

Massachusetts MCAS 2021 Grade 7 Math

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Massachusetts Comprehensive Assessment System Grade 7 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 $A = \frac{1}{2}bh$

trapezoid $A = \frac{1}{2}h(b_1 + b_2)$

circle $A = \pi r^2$

VOLUME (V) FORMULAS

cube $V = s^3$

(s = length of an edge)

right prism $V = Bh$

TOTAL SURFACE AREA (SA) FORMULAS

right rectangular prism . . $SA = 2(lw) + 2(hw) + 2(lh)$

CIRCLE FORMULAS

area $A = \pi r^2$

circumference . . $C = 2\pi r$

OR

$C = \pi d$



MASSACHUSETTS DEPARTMENT OF
ELEMENTARY AND SECONDARY
EDUCATION

*Release of Spring 2021
MCAS Test Items*

from the

*Grade 7 Mathematics
Paper-Based Test*

June 2021

**Massachusetts Department of
Elementary and Secondary Education**

Grade 7 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.

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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.
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6. Fractions cannot be entered into an answer grid and will not be scored. Enter fractions as decimals.
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8. See below for examples of how to correctly complete an answer grid.

EXAMPLES

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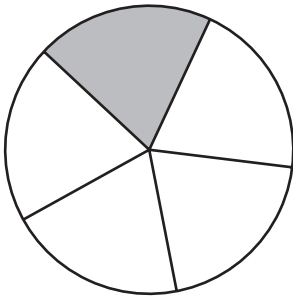
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1 Two friends shared a pie.

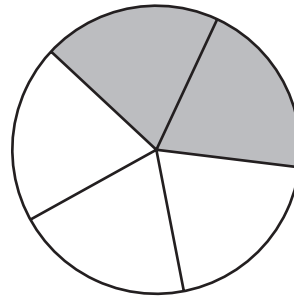
- One friend ate $\frac{2}{5}$ of the whole pie.
- The other friend ate 40% of the whole pie.

In which fraction model does the shaded portion show the fraction of the pie that was **not** eaten?

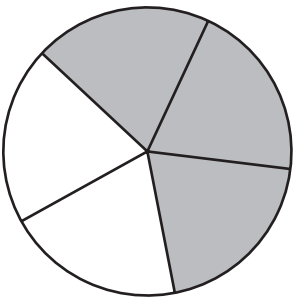
(A)



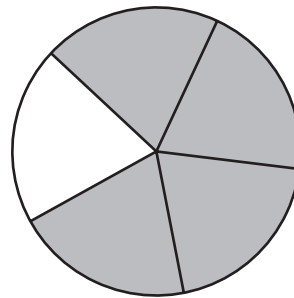
(B)



(C)



(D)



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

- 2** A student is practicing multiplication and division.

A. The student writes these numbers on a sheet of paper.

$$-35, \frac{5}{7}$$

The student multiplies the two numbers.

What is the value of $-35 \cdot \left(\frac{5}{7}\right)$?

B. The student writes these numbers on another sheet of paper.

$$-35, -\frac{5}{7}$$

The student multiplies the two numbers.

What is the value of $(-35) \cdot \left(-\frac{5}{7}\right)$?

C. The student then divides the two numbers used in Part A.

What is the value of $(-35) \div \left(\frac{5}{7}\right)$?

D. Determine whether your answer in Part C is a rational number.
Explain your reasoning.

Write your answers on the next page.

2

- 3 Which of the following is equivalent to this expression?

$$3(x - 1)$$

- Ⓐ $3 + x + 3 - 1$
- Ⓑ $3 + x - 1$
- Ⓒ $3x - 3$
- Ⓓ $3x - 1$

- 4 A recipe requires only blueberries and strawberries. This list shows the amounts required for $\frac{1}{4}$ of the whole recipe:

- $\frac{1}{2}$ cup blueberries
- $\frac{2}{5}$ cup strawberries

What is the number of cups of blueberries and the number of cups of strawberries required for the whole recipe?

