XIV. Mathematics, Grade 8

Grade 8 Mathematics Test

The spring 2012 grade 8 Mathematics test was based on learning standards in the five major content strands in the Massachusetts *Mathematics Curriculum Framework* (2000) listed below.

- Number Sense and Operations
- Patterns, Relations, and Algebra
- Geometry
- Measurement
- Data Analysis, Statistics, and Probability

The grades 7–8 learning standards for each of these strands appear on pages 62–66 of the *Mathematics Curriculum Framework*, which is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Mathematics test results are reported under five MCAS reporting categories, which are identical to the five framework content strands listed above.

Test Sessions

The grade 8 Mathematics test included two separate test sessions. Each session included multiple-choice, short-answer, and open-response questions. Approximately half of the common test items are shown on the following pages as they appeared in test booklets.

Reference Materials and Tools

Each student taking the grade 8 Mathematics test was provided with a plastic ruler and a grade 8 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 with at least four functions and a square root key. Calculator use was not allowed during session 1.

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

Cross-Reference Information

The tables at the conclusion of this chapter indicate each released and unreleased common item's reporting category and the framework learning standard it assesses. The correct answers for released multiple-choice and short-answer questions are also displayed in the released item table.

Mathematics

Session 1

You may use your reference sheet and MCAS ruler during this session.
*You may **not** use a calculator during this session.*

DIRECTIONS

This session contains nine multiple-choice questions, one short-answer question, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

1 A cooking instructor stated that 5 pounds of roast beef is needed to serve 8 people. Based on the instructor's statement, which of the following equations can be used to find r, the number of pounds of roast beef needed to serve 12 people?

A. $\frac{5}{8} = \frac{r}{12}$

B. $\frac{5}{8} = \frac{12}{r}$

C. $12r = 8 \cdot 5$

D. $12r = 8 \div 5$

2 Which of the following is equivalent to the expression below?

$$4(26 + 59)$$

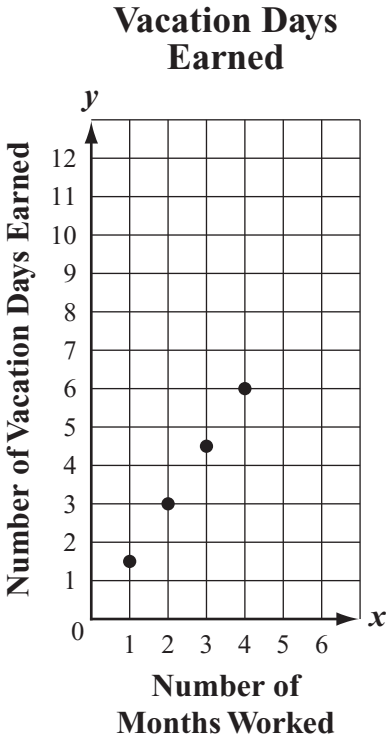
A. $4(26) + 4(59)$

B. $4(26) \cdot 4(59)$

C. $4(26) + 59$

D. $4(26) \cdot 59$

3 The graph below represents the relationship between x, the number of months Camille works, and y, the number of vacation days Camille earns.



What is the number of vacation days Camille will earn for 6 months of work?

A. 10

B. 9

C. 8

D. 4

4 Which of the following will **always** be similar?

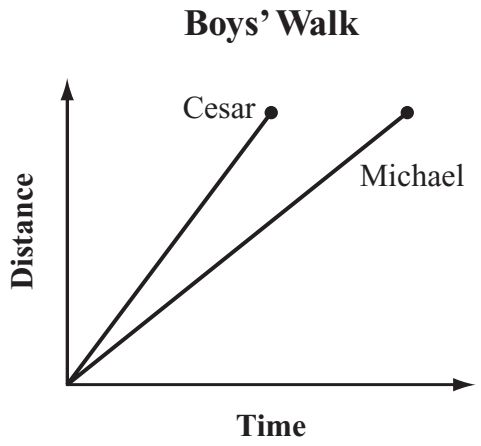
A. two different squares

B. two different rectangles

C. two different rhombuses

D. two different parallelograms

5 Cesar and his brother Michael left home for a walk at the same time. The graph below shows the distance each boy walked over time.



