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## XIII. Mathematics, Grade 7

# Grade 7 Mathematics Test

The spring 2017 grade 7 Mathematics test was a next-generation assessment, featuring a new test design and new item types. The test was administered in two formats: a computer-based version and a paper-based version. The test included both operational items, which count toward a student's score, and matrix items. The matrix portion of the test consisted of field-test questions that do not count toward a student's score.

In general, all students were administered the same operational items, regardless of whether they took the computer-based test or the paper-based test. In some instances, the wording or content of a paper item differed slightly from the computer-based version. More information about the differences between the computer-based and paper-based tests will be posted to the MCAS website at [www.doe.mass.edu/mcas/](http://www.doe.mass.edu/mcas/).

This document displays the **paper-based versions** of the 2017 operational items that have been released. The **computer-based versions** of the released items are available on the MCAS Resource Center website at [mcas.pearsonsupport.com](http://mcas.pearsonsupport.com).

## Test Sessions and Content Overview

The grade 7 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 7 Mathematics test was based on standards in the five domains for grade 7 in the *Massachusetts Curriculum Framework for Mathematics* (March 2011). The grade 7 standards can be found on pages 59–64 in the *Framework*, and 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](http://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 7 Mathematics test was provided with a plastic ruler and a grade 7 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 Session 2, each student had sole access to a calculator. Calculator use was not allowed during Session 1.

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

# Grade 7 Mathematics

This session contains 5 questions.

*You may use your reference sheet during this session.  
You may use a calculator for questions 4 and 5.*

## **Directions**

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

For some questions, you will mark your answers by filling in the circles in your Student 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 your Student Answer Booklet. Only responses written within the provided space will be scored.

# Mathematics

## Directions for Completing Questions with Answer Grids

1. Work the question and find an answer.
2. Write your answer in the boxes at the top of the 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 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 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 on how to correctly complete an answer grid.

### EXAMPLES

To answer  $-3$  in a question, fill in the answer grid as shown below.

-	3				
●					
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○

To answer  $.75$  in a question, fill in the answer grid as shown below.

.	7	5			
○					
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○

## Mathematics

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- 1 Sandy leads an outdoor adventure group. She asked each member of the group to choose one activity for the next weekend. Each member chose hiking, camping, or boating. This table shows what part of the group chose hiking and what part of the group chose camping.

**Outdoor Activities**

Activity	Part of Group
Hiking	25%
Camping	$\frac{2}{5}$
Boating	

### Part A

What fractional part of the group chose hiking? Write your answer as a fraction in lowest terms. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

### Part B

What fractional part of the group chose hiking or camping? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

### Part C

What fractional part of the group chose boating? Write your answer as a fraction in lowest terms. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

### Part D

There were 24 members who chose camping for the outdoor activity. What was the number of members who chose boating? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

## Mathematics

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- 2 Brian read  $8\frac{1}{4}$  pages of a book in  $\frac{1}{6}$  hour. At this rate, what is the total number of pages of the book he will read in 1 hour?
- A.  $49\frac{1}{2}$
- B. 48
- C.  $8\frac{1}{24}$
- D.  $1\frac{3}{8}$

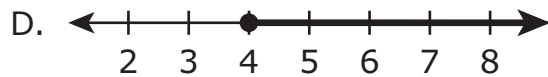
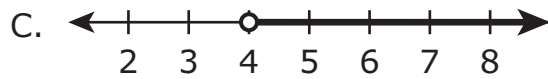
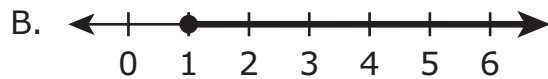
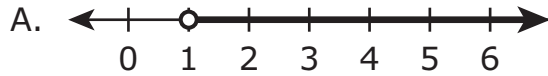
## Mathematics

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**3** Frantz must buy a minimum of \$25 of art supplies to qualify for free shipping. He bought 10 tubes of paint and an easel.

- Each tube of paint cost the same amount.
- The easel cost \$15.

Which of the following number lines shows all the possible costs, in dollars, of one tube of paint if Frantz qualified for free shipping?