- Ⓐ $\frac{1}{8}$ cup of blueberries and $\frac{1}{10}$ cup of strawberries
- Ⓑ $\frac{1}{8}$ cup of blueberries and $1\frac{3}{5}$ cups of strawberries
- Ⓒ 2 cups of blueberries and $\frac{1}{10}$ cup of strawberries
- Ⓓ 2 cups of blueberries and $1\frac{3}{5}$ cups of strawberries

- 5 Which of the following is **not** equivalent to this expression?

$$2m + 10m + 14 + 3$$

- Ⓐ $m + 12m + 8 + 9$
- Ⓑ $2m + 10 + 10m + 7$
- Ⓒ $6m + 6m - 1 + 18$
- Ⓓ $15m + 15 - 3m + 2$

- 6 This table shows the relationship between h , the number of hours a car is parked at a parking meter, and q , the number of quarters it costs to park at the parking meter.

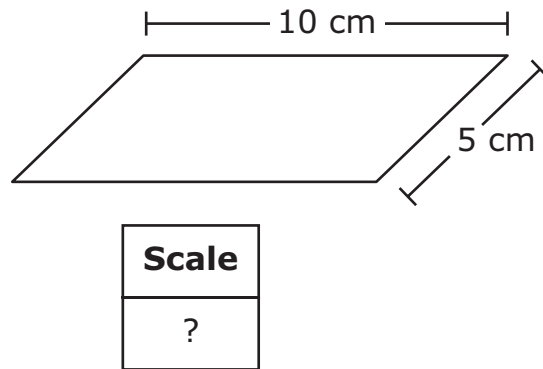
Parking Meter Costs

Number of Hours (h)	Number of Quarters (q)
$\frac{1}{2}$	1
1	2
$1\frac{1}{2}$	3
2	4

Which of the following equations **best** models the relationship between h and q ?

- Ⓐ $q = h$
- Ⓑ $q = 2h$
- Ⓒ $q = h + 1$
- Ⓓ $q = h + 2$

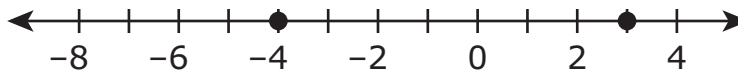
- 7 A parking lot in the shape of a parallelogram has a length of 300 meters and a width of 150 meters. A scale drawing of the parking lot has a length of 10 centimeters and a width of 5 centimeters, as shown.



Which of the following is the scale used in the drawing?

- Ⓐ 1 centimeter = 10 meters
- Ⓑ 1 centimeter = 15 meters
- Ⓒ 1 centimeter = 30 meters
- Ⓓ 1 centimeter = 60 meters

- 8 Which of the following expressions represents the distance, in units, between the two points plotted on the number line?



- (A) $3 - |-4|$
 (B) $3 + |-4|$
 (C) $3 + (-4)$
 (D) $|3 + (-4)|$
- 9 Consider this equation.

$$\frac{1}{2}(x + 4) = -8$$

What value of x makes the equation true?

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

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Grade 7 Mathematics

SESSION 2

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- 10** Jacinta has 2 blue marbles, 4 red marbles, and 5 green marbles in a bag. All the marbles are the same size. She will select one marble from the bag without looking.

What is the probability that Jacinta will select a green marble?

Ⓐ $\frac{1}{3}$

Ⓑ $\frac{5}{6}$

Ⓒ $\frac{5}{11}$

Ⓓ $\frac{6}{11}$

- 11** A watermelon that weighed 12 pounds cost \$5.76. What was the cost per **ounce** of the watermelon?

Ⓐ \$0.48

Ⓑ \$0.36

Ⓒ \$0.03

Ⓓ \$0.02

- 12** A grocery store manager wants to conduct a survey to determine the average number of items bought by shoppers in the express checkout lane weekly between 5:00 p.m. and 7:00 p.m.