Based on the graph, which statement is true?

A. Cesar walked at a greater speed than Michael did.

B. Michael walked a greater distance than Cesar did.

C. The boys walked for the same amount of time.

D. The boys walked at the same speed.

Mark your answers to multiple-choice questions 6 through 8 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

6 A store claims it has served more than 3 billion customers. What is 3 billion written in scientific notation?

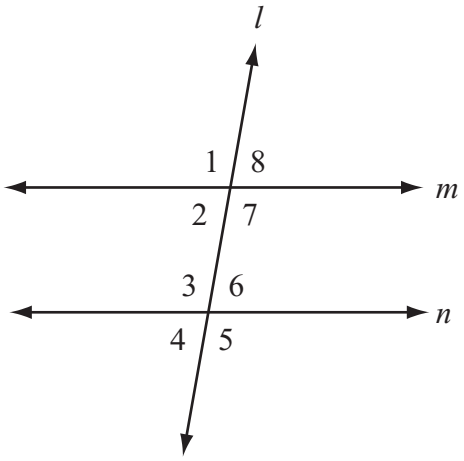
A. 3.0×10^6

B. 3.0×10^9

C. 3.0×10^{10}

D. 3.0×10^{12}

7 Line m and line n are parallel lines intersected by transversal line l, as shown below.



Which of the following pairs of angles **must** have the same measure?

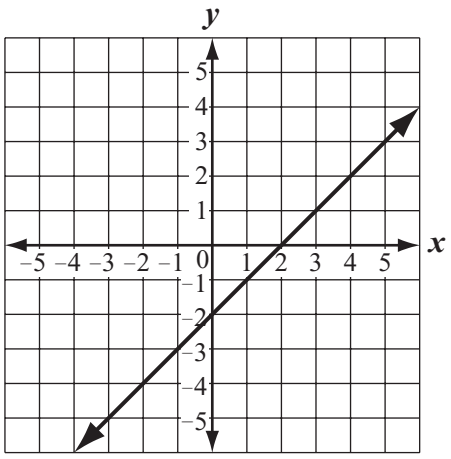
A. $\angle 1$ and $\angle 8$

B. $\angle 2$ and $\angle 6$

C. $\angle 6$ and $\angle 7$

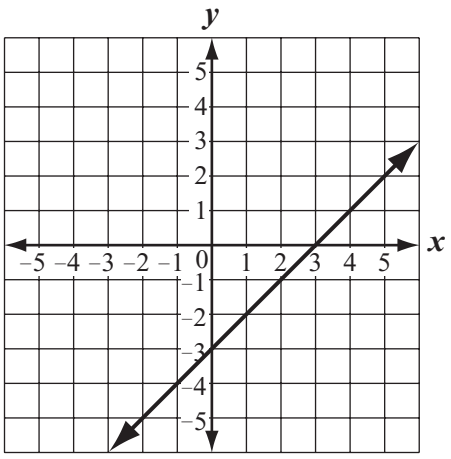
D. $\angle 8$ and $\angle 5$

8 Tori graphed the line shown below.

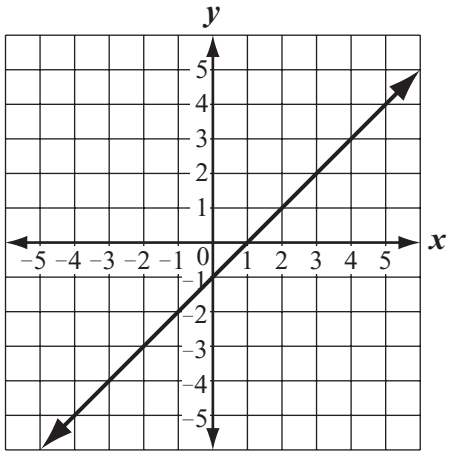


Which of the following graphs shows the result of increasing the *y*-intercept of Tori's line by 1 and leaving the slope the same?

