
XIII. Mathematics, Grade 7

Grade 7 Mathematics Test

The spring 2018 grade 7 Mathematics test was a next-generation assessment that 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 and equating questions that do not count toward a student's score.

Most of the operational items on the grade 7 Mathematics test were the same, regardless of whether a student took the computer-based version or the paper-based version. In some instances, the wording of a paper item differed slightly from the computer-based version. In places where a technology-enhanced item was used on the computer-based test, that item was typically replaced with one or more alternative items on the paper test. These alternative items sometimes assessed the same standard as the technology-enhanced item, or other standards from the same reporting category.

This document displays the **paper-based versions** of the 2018 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/released-items.

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* (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/.

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 learner students only. No other reference tools or materials were allowed.

Grade 7 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 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.

- 1 Charles bought a box of fruit that contained only oranges and tangerines.
- There were 5 oranges for every 3 tangerines in the box.
 - There were 20 oranges in the box.

Which of the following proportions can be used to find x , the number of tangerines in the box?

A. $\frac{5}{8} = \frac{x}{20}$

B. $\frac{5}{8} = \frac{20}{x}$

C. $\frac{5}{3} = \frac{x}{20}$

D. $\frac{5}{3} = \frac{20}{x}$

- 2 What is the value of this expression?

$$6 + (-9) - (-4)$$

- A. -11
B. -7
C. 1
D. 19
- 3 Brayden adds $\frac{1}{3}$ cup of flour into a mixture every $\frac{1}{2}$ minute. What is the rate, in cups per minute, at which Brayden adds flour to the mixture?

- A. $\frac{1}{6}$
B. $\frac{1}{5}$
C. $\frac{2}{3}$
D. $\frac{3}{2}$

- 6 A carton of pens contains 4 blue pens, 3 red pens, 10 black pens, and 1 green pen. All the pens are the same size and shape. Harry will select a pen at random.

Which of the following best describes the probability that Harry will select a green pen?

- A. likely
 - B. certain
 - C. unlikely
 - D. impossible
- 9 Emma noticed that the new admission fee for the zoo is 50% more than last year's fee. She wrote this expression to represent the new admission fee, where f represents last year's fee.

$$f + (0.50 \times f)$$

Which of the following expressions shows another way Emma could have represented the new admission fee?

- A. $1.5f$
- B. $150f$
- C. $f + 1.5$
- D. $f + 150$

This question has four parts.

- 12** Gloria has two number cubes with faces numbered 1 through 6. She will roll each number cube once.

Part A

Make an organized list to show the sample space for rolling the two number cubes once.

Enter your organized list in the space provided.

Part B

How many possible outcomes are in the sample space for rolling the two number cubes once?

Enter your answer in the space provided.

Part C

Gloria wants to roll the number cubes once and get a sum of 8 on the top faces.

List the outcomes in the sample space that have a sum of 8.

Enter your list in the space provided.

Part D

What is the probability that Gloria will get a sum of 8 on the top faces when she rolls the two number cubes once?

Enter your answer in the space provided.

- 13** The first number in a pattern is 8. Each following number is found by subtracting 9 from the previous number.

What is the fifth number in the pattern?

- A. -45
- B. -40
- C. -37
- D. -28

- 16** What is the value of this expression?

$$12 \div 0.48$$

- A. 4
- B. 25
- C. 0.04
- D. 0.25

- 19 Ava and Jiao each swam a two-lap swimming race. Ava took 31.49 seconds to finish her first lap and 30.03 seconds to finish her second lap. Jiao finished her two-lap swimming race 1.76 seconds faster than Ava.

What was Jiao's total swimming time, in seconds, after she finished her two-lap race?

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

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

$$40 \div \frac{1}{4}$$

- A. $\frac{1}{4} \cdot 40$
- B. $40 \cdot 4$
- C. $\frac{1}{4} \div 40$
- D. $40 \div 4$

Grade 7 Mathematics

SESSION 2

This session contains 11 questions.

You may use your reference sheet during this session.

You may 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 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.

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

- 21 The computer teacher at a middle school spent \$12,950 to buy a storage cart and 25 laptop computers. The total purchase is represented by this equation, where c stands for the cost of each laptop computer purchased.

$$25c + 450 = 12,950$$

What was the cost of each laptop computer that the teacher purchased?