Which of the following plans would obtain a random sample that **best** represents the population of shoppers during this time?

- Ⓐ Count the number of items bought by each shopper in the express checkout lane on Monday night between 5:00 p.m. and 7:00 p.m.
- Ⓑ Count the number of items bought by each shopper in the express checkout lane between 5:00 p.m. and 5:10 p.m. each evening for a week.
- Ⓒ Choose a day of the week at random, and count the number of items bought by each shopper in the express checkout lane between 5:00 p.m. and 7:00 p.m. on that day.
- Ⓓ Choose eight random 10-minute intervals between 5:00 p.m. and 7:00 p.m. during a week, and count the number of items bought by each shopper in the express checkout lane during the intervals.

- 13 A math teacher has a number cube with faces numbered 1 through 6. He will roll the number cube 400 times.

Which of the following ranges contains the **best** prediction for the number of times the number cube will land with a 1 or a 4 on the top face?

- Ⓐ 30–35
- Ⓑ 65–70
- Ⓒ 130–135
- Ⓓ 265–270

- 14 These lists show the ages of attendees in a yoga class and a dance class.

Yoga: 18, 31, 17, 44, 20, 33, 36

Dance: 20, 47, 23, 38, 26, 42, 30

Which statements about the attendees in the two classes are true?

Select the **two** correct answers.

- Ⓐ The median age of the attendees in the yoga class is greater than the median age of the attendees in the dance class.
- Ⓑ The median age of the attendees in the yoga class is less than the median age of the attendees in the dance class.
- Ⓒ The median age of the attendees in the yoga class is the same as the median age of the attendees in the dance class.
- Ⓓ The range of ages of the attendees in the yoga class is greater than the range of ages of the attendees in the dance class.
- Ⓔ The range of ages of the attendees in the yoga class is less than the range of ages of the attendees in the dance class.
- Ⓕ The range of ages of the attendees in the yoga class is the same as the range of ages of the attendees in the dance class.

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

15 A playground has two sandboxes. Each sandbox is in the shape of a right prism.

- A. The first sandbox has a square base with a side length of 8 feet. What is the area, in square feet, of the base of the first sandbox? Show or explain how you got your answer.
- B. The groundskeeper filled the first sandbox with sand to a height of 6 inches. What is the volume, in cubic **feet**, of the sand that was used to fill the first sandbox to a height of 6 inches? Show or explain how you got your answer.
- C. After filling the first sandbox to a height of 6 inches, the groundskeeper had 24 cubic feet of sand left over. She used all the leftover sand to fill the second sandbox.
- The second sandbox has a base in the shape of a rectangle.
 - The base of the second sandbox has a perimeter that is less than 35 feet.
 - The groundskeeper filled the second sandbox to a height of 6 inches.

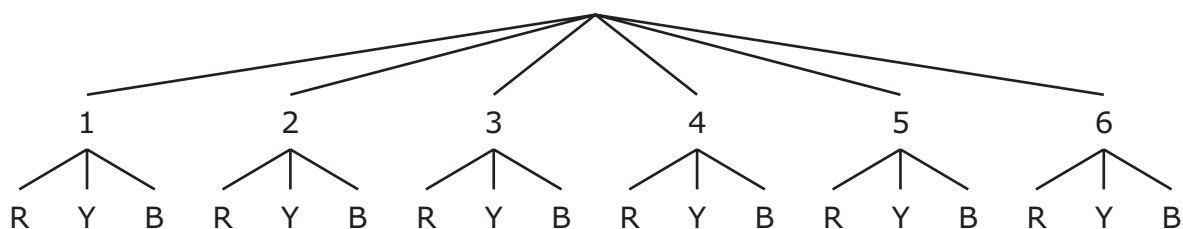
What could be the length and width, in feet, of the second sandbox?
Show or explain how you got your answers.

15

- 16** Some students are playing a game. They roll a number cube and spin the arrow on a spinner on each turn.