## Mathematics

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- 4 Students at a school are collecting canned goods for a food drive. The principal asked a random sample of 10 students how many cans they are planning to bring for the food drive. Their responses are shown in this box.

3, 4, 8, 2, 0, 1, 10, 6, 5, 1
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There are 250 students in the school. If the sample is representative of the school population, what is the total number of cans the students can expect to collect?

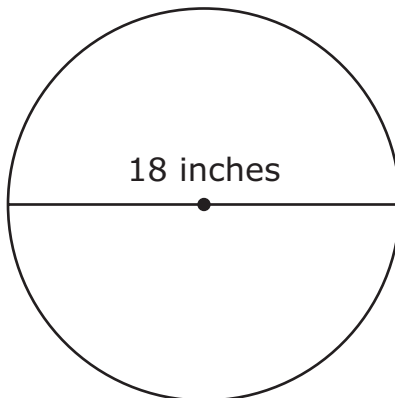
Enter your answer in the box.



## Mathematics

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- 5 A mirror in the shape of a circle is shown in this diagram.



Based on the dimension in the diagram, what is the area, to the nearest tenth of a square inch, of the mirror? (Use 3.14 for  $\pi$ .)

- A. 56.5
- B. 254.3
- C. 798.6
- D. 1017.4

**CONVERSIONS**

- |                                  |                                   |                                  |
|----------------------------------|-----------------------------------|----------------------------------|
| 1 cup = 8 fluid ounces           | 1 inch = 2.54 centimeters         | 1 pound = 16 ounces              |
| 1 pint = 2 cups                  | 1 meter $\approx$ 39.37 inches    | 1 pound $\approx$ 0.454 kilogram |
| 1 quart = 2 pints                | 1 mile = 5280 feet                | 1 kilogram $\approx$ 2.2 pounds  |
| 1 gallon = 4 quarts              | 1 mile = 1760 yards               | 1 ton = 2000 pounds              |
| 1 gallon $\approx$ 3.785 liters  | 1 mile $\approx$ 1.609 kilometers |                                  |
| 1 liter $\approx$ 0.264 gallon   | 1 kilometer $\approx$ 0.62 mile   |                                  |
| 1 liter = 1000 cubic centimeters |                                   |                                  |

**AREA (A) FORMULAS**

- square . . . . .  $A = s^2$
- rectangle . . . . .  $A = bh$   
OR  
 $A = lw$
- parallelogram . . . . .  $A = bh$
- triangle . . . . .  $A = \frac{1}{2}bh$
- trapezoid . . . . .  $A = \frac{1}{2}h(b_1 + b_2)$
- circle . . . . .  $A = \pi r^2$

**CIRCLE FORMULAS**

- area . . . . .  $A = \pi r^2$
- circumference . . . . .  $C = 2\pi r$   
OR  
 $C = \pi d$

**VOLUME (V) FORMULAS**

- cube . . . . .  $V = s^3$   
( $s$  = length of an edge)
- right prism . . . . .  $V = Bh$

**TOTAL SURFACE AREA (SA) FORMULAS**

- right rectangular prism . . . . .  $SA = 2(lw) + 2(hw) + 2(lh)$
- sphere . . . . .  $SA = 4\pi r^2$

**Grade 7 Mathematics**  
**Spring 2017 Released Operational Items:**  
**Reporting Categories, Standards, Item Descriptions, and Correct Answers**

Item No.	Page No.	Reporting Category	Standard	Item Type*	Description	Correct Answer**
1	179	<i>The Number System</i>	7.NS.1.03	CR	Solve a real-world problem involving the four operations on rational numbers.	
2	180	<i>Ratios and Proportional Relationships</i>	7.RP.1.01	SR	Calculate the unit rate in a given real-world context.	A
3	181	<i>Expressions and Equations</i>	7.EE.2.04	SR	Determine which number line shows the solution set of an inequality based on a real-world situation.	B
4	182	<i>Statistics and Probability</i>	7.SP.1.01	SA	Use the statistics from a random sample to determine additional information about the real-world situation.	1000 cans
5	183	<i>Geometry</i>	7.G.2.04	SR	Find the area based on the dimensions of a circle in a given real-world context.	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 7 Mathematics**  
**Spring 2017 Unreleased Operational Items:**  
**Reporting Categories, Standards, and Item Descriptions**