- A. \$536
- B. \$518
- C. \$500
- D. \$475

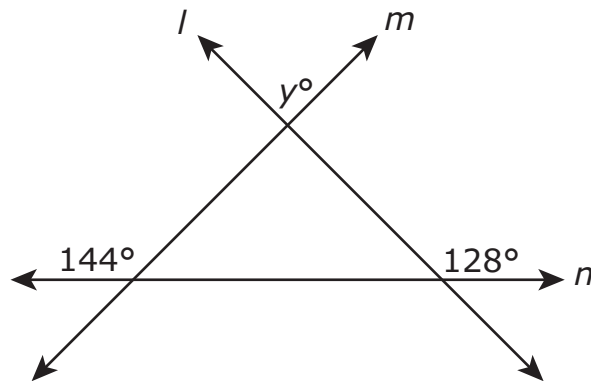
22 The label on Adriana's carton of juice has this information listed.

- One serving size equals $\frac{1}{2}$ cup.
- Each serving has 30% of the recommended daily amount of vitamin C.

Yesterday, Adriana drank $2\frac{1}{4}$ cups of juice. What percent of the recommended daily amount of vitamin C was in the juice Adriana drank yesterday?

- A. 33.75%
- B. 67.5%
- C. 120%
- D. 135%

- 23 Lines l , m , and n intersect each other, as shown in this diagram.



Based on the angle measures in the diagram, what is the value of y ?

- A. 36
- B. 52
- C. 88
- D. 92

- 24 This table shows the numbers of students in different age groups who participate and do not participate in sports in one school district, as well as the total number of students in each age group.

Participation in Sports

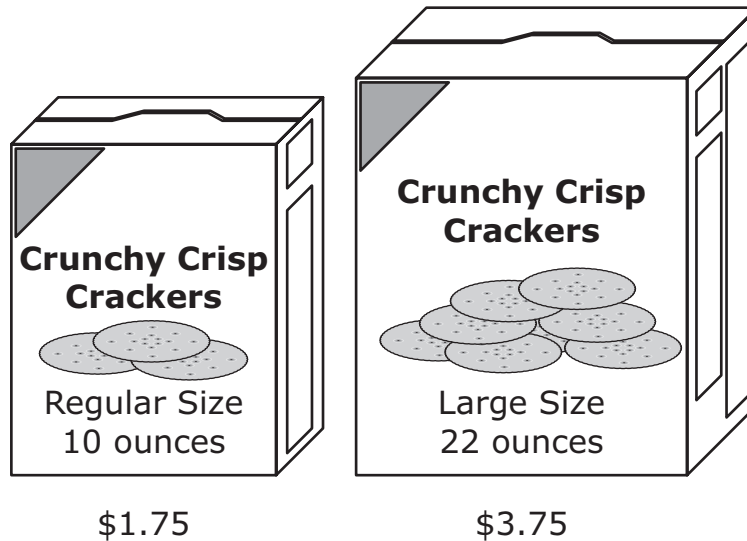
	Age Group (years)		
	7-10	11-14	15-18
Number of Students Who Participate	493	345	1,088
Number of Students Who Do Not Participate	147	249	1,384
Total Number of Students	640	594	2,472

What is the difference of the percentage of students in the 7–10 age group who participate in sports and the percentage of students in the 15–18 age group who participate in sports? Round your answer to the nearest whole percent.

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

This question has three parts.

- 25 Kelsey's favorite crackers are available in two different sizes. The two different-size boxes and their prices are shown.



Part A

What is the price per ounce of the regular-size box of crackers? Show or explain how you got your answer.

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

Part B

Which size box of crackers has the lower price per ounce? Show or explain how you got your answer.

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

Part C

Kelsey has the following coupons:

- Coupon 1: Save \$0.50 off the total price when you buy 2 regular-size boxes of Crunchy Crisp Crackers.
- Coupon 2: Save \$0.30 off the price when you buy 1 large-size box of Crunchy Crisp Crackers.

Which coupon should Kelsey use to pay the lower price per ounce for the crackers? Show or explain how you got your answer.