- The number cube has sides numbered 1 through 6.
- The spinner has 3 equal-sized sections colored red (R), yellow (Y), and blue (B).

This tree diagram shows the sample space for the possible outcomes of rolling a number cube one time and then spinning the arrow on the spinner once.



What is the probability that, on a student's turn, the number cube will land with an even number on the top face and the arrow on the spinner will stop on the blue (B) section?

- Ⓐ $\frac{1}{3}$
- Ⓑ $\frac{3}{6}$
- Ⓒ $\frac{3}{18}$
- Ⓓ $\frac{9}{16}$

This question has two parts.

- 17 A baker sells boxes of cookies.

This table shows the total cost, in dollars, for different numbers of boxes of cookies.

Cost of Cookies

Number of Boxes, n	Total Cost, c (dollars)
3	10.50
4	14.00
5	17.50
9	31.50

Part A

Based on the table, what is the total cost, in dollars, of 7 boxes of cookies?

- Ⓐ \$20.50
- Ⓑ \$21.00
- Ⓒ \$24.50
- Ⓓ \$28.00

Part B

Which equation can be used to find c , the total cost in dollars of n boxes of cookies?

- Ⓐ $c = 3.50n$
- Ⓑ $c = 7.00n$
- Ⓒ $c = 10.50n$
- Ⓓ $c = 21.00n$

18 Sharon has a patio in the shape of a rectangle.

- The length of the patio is l feet.
- The width of the patio is w feet.

Sharon plans to expand the patio by increasing the length by 50% and increasing the width by 20%.

Which of the following expressions could be used to find the area, in square feet, of the expanded patio?

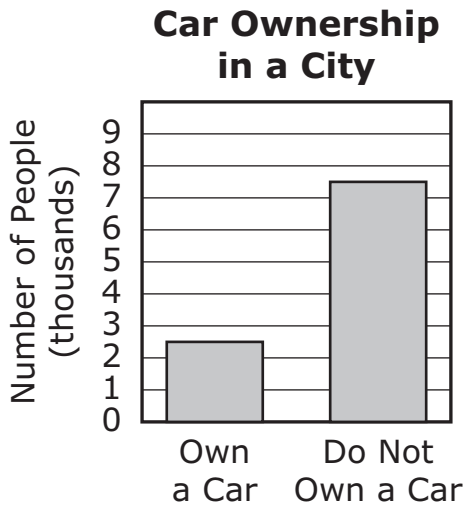
- Ⓐ $(1.5l) \times (1.2w)$
- Ⓑ $(l + 0.5) \times (w + 0.2)$
- Ⓒ $(l \times w) + (0.5 + 0.2)$
- Ⓓ $(0.5l) \times (0.2w)$

- 19 The population of a city is 10,000 people. A researcher wants to estimate how many people in the city own a car. The researcher surveys a random sample of 240 people and records these results.

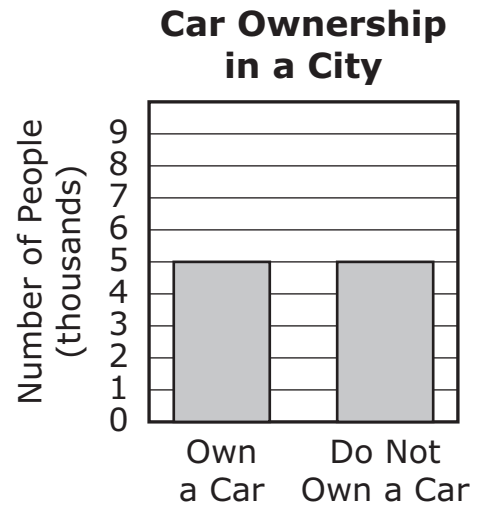
- 180 people own a car.
- 60 people do not own a car.

Based on the sample results, which bar graph shows the **best** estimates, rounded to the nearest 500, of the number of people in the city's population that own a car and the number that do not own a car?

