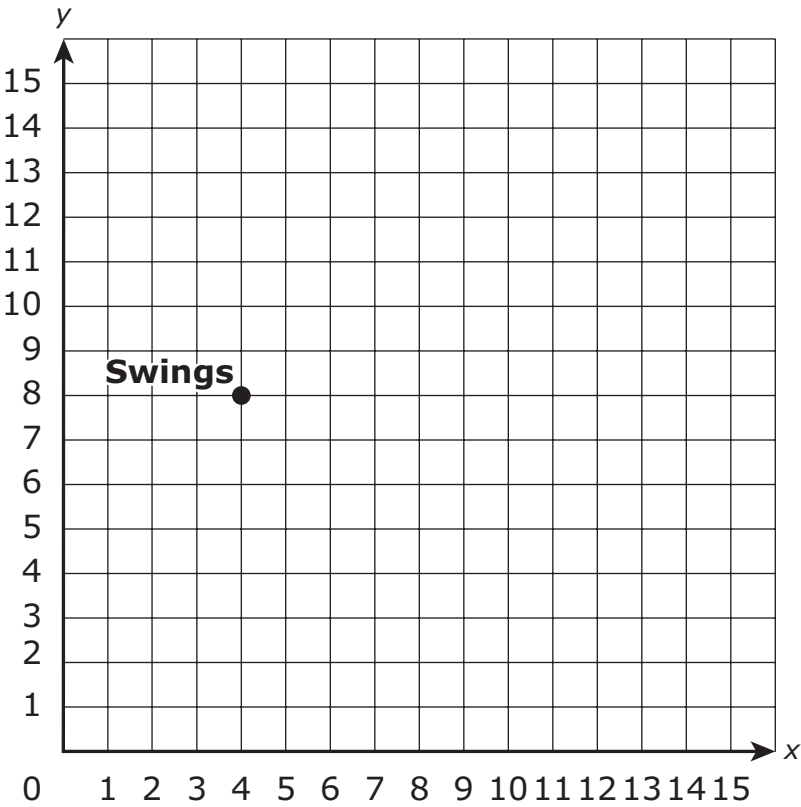
D. The planner will locate a picnic area 3 units away from the swings on the coordinate plane.

What are **two** ordered pairs that she can use to represent possible locations of the picnic area? Show or explain how you found your answers.

**Write your answers on the next page.**

13

A.



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- 14 Matthew bought  $\frac{1}{3}$  pound of cheese. He put all the cheese on 2 sandwiches. Matthew put the same amount of cheese on each sandwich.

Which of the following equations shows the amount of cheese, in pounds, on each sandwich?

Ⓐ  $\frac{1}{3} \times 6 = 2$

Ⓑ  $\frac{1}{3} \div 2 = \frac{1}{6}$

Ⓒ  $2 \times \frac{1}{3} = \frac{2}{3}$

Ⓓ  $2 \div \frac{1}{3} = 6$

**This question has two parts.**

- 15** A student wrote some expressions using the numbers 3, 7, and 12.

**Part A**

The student wrote the word expression shown in this box.

7 times the difference of 12 and 3

Which of the following numerical expressions is equivalent to the student's word expression?

- Ⓐ  $7 \times 12 - 3$
- Ⓑ  $12 - 3 \times 7$
- Ⓒ  $(7 \times 12) - 3$
- Ⓓ  $(12 - 3) \times 7$

**Part B**

The student wrote this numerical expression.

$$(12 + 7) \div 3$$

Which of the following word expressions is equivalent to the student's numerical expression?

- Ⓐ  $\frac{1}{3}$  the sum of 12 and 7
- Ⓑ 3 divided by the sum of 12 and 7
- Ⓒ  $\frac{1}{3}$  divided by the sum of 12 and 7
- Ⓓ 12 added to the quotient of 7 and 3

- 16 Which of the following shows the measurements ordered from **least** to **greatest** length?

Ⓐ 

35 inches	2 feet	$3\frac{1}{2}$ feet	1 yard
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Ⓑ 

35 inches	2 feet	1 yard	$3\frac{1}{2}$ feet
-----------	--------	--------	---------------------

Ⓒ 

2 feet	35 inches	$3\frac{1}{2}$ feet	1 yard
--------	-----------	---------------------	--------

Ⓓ 

2 feet	35 inches	1 yard	$3\frac{1}{2}$ feet
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- 17 Compute:

$$8\frac{4}{5} - 3\frac{3}{4}$$

- Ⓐ  $5\frac{1}{1}$
- Ⓑ  $5\frac{1}{5}$
- Ⓒ  $5\frac{1}{9}$
- Ⓓ  $5\frac{1}{20}$

- 18 A recipe for cookies requires these ingredients:

- 3 cups of flour
- 1 cup of brown sugar
- 2 cups of coconut

A  $\frac{1}{4}$ -cup measuring scoop will be used to measure each ingredient.

Which of the following tables shows the correct number of  $\frac{1}{4}$ -cup scoops for each ingredient needed to make the cookies?