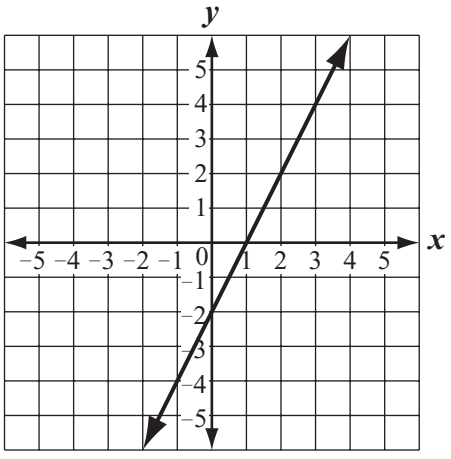
A.



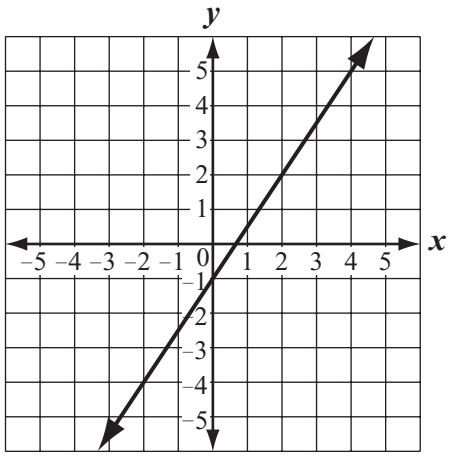
C.



B.



D.



Question 9 is a short-answer question. Write your answer to this question in the box provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

9 Brad purchased a bag of apples for \$2 and b pounds of bananas for \$0.50 per pound. He spent a total of \$3. The total price of his purchase is represented by the equation below.

$$0.5b + 2 = 3$$

What was the total number of pounds of bananas that Brad purchased?

Question 10 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 10 in the space provided in your Student Answer Booklet.

10 One lap around a track is $\frac{1}{4}$ mile. On Monday, Stacy ran 11 laps.

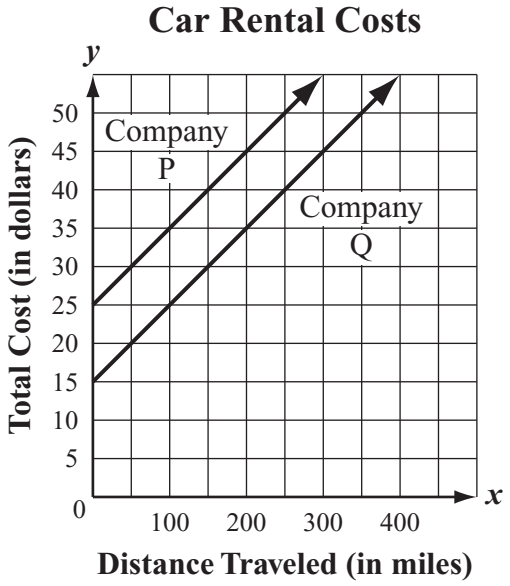
a. What was the total number of miles that Stacy ran on Monday? Show or explain how you got your answer.

b. It took Stacy $\frac{1}{2}$ hour to run 11 laps on Monday. What was Stacy's average speed, in miles per hour, on Monday? Show or explain how you got your answer.

c. Stacy's goal is to run at an average speed of 1 mile per 10 minutes. What is the number of laps that she must run in $\frac{1}{2}$ hour to reach her goal? Show or explain how you got your answer.

Mark your answer to multiple-choice question 11 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

11 Two car rental companies charge a one-time fee and a mileage rate for renting a car. The graph below compares the costs for renting cars from the two companies.



Based on the graph, which of the following statements appears to be true about the costs of renting cars from the two companies?