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

- 26 A circular mirror has a circumference of 30π inches. What is the area of the mirror?
- A. 30π square inches
 - B. 60π square inches
 - C. 225π square inches
 - D. 900π square inches

- 27 A television originally cost t dollars, including tax. Ricardo purchased the television when it was on sale for 35% off its original cost.

Which of the following expressions represents the final cost, in dollars, of the television Ricardo purchased?

- A. $t - 0.35$
- B. $t + 0.65$
- C. $0.35t$
- D. $0.65t$

- 30 A school cafeteria manager conducted a survey to determine the students' favorite hot lunch. Five different random samples of 100 students each completed the survey. The results are shown in this table.

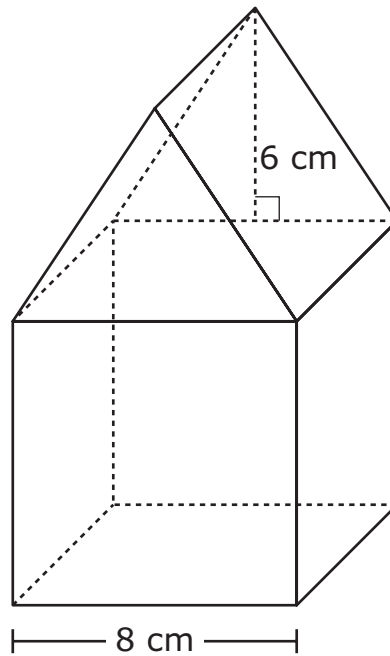
Favorite Hot Lunch

Sample	Grilled Cheese	Pizza	Chicken Nuggets
1	33	57	10
2	52	31	17
3	46	40	14
4	41	42	17
5	47	38	15

There are 2,000 students in the school. Based on the survey results, which of the following is closest to the expected total number of students whose favorite hot lunch is grilled cheese?

- A. 220
- B. 500
- C. 900
- D. 1,040

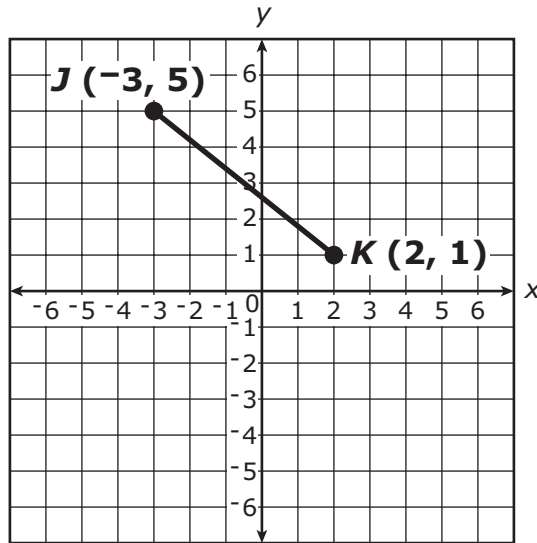
- 31 A solid figure is composed of a cube and a right triangular prism. The figure and some of its dimensions are shown in this diagram.



What is the volume of the figure?

- A. 560 cubic centimeters
- B. 704 cubic centimeters
- C. 728 cubic centimeters
- D. 896 cubic centimeters

- 37 Two vertices and one side of right triangle JKL are shown on this coordinate plane.



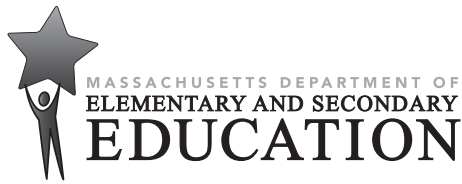
Which ordered pair could represent the location of vertex L of right triangle JKL ?

- A. $(-4, 1)$
- B. $(-3, 2)$
- C. $(1, 6)$
- D. $(2, 5)$

- 40 The members of a tennis team have a goal of raising at least \$500 for new equipment. They have already raised \$275. The team members plan to raise more money by washing cars. They will charge \$5 for each car they wash.

Let c represent the number of cars the team members will wash. Which of the following could be used to find the **least** number of cars they must wash to reach their goal?