Ⓐ

**Cookie Recipe**

Ingredients	Number of $\frac{1}{4}$ -Cup Scoops
3 cups of flour	$\frac{3}{4}$
1 cup of brown sugar	$\frac{1}{4}$
2 cups of coconut	$\frac{2}{4}$

Ⓑ

**Cookie Recipe**

Ingredients	Number of $\frac{1}{4}$ -Cup Scoops
3 cups of flour	$\frac{3}{4}$
1 cup of brown sugar	4
2 cups of coconut	2

Ⓒ

**Cookie Recipe**

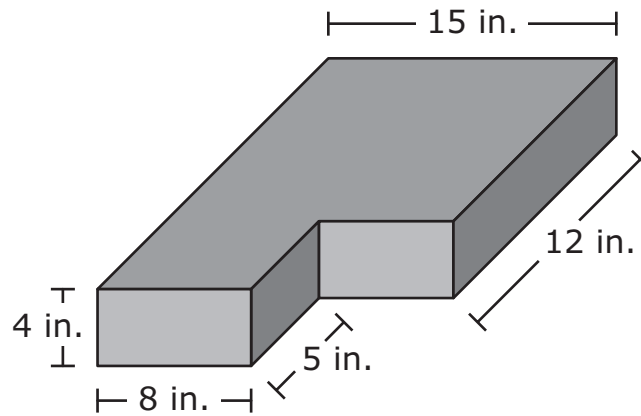
Ingredients	Number of $\frac{1}{4}$ -Cup Scoops
3 cups of flour	12
1 cup of brown sugar	4
2 cups of coconut	8

Ⓓ

**Cookie Recipe**

Ingredients	Number of $\frac{1}{4}$ -Cup Scoops
3 cups of flour	6
1 cup of brown sugar	2
2 cups of coconut	4

- 19 A three-dimensional figure is composed of two rectangular prisms. The figure and some of its dimensions are shown.



What is the volume, in cubic inches, of the three-dimensional figure?

- Ⓐ 880
- Ⓑ 720
- Ⓒ 496
- Ⓓ 160

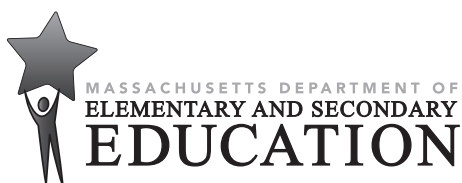
**20** Beatriz hiked on Saturday and Sunday.

- She hiked a distance of  $3\frac{3}{5}$  miles on Saturday.
- She hiked a distance of  $2\frac{2}{3}$  miles on Sunday.

What is the total distance Beatriz hiked on both days?

- Ⓐ  $5\frac{1}{5}$  miles
- Ⓑ  $5\frac{5}{8}$  miles
- Ⓒ  $6\frac{2}{3}$  miles
- Ⓓ  $6\frac{4}{15}$  miles





## Massachusetts Comprehensive Assessment System Grade 5 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 mile = 5280 feet

1 mile = 1760 yards

1 pound = 16 ounces

1 ton = 2000 pounds

### AREA (A) FORMULAS

square . . . . .  $A = s \times s$

( $s$  = length of a side)

rectangle . . . . .  $A = b \times h$

( $b$  = length of base;  $h$  = height)

OR

$A = l \times w$

( $l$  = length;  $w$  = width)

### VOLUME (V) FORMULAS

right rectangular prism . . . .  $V = l \times w \times h$

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

OR

$V = B \times h$

( $B$  = area of base;  $h$  = height)