A. The one-time fee at both companies is the same.

B. The mileage rate at both companies is the same.

C. Company P charges a lower one-time fee than Company Q.

D. Company Q charges a lower mileage rate than Company P.

Mathematics

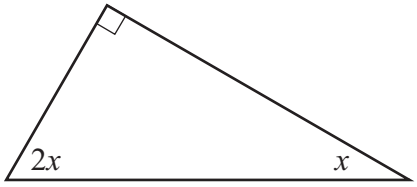
SESSION 2

You may use your reference sheet and MCAS ruler during this session.
You may use a calculator during this session.

DIRECTIONS

This session contains seven multiple-choice questions, two short-answer questions, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

12 A right triangle is shown below.



Based on the measures in the triangle, what is x?

A. 15°

B. 30°

C. 45°

D. 60°

13 The expression below represents Brianna's age in terms of m, Molly's age.

$$3m - 5$$

Which of the following statements must be true?

A. Brianna's age is 3 less than 5 times Molly's age.

B. Brianna's age is 5 less than 3 times Molly's age.

C. Molly's age is 3 less than 5 times Brianna's age.

D. Molly's age is 5 less than 3 times Brianna's age.

14 Two triangles have the same area. The base length of the first triangle is 2 times the base length of the second triangle.

Which of the following statements correctly compares the heights of the two triangles?

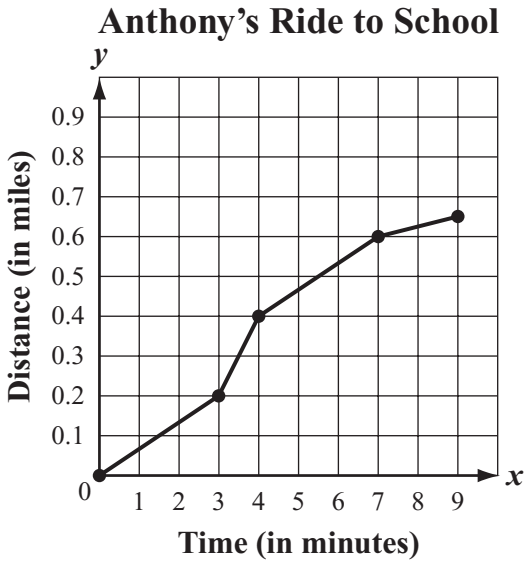
A. The height of the first triangle is $\frac{1}{2}$ the height of the second triangle.

B. The height of the first triangle is 2 times the height of the second triangle.

C. The height of the first triangle is $\frac{1}{4}$ the height of the second triangle.

D. The height of the first triangle is 4 times the height of the second triangle.

15 Anthony rode his bicycle from his home to school. The graph below shows the distance, in miles, that Anthony rode over time.



During which time interval was Anthony riding his bicycle at the greatest speed?

A. between minute 0 and minute 3 of the ride

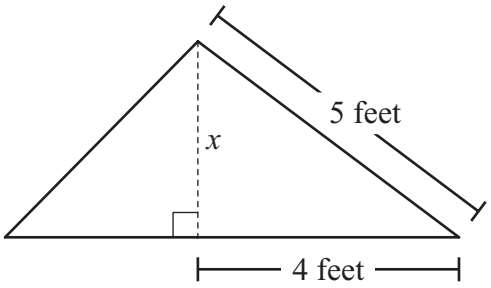
B. between minute 3 and minute 4 of the ride

C. between minute 4 and minute 7 of the ride

D. between minute 7 and minute 9 of the ride

Question 16 is a short-answer question. Write your answer to this question in the box provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

16 A triangle and some of its dimensions are shown in the diagram below.



Based on the dimensions in the diagram, what is x, the height in feet of the triangle?

Mark your answer to multiple-choice question 17 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

17 As shown in the box below, a baseball player's batting average is calculated by dividing the total number of the player's hits by the total number of times the player was at bat.

$$\text{batting average} = \frac{\text{total number of hits}}{\text{total number of times at bat}}$$

Donald was at bat a total of 120 times last season. If his batting average was 0.250, what was his total number of hits last season?