- A. $5c - 275 > 500$
- B. $5c - 275 \geq 500$
- C. $5c + 275 > 500$
- D. $5c + 275 \geq 500$



Massachusetts Comprehensive Assessment System Grade 7 Mathematics Reference Sheet

CONVERSIONS

$$1 \text{ cup} = 8 \text{ fluid ounces}$$

$$1 \text{ pint} = 2 \text{ cups}$$

$$1 \text{ quart} = 2 \text{ pints}$$

$$1 \text{ gallon} = 4 \text{ quarts}$$

$$1 \text{ gallon} \approx 3.785 \text{ liters}$$

$$1 \text{ liter} \approx 0.264 \text{ gallon}$$

$$1 \text{ liter} = 1000 \text{ cubic centimeters}$$

$$1 \text{ inch} = 2.54 \text{ centimeters}$$

$$1 \text{ meter} \approx 39.37 \text{ inches}$$

$$1 \text{ mile} = 5280 \text{ feet}$$

$$1 \text{ mile} = 1760 \text{ yards}$$

$$1 \text{ mile} \approx 1.609 \text{ kilometers}$$

$$1 \text{ kilometer} \approx 0.62 \text{ mile}$$

$$1 \text{ pound} = 16 \text{ ounces}$$

$$1 \text{ pound} \approx 0.454 \text{ kilogram}$$

$$1 \text{ kilogram} \approx 2.2 \text{ pounds}$$

$$1 \text{ ton} = 2000 \text{ pounds}$$

AREA (A) FORMULAS

$$\text{square} \dots\dots\dots A = s^2$$

$$\text{rectangle} \dots\dots\dots A = bh$$

OR

$$A = lw$$

$$\text{parallelogram} \dots\dots A = bh$$

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

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

$$\text{circle} \dots\dots\dots A = \pi r^2$$

CIRCLE FORMULAS

$$\text{area} \dots\dots\dots A = \pi r^2$$

$$\text{circumference} \dots\dots C = 2\pi r$$

OR

$$C = \pi d$$

VOLUME (V) FORMULAS

$$\text{cube} \dots\dots\dots V = s^3$$

(s = length of an edge)

$$\text{right prism} \dots\dots\dots V = Bh$$

TOTAL SURFACE AREA (SA) FORMULAS

$$\text{right rectangular prism} \dots\dots SA = 2(lw) + 2(hw) + 2(lh)$$

Grade 7 Mathematics
Spring 2018 Released Operational Items:
Reporting Categories, Standards, Item Descriptions, and Correct Answers

PBT Item No.*	Page No.	Reporting Category	Standard	Item Type**	Description	Correct Answer***
1	266	<i>Ratios and Proportional Relationships</i>	7.RP.A.02	SR	Determine which equation represents the proportional relationship in a given context.	D
2	267	<i>The Number System</i>	7.NS.A.01	SR	Use addition and subtraction to find the value of an expression involving integers.	C
3	267	<i>Ratios and Proportional Relationships</i>	7.RP.A.01	SR	Determine the unit rate in a real-world problem.	C
6	268	<i>Statistics and Probability</i>	7.SP.C.05	SR	Determine the likelihood of an event in a real-world context.	C
9	268	<i>Expressions and Equations</i>	7.EE.A.02	SR	Rewrite a given expression in a real-world context.	A
12	269	<i>Statistics and Probability</i>	7.SP.C.08	CR	Find the sample space, list possible outcomes, and determine the probability of a compound event.	
13	270	<i>Expressions and Equations</i>	7.EE.B.04	SR	Extend a pattern to find a number in the pattern.	D
16	270	<i>The Number System</i>	7.NS.A.02	SR	Divide rational numbers to solve a mathematical problem.	B
19	271	<i>The Number System</i>	7.NS.A.03	SA	Use operations on rational numbers to solve a real-world problem.	59.76
20	271	<i>The Number System</i>	7.NS.A.02	SR	Determine which expression is equivalent to a given expression.	B
21	274	<i>Expressions and Equations</i>	7.EE.B.04	SR	Use a simple equation to solve a real-world problem.	C
22	275	<i>Expressions and Equations</i>	7.EE.B.03	SR	Solve a multi-step, real-world problem using operations on rational numbers.	D
23	276	<i>Geometry</i>	7.G.B.05	SR	Solve a multi-step problem using facts about supplementary angles and triangles.	D
24	277	<i>Expressions and Equations</i>	7.EE.B.03	SA	Calculate two percentages and find the difference between them.	33
25	278–279	<i>Ratios and Proportional Relationships</i>	7.RP.A.03	CR	Solve multi-step, real-world problems involving unit rates.	
26	280	<i>Geometry</i>	7.G.B.04	SR	Determine the area of a circle when given the circumference of the circle.	C
27	280	<i>Expressions and Equations</i>	7.EE.A.02	SR	Determine which expression represents a given real-world context.	D
30	281	<i>Statistics and Probability</i>	7.SP.A.02	SR	Use data from random samples to draw an inference about a population.	C
31	282	<i>Geometry</i>	7.G.B.06	SR	Solve a mathematical problem involving the volume of a composite three-dimensional shape.	B
37	283	<i>Geometry</i>	7.G.A.02	SR	Determine the possible coordinates of the third vertex of a right triangle, given two vertices.	D
40	284	<i>Expressions and Equations</i>	7.EE.B.04	SR	Represent a real-world context with an inequality.	D