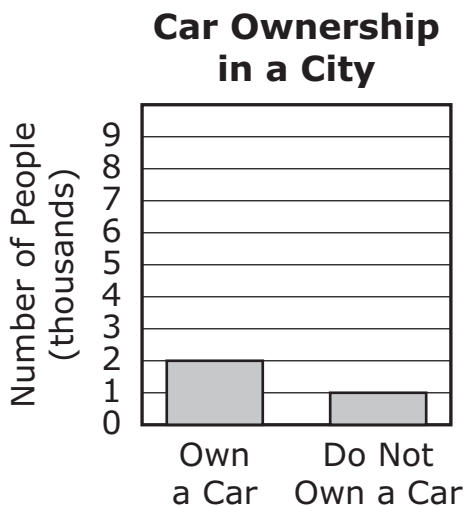
Ⓐ



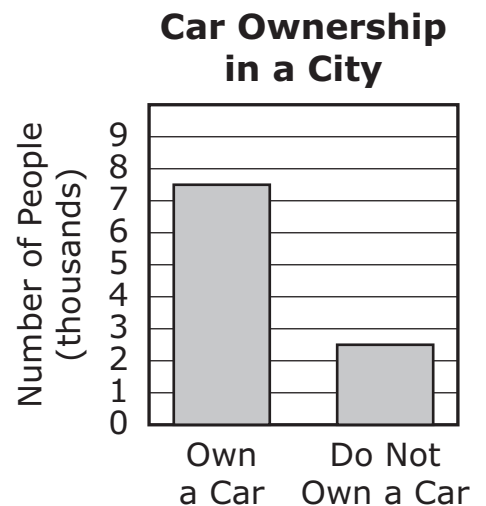
Ⓑ



Ⓒ



Ⓓ



- 20 Paloma opened a savings account with a deposit of \$750. She earns 2% simple interest per year on the account.

What will be the total amount of money, in dollars, in Paloma’s account after 1 year if there are no other deposits or withdrawals?

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

⊖							
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Grade 7 Mathematics
Spring 2021 Released Operational Items

PBT Item No.	Page No.	Reporting Category	Standard	Item Type*	Item Description	Correct Answer**
1	4	<i>Expressions and Equations</i>	7.EE.B.3	SR	Use operations with a fraction and a percentage to solve a real-world problem and determine which fraction model represents the solution.	A
2	5	<i>The Number System</i>	7.NS.A.2	CR	Use operations with positive and negative rational numbers to solve mathematical problems.	
3	7	<i>Expressions and Equations</i>	7.EE.A.1	SR	Apply the distributive property to determine which expression is equivalent to a given expression.	C
4	7	<i>Ratios and Proportional Relationships</i>	7.RP.A.1	SR	Compute two rates associated with given fractional ratios in a real-world problem.	D
5	8	<i>Expressions and Equations</i>	7.EE.A.1	SR	Apply properties of addition to determine which expression is not equivalent to a given expression.	A
6	9	<i>Ratios and Proportional Relationships</i>	7.RP.A.2	SR	Determine which equation models a proportional relationship shown in a table.	B
7	10	<i>Geometry</i>	7.G.A.1	SR	Determine the scale used in a given real-world context.	C
8	11	<i>The Number System</i>	7.NS.A.1	SR	Represent distance on a number line using an absolute value expression.	B
9	11	<i>Expressions and Equations</i>	7.EE.B.4	SA	Solve an equation of the form $px + q = r$.	-20
10	14	<i>Statistics and Probability</i>	7.SP.C.5	SR	Determine the likelihood of an event in a real-world context.	C
11	14	<i>The Number System</i>	7.NS.A.3	SR	Solve a multi-step, real-world problem by converting units.	C
12	15	<i>Statistics and Probability</i>	7.SP.A.1	SR	Determine which sampling strategy will produce a valid sample that represents a specific population.	D
13	16	<i>Statistics and Probability</i>	7.SP.C.6	SR	Determine which range of expected probabilities best predicts a random outcome.	C
14	17	<i>Statistics and Probability</i>	7.SP.B.4	SR	Determine which statements compare the medians and ranges of two data sets.	A,F
15	18	<i>Geometry</i>	7.G.B.6	CR	Solve real-world problems involving area and volume for right prisms of varying dimensions.	
16	20	<i>Statistics and Probability</i>	7.SP.C.8	SR	Determine the probability of a compound event, given a tree diagram.	C
17	21	<i>Ratios and Proportional Relationships</i>	7.RP.A.2	SR	Use proportional reasoning to solve a real-world problem and determine which equation represents the proportional relationship shown in a table.	C;A
18	22	<i>Expressions and Equations</i>	7.EE.A.2	SR	Determine which expression can be used to represent a real-world problem involving area.	A
19	23	<i>Statistics and Probability</i>	7.SP.A.2	SR	Use data from a random sample to draw an inference about a population and determine which bar graph represents the inference.	D
20	24	<i>Ratios and Proportional Relationships</i>	7.RP.A.3	SA	Use proportional reasoning to solve a two-step simple interest problem.	765