A. 12

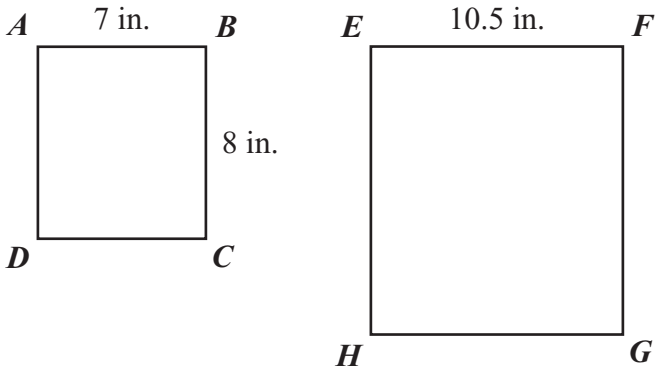
B. 25

C. 30

D. 48

Question 18 is a short-answer question. Write your answer to this question in the box provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

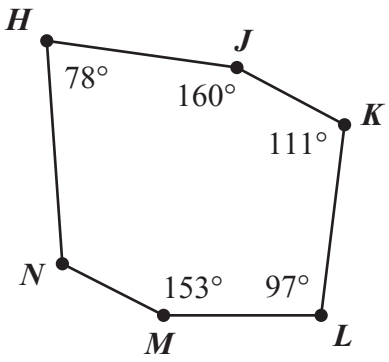
18 Rectangle *ABCD* is similar to rectangle *EFGH*. The rectangles and some of their dimensions are shown in the diagram below.



Based on the diagram, what is the length, in inches, of side *FG*?

Mark your answers to multiple-choice questions 19 and 20 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

19 A hexagon and the measures of some of its angles are shown below.



What is the measure of $\angle N$?

A. 129°

B. 121°

C. 111°

D. 102°

20 Kareema earned $22.50 for 3 hours of baby-sitting. At this rate, which equation can be used to find y, the amount of money Kareema will earn for x hours of baby-sitting?

A. $y = -3x + 22.50$

B. $y = 3x + \frac{22.50}{3}$

C. $y = 3(22.50)x$

D. $y = \frac{22.50}{3}x$

Question 21 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 21 in the space provided in your Student Answer Booklet.

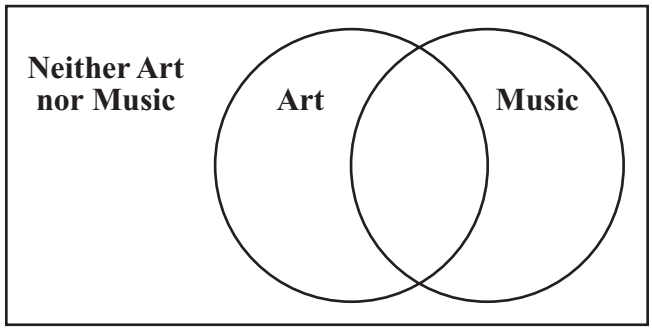
21 The students at Smithfield Middle School are enrolled in Art, Music, both Art and Music, or neither Art nor Music.

- A total of 88 students are enrolled in both Art and Music.
- A total of 194 students are enrolled in Art.
- A total of 143 students are enrolled in Music.
- There are a total of 351 students at the school.

a. What is the number of students who are enrolled in Music but not in Art? Show or explain how you got your answer.

In your Student Answer Booklet, copy the Venn diagram below.

Art and Music Enrollment



b. Use the information given above to complete the Venn diagram you copied.

c. What is the number of students who are enrolled in neither Art nor Music? Show or explain how you got your answer.