* “PBT Item Number” refers to the position of the item on the operational paper-based test. This is the item number that DESE refers to when reporting student results for a PBT item.

** 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 2018 Unreleased Operational Items:
Reporting Categories, Standards, and Item Descriptions

PBT Item No.*	Reporting Category	Standard	Item Type**	Description
4	<i>Statistics and Probability</i>	7.SP.A.01	SR	Determine which sampling method would provide a random sample in a given context.
5	<i>The Number System</i>	7.NS.A.03	CR	Use operations on integers and rational numbers to solve a real-world problem.
7	<i>The Number System</i>	7.NS.A.01	SR	Use subtraction of integers to solve a problem.
8	<i>The Number System</i>	7.NS.A.02	SR	Convert a rational number to a decimal.
10	<i>The Number System</i>	7.NS.A.03	SR	Use operations on rational numbers to solve a real-world problem.
11	<i>Geometry</i>	7.G.A.03	SR	Determine which two-dimensional figure will not result from slicing a given three-dimensional figure.
14	<i>Ratios and Proportional Relationships</i>	7.RP.A.02	SA	Determine the unit rate in a real-world problem, given a graph.
15	<i>Geometry</i>	7.G.B.05	SA	Solve a multi-step problem using facts about supplementary and complementary angles.
17	<i>Statistics and Probability</i>	7.SP.C.07	SR	Determine the probability of an event and give the probability as a fraction.
18	<i>Ratios and Proportional Relationships</i>	7.RP.A.02	SR	Determine which table represents a proportional relationship between two quantities.
28	<i>Statistics and Probability</i>	7.SP.B.04	SR	Determine the possible mean and mean absolute deviation for two sets of data in a real-world context.
29	<i>Ratios and Proportional Relationships</i>	7.RP.A.01	SR	Determine the unit rate in a real-world problem.
32	<i>Expressions and Equations</i>	7.EE.B.03	CR	Use properties of rational numbers to solve multi-step, real-world problems involving money and percents.
33	<i>Geometry</i>	7.G.A.01	SR	Solve a problem by using a scale drawing to determine the actual area.
34	<i>Statistics and Probability</i>	7.SP.C.08	SR	Find the probability of a compound event, given an organized list.
35	<i>Expressions and Equations</i>	7.EE.B.04	SA	Given a real-world situation, determine which equation can be used to solve a problem; and solve a different problem by reasoning about the quantities.
36	<i>Ratios and Proportional Relationships</i>	7.RP.A.03	SR	Solve a real-world problem involving percents.
38	<i>Statistics and Probability</i>	7.SP.B.03	SR	Compare the medians of two sets of data in a real-world context.
39	<i>Geometry</i>	7.G.B.06	SA	Solve a mathematical problem involving the surface area of a composite three-dimensional shape.

* “PBT Item Number” refers to the position of the item on the operational paper-based test. This is the item number that DESE refers to when reporting student results for a PBT item.

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