Item No.	Reporting Category	Standard	Item Type*	Description
6	<i>The Number System</i>	7.NS.1.01	SR	Determine which real-world context describes a situation in which opposite quantities combine to make zero.
7	<i>Ratios and Proportional Relationships</i>	7.RP.1.02	SA	Calculate the unit rate in a given real-world context.
8	<i>Geometry</i>	7.G.1.02	SR	Determine which triangle is best described by given conditions, and select a statement that describes other possible triangles with the same given conditions.
9	<i>Expressions and Equations</i>	7.EE.1.01	SR	Determine which expression is equivalent to a given expression.
10	<i>Expressions and Equations</i>	7.EE.1.02	SR	Determine which expression is a rewrite of a given expression in a real-world context.
11	<i>Ratios and Proportional Relationships</i>	7.RP.1.03	SA	Solve a multi-step real-world problem involving ratio and percents.

Item No.	Reporting Category	Standard	Item Type*	Description
12	<i>Statistics and Probability</i>	7.SP.3.05	SR	Find the only unknown probability in a real-world context, given the other probabilities.
13	<i>The Number System</i>	7.NS.1.01	SA	Solve a real-world problem using the understanding that subtraction of a rational number is adding the additive inverse.
14	<i>The Number System</i>	7.NS.1.02	SA	Find the value of a given expression.
15	<i>The Number System</i>	7.NS.1.02	CR	Review and solve a given long division problem, and explain the results in respect to a terminating or repeating decimal.
16	<i>Expressions and Equations</i>	7.EE.1.01	SR	Determine which expression is equivalent to a given expression.
17	<i>Statistics and Probability</i>	7.SP.3.08	SR	Solve real-world problems involving a simulation of the probability of a compound event.
18	<i>The Number System</i>	7.NS.1.01	SA	Find the value of a given expression.
19	<i>The Number System</i>	7.NS.1.01	SR	Determine which expression is equivalent to a given expression.
20	<i>Statistics and Probability</i>	7.SP.2.04	SR	Determine which comparative inference about a real-world context is true, based on the information given in a table.
21	<i>Geometry</i>	7.G.1.03	SR	Determine which two-dimensional figure will not be the result from slicing a shown three-dimensional figure.
22	<i>Expressions and Equations</i>	7.EE.2.03	SR	Solve a multi-step real-world problem involving numbers expressed in varying forms.
23	<i>Ratios and Proportional Relationships</i>	7.RP.1.02	SR	Determine which point on a graph represents the given meaning of the proportional relationship in a real-world context.
24	<i>Expressions and Equations</i>	7.EE.2.04	SR	Determine which expression represents a given real-world context.
25	<i>Ratios and Proportional Relationships</i>	7.RP.1.03	SA	Solve a multi-step real-world problem involving ratio and percents.
26	<i>Statistics and Probability</i>	7.SP.3.05	SR	Determine the likeliness or unlikeliness of an event in a real-world context, given the probability of the event occurring.
27	<i>Geometry</i>	7.G.2.06	CR	Solve real-world problems involving area and volume for right prisms of varying dimensions.
28	<i>Expressions and Equations</i>	7.EE.2.03	SR	Solve a real-world problem that involves rational numbers in different forms.
29	<i>Geometry</i>	7.G.2.05	SA	Solve multi-step real-world problems using facts about supplementary, complementary, vertical, and adjacent angles.
30	<i>Statistics and Probability</i>	7.SP.2.04	SR	Determine which comparative inference about a real-world context is true based on the information given in a table.
31	<i>Geometry</i>	7.G.2.07	SR	Find the surface area based on the dimensions of a sphere in a given real-world context.
32	<i>Statistics and Probability</i>	7.SP.1.01	SR	Determine which random sample would provide information sought in a given real-world context.
33	<i>Statistics and Probability</i>	7.SP.1.02	SA	Use the statistics from different random samples to determine overall percentage in a real-world situation.
34	<i>Expressions and Equations</i>	7.EE.2.04	CR	Create, explain the creation of, and solve expressions, based on a given real-world context.

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