Massachusetts Department of ELEMENTARY & SECONDARY EDUCATION

Massachusetts Comprehensive Assessment System
Grade 8 Mathematics Reference Sheet

PERIMETER FORMULAS

square . . . . . $P = 4s$

rectangle . . . . . $P = 2b + 2h$
OR
$P = 2l + 2w$

triangle . . . . . $P = a + b + c$

AREA 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 . . . . . $A = \pi r^2$

TOTAL SURFACE AREA FORMULAS

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

cylinder . . . . . $SA = 2\pi r^2 + 2\pi rh$

sphere . . . . . $SA = 4\pi r^2$

VOLUME FORMULAS

rectangular prism . . . . . $V = lwh$
OR
$V = Bh$
(B = area of a base)

cube . . . . . $V = s^3$
(s = length of an edge)

cylinder . . . . . $V = \pi r^2 h$

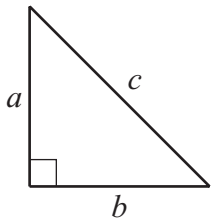
sphere . . . . . $V = \frac{4}{3}\pi r^3$

CIRCLE FORMULAS

$C = 2\pi r$
OR
$C = \pi d$

$A = \pi r^2$

PYTHAGOREAN THEOREM



$a^2 + b^2 = c^2$

Grade 8 Mathematics
Spring 2012 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	224	*Patterns, Relations, and Algebra*	8.P.9	A
2	224	*Number Sense and Operations*	8.N.8	A
3	224	*Patterns, Relations, and Algebra*	8.P.1	B
4	225	*Geometry*	8.G.2	A
5	225	*Patterns, Relations, and Algebra*	8.P.10	A
6	226	*Number Sense and Operations*	8.N.4	B
7	226	*Geometry*	8.G.3	B
8	227	*Patterns, Relations, and Algebra*	8.P.10	C
9	228	*Patterns, Relations, and Algebra*	8.P.7	2 pounds
10	229	*Number Sense and Operations*	8.N.12	
11	230	*Patterns, Relations, and Algebra*	8.P.10	B
12	231	*Geometry*	8.G.1	B
13	231	*Patterns, Relations, and Algebra*	8.P.4	B
14	232	*Patterns, Relations, and Algebra*	8.P.8	A
15	232	*Patterns, Relations, and Algebra*	8.P.5	B
16	233	*Geometry*	8.G.4	3 feet
17	234	*Number Sense and Operations*	8.N.12	C
18	235	*Measurement*	8.M.4	12 inches
19	236	*Geometry*	8.G.1	B
20	236	*Patterns, Relations, and Algebra*	8.P.9	D
21	237	*Data Analysis, Statistics, and Probability*	8.D.2	

***** Answers are provided here for multiple-choice items and short-answer items only. Sample responses and scoring guidelines for open-response items, which are indicated by shaded cells, will be posted to the Department's website later this year.

Grade 8 Mathematics
Spring 2012 Unreleased Common Items:
Reporting Categories and Standards

Item No.	Reporting Category	Standard
22	*Number Sense and Operations*	8.N.9
23	*Data Analysis, Statistics, and Probability*	8.D.2
24	*Patterns, Relations, and Algebra*	8.P.6
25	*Patterns, Relations, and Algebra*	8.P.1
26	*Geometry*	8.G.6
27	*Number Sense and Operations*	8.N.6
28	*Number Sense and Operations*	8.N.7
29	*Number Sense and Operations*	8.N.2
30	*Patterns, Relations, and Algebra*	8.P.5
31	*Patterns, Relations, and Algebra*	8.P.7
32	*Number Sense and Operations*	8.N.3
33	*Patterns, Relations, and Algebra*	8.P.8
34	*Geometry*	8.G.4
35	*Data Analysis, Statistics, and Probability*	8.D.2
36	*Number Sense and Operations*	8.N.3
37	*Data Analysis, Statistics, and Probability*	8.D.2
38	*Data Analysis, Statistics, and Probability*	8.D.2
39	*Number Sense and Operations*	8.N.1
40	*Measurement*	8.M.3
41	*Patterns, Relations, and Algebra*	8.P.4
42	*Geometry*	8.G.2