* 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 2021 Unreleased Operational Items

PBT Item No.	Reporting Category	Standard	Item Type*	Item Description
21	<i>The Number System</i>	7.NS.A.3	SA	Solve a real-world problem involving addition and subtraction with decimals.
22	<i>Geometry</i>	7.G.B.6	SR	Solve a real-world problem involving the area of a two-dimensional object.
23	<i>Ratios and Proportional Relationships</i>	7.R.P.A.3	SR	Use ratio and proportional reasoning to calculate actual distance given a scale on a map.
24	<i>Expressions and Equations</i>	7.EE.B.3	SR	Determine which equation is equivalent to a given equation.
25	<i>The Number System</i>	7.NS.A.3	SA	Use operations with positive and negative integers to solve a given real-world problem involving temperature.
26	<i>Expressions and Equations</i>	7.EE.B.3	SR	Solve a multi-step, real-world problem using rational numbers in different forms.
27	<i>Statistics and Probability</i>	7.S.P.C.7	CR	Develop a probability model from a visual model, develop another probability model from a set of data, and explain the differences in predictions made from both models.
28	<i>The Number System</i>	7.NS.A.1	SR	Determine which number line represents the additive inverse of a number.
29	<i>Expressions and Equations</i>	7.EE.B.3	SR	Solve a multi-step, real-world problem involving fractions, decimals, and percentages.
30	<i>Expressions and Equations</i>	7.EE.A.2	SR	Determine which expression is not equivalent to a given expression within a real-world context.
31	<i>Expressions and Equations</i>	7.EE.A.1	SR	Use properties of operations to determine which expression is equivalent to a given expression.
32	<i>Geometry</i>	7.G.B.5	SR	Identify angles in a diagram that represent vertical angles.
33	<i>Ratios and Proportional Relationships</i>	7.R.P.A.3	CR	Use proportional relationships to solve multi-step ratio, rate, and percent problems within a real-world context.
34	<i>Geometry</i>	7.G.A.1	SR	Determine the area of a scale drawing.
35	<i>Ratios and Proportional Relationships</i>	7.R.P.A.2	SR	Determine which equation can be used to represent a proportional relationship in a table.
36	<i>The Number System</i>	7.NS.A.3	SA	Use operations with decimals to solve a real-world problem.
37	<i>Expressions and Equations</i>	7.EE.A.2	SR	Rewrite an expression in a different form and then evaluate the expression for a given value.
38	<i>Statistics and Probability</i>	7.S.P.C.5	SR	Determine how likely an event is to occur given the probability of the event.
39	<i>Expressions and Equations</i>	7.EE.B.4	SA	Solve a real-world problem involving the maximum value of an inequality.
40	<i>The Number System</i>	7.NS.A.3	SR	Solve a multi-step, real-world problem by converting units.

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