**Grade 5 Mathematics**  
**Spring 2022 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>Measurement and Data</i>	5.MD.C.5	SR	Determine the expression that can be used to find the volume of a right rectangular prism that is packed with unit cubes.	B
2	4	<i>Number and Operations in Base Ten</i>	5.NBT.A.4	SA	Round a decimal to the nearest whole number.	18
3	5	<i>Number and Operations-Fractions</i>	5.NF.B.5	SR	Determine the relationship between the value of an expression and its factors by comparing the size of the factor to 1.	A
4	5	<i>Operations and Algebraic Thinking</i>	5.OA.A.1	SR	Identify an expression with parentheses that is equivalent to a given expression without parentheses.	C
5	6	<i>Measurement and Data</i>	5.MD.C.5	SR	Determine the number of cubes that are used to create a figure when the length of one edge of the cube and the volume of the figure are given.	A
6	7	<i>Number and Operations in Base Ten</i>	5.NBT.A.3	SA	Write a decimal number given in word form in number form.	63.546
7	7	<i>Number and Operations-Fractions</i>	5.NF.B.4	SR	Write the product of a whole number and a fraction as an equivalent expression with multiplication and division of whole numbers.	A
8	10	<i>Number and Operations in Base Ten</i>	5.NBT.B.6	SR	Find the quotient of a 4-digit dividend and a 1-digit divisor.	D
9	11–12	<i>Number and Operations in Base Ten</i>	5.NBT.B.7	CR	Solve multi-step real-world problems using the four operations with given whole numbers and decimals to hundredths.	
10	13	<i>Operations and Algebraic Thinking</i>	5.OA.A.1	SR	Determine the value of a given expression that has two operations and parentheses.	C
11	13	<i>Number and Operations in Base Ten</i>	5.NBT.A.1	SR	Compare the values of a digit in two different four-digit whole numbers.	A,E
12	14	<i>Measurement and Data</i>	5.MD.B.2	SR	Subtract mixed numbers to solve a problem involving information presented in a line plot.	B
13	15–16	<i>Geometry</i>	5.G.A.2	CR	Graph a given ordered pair on a coordinate plane, give the ordered pair of a point on a coordinate plane, and interpret coordinate values of points in the context of the situation.	
14	17	<i>Number and Operations-Fractions</i>	5.NF.B.7	SR	Determine the quotient of a unit fraction divided by a whole number in a real-world context.	B
15	18	<i>Operations and Algebraic Thinking</i>	5.OA.A.2	SR	Identify equivalent numerical and word expressions.	D;A
16	19	<i>Measurement and Data</i>	5.MD.A.1	SR	Compare lengths with measurements given in yards, feet, and inches and order from least to greatest.	D
17	19	<i>Number and Operations-Fractions</i>	5.NF.A.1	SR	Find the difference of two mixed numbers with unlike denominators.	D
18	20	<i>Number and Operations-Fractions</i>	5.NF.B.7	SR	Determine the quotients of whole numbers divided by fractions in real-world contexts.	C
19	21	<i>Measurement and Data</i>	5.MD.C.5	SR	Determine the total volume of two non-overlapping right rectangular prisms.	A
20	22	<i>Number and Operations-Fractions</i>	5.NF.A.2	SR	Solve a word problem by finding the sum of two mixed numbers with unlike denominators.	D

\* 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 5 Mathematics**  
**Spring 2022 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>Number and Operations in Base Ten</i>	5.NBT.A.2	SR	Find the multiple of 10 that makes an equation true when multiplying a decimal by an unknown factor.
22	<i>Measurement and Data</i>	5.MD.B.2	SR	Identify a line plot created with data given in the form of fractions with different denominators.
23	<i>Number and Operations in Base Ten</i>	5.NBT.A.2	SR	Identify which whole number is equivalent to a given power of ten.
24	<i>Operations and Algebraic Thinking</i>	5.OA.B.3	CR	Extend two different addition patterns and explain the relationship between corresponding terms in the patterns.
25	<i>Number and Operations in Base Ten</i>	5.NBT.B.7	SR	Add, subtract, multiply, and divide decimals to hundredths.
26	<i>Number and Operations-Fractions</i>	5.NF.B.6	CR	Solve real-world problems by finding the products of a whole number and a fraction, two fractions, a mixed number and a fraction, and two mixed numbers.
27	<i>Measurement and Data</i>	5.MD.B.2	SR	Use information from a given line plot to solve problems that involve adding and dividing fractions.
28	<i>Number and Operations in Base Ten</i>	5.NBT.B.5	SA	Determine the product of a two-digit whole number and a four-digit whole number.
29	<i>Number and Operations in Base Ten</i>	5.NBT.B.6	SR	Identify the division equation with a 4-digit dividend, a 1-digit divisor, and a variable quotient that can be used to solve a given word problem.
30	<i>Number and Operations-Fractions</i>	5.NF.B.3	SR	Identify a fraction as division of the numerator by the denominator and solve a word problem with division of two whole numbers with a mixed number answer.
31	<i>Geometry</i>	5.G.B.3	SR	Given a set of two-dimensional figures, identify which figures are rectangles.
32	<i>Number and Operations-Fractions</i>	5.NF.B.7	SR	Determine the word problem that can be solved by dividing a unit fraction by a whole number.
33	<i>Measurement and Data</i>	5.MD.C.4	SR	Solve a word problem involving finding the volume of a right rectangular prism by counting unit cubes.
34	<i>Geometry</i>	5.G.A.1	SR	Identify the ordered pair that describes the location of a point plotted on a coordinate plane.
35	<i>Number and Operations in Base Ten</i>	5.NBT.A.4	SR	Round a given decimal number in thousandths to the nearest tenth.
36	<i>Geometry</i>	5.G.B.4	SR	Determine if sets of quadrilaterals can also be classified as another quadrilateral.
37	<i>Measurement and Data</i>	5.MD.C.4	SR	Determine the volume of a right rectangular prism, with dimensions in metric units, by counting the cubes that make up the prism.
38	<i>Number and Operations in Base Ten</i>	5.NBT.A.3	SR	Compare values from a table that include mixed numbers and decimals.
39	<i>Number and Operations-Fractions</i>	5.NF.B.4	SR	Identify a real-world problem that represents a given multiplication equation with a unit fraction and a whole number.
40	<i>Number and Operations in Base Ten</i>	5.NBT.B.5	SA	Multiply a three-digit whole number by a two-digit whole number.

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