8th Grade Math

Chapter 2: LEAP Mathematics, Grade 8

This section describes the overall design of the LEAP Mathematics test to be administered to students in grade 8. Test specifications, sample test questions, and scoring rubrics are provided so that teachers may align classroom practices with the state assessment.

Test Structure

The Mathematics test consists of three subtests which are administered in two phases, each phase in a single day:

Phase 1:
- Constructed Response: a 4-item session that **allows** the use of calculators

Phase 2:
- Multiple Choice: a 30-item session that **does not** allow the use of calculators
- Multiple Choice: a 30-item session that **allows** the use of calculators

The suggested testing times for the Grade 8 LEAP Mathematics test listed in Table 2.1 are estimates only. The Mathematics test is **untimed.**

Table 2.1: Suggested Testing Times

Phase	Subtest Description	Number of Items	Testing Time
1	Constructed Response, calculator	4	60 minutes
2	Multiple Choice, no calculator	30	75 minutes
2	Multiple Choice, calculator	30	75 minutes
	TOTAL	64	210 minutes

Information about additional time needed to read test directions to students and accomplish other activities related to test administration is included in the *LEAP Test Administration Manual.*

The Mathematics test is composed of criterion-referenced test (CRT) items. These items measure Louisiana GLEs that more closely match the Common Core State Standards (CCSS) focus areas.

Item Types and Scoring Information

The test has sixty (60) multiple-choice items and four constructed-response items.

The multiple-choice items consist of an interrogatory stem and four answer options. These items assess a student's knowledge and conceptual understanding, and responses are scored 1 if correct and 0 if incorrect.

The constructed-response items, which involve a number of separate steps and application of multiple skills, are designed to assess one or more of the GLEs. The response format is

open-ended and may include numerical answers, short written answers, and other types of constructed response (e.g., solve and graph solutions of multi-step linear equations and inequalities). Students may be required to explain in writing how they arrived at their answers. These items are scored, according to an item-specific rubric, on a scale of 0 to 4 points.

General Scoring Rubric for Grade 8 LEAP Mathematics Constructed-Response Items

4	• The response demonstrates in-depth understanding of the relevant content and/or procedures. • The student completes all important components of the task accurately and communicates ideas effectively. • Where appropriate, the student offers insightful interpretations and/or extensions. • Where appropriate, the student uses more sophisticated reasoning and/or efficient procedures.
3	• The response demonstrates understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood. • The student completes most important aspects of the task accurately and communicates clearly. • The student's logic and reasoning may contain minor flaws.
2	• The student completes some parts of the task successfully. • The response demonstrates gaps in conceptual understanding.
1	• The student completes only a small portion of the tasks and/or shows minimal understanding of the concepts and/or processes.
0	• The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Description of the Mathematics Test and GLEs Assessed

The Mathematics test was developed specifically for Louisiana. Committees of Louisiana educators reviewed all items for content and alignment with Louisiana's GLEs. Separate committees reviewed the items for potential bias and sensitive material.

The Mathematics test is **untimed.** Suggested times are estimates for scheduling sessions and assisting students in managing their time.

Students are given a Mathematics Reference Sheet to consult as a reference. Calculators may be used on two parts of the test.

As Louisiana students and teachers transition to the CCSS (http://www.doe.state.la.us/topics/common_core.html) and PARCC assessments (http://www.doe.state.la.us/topics/common_core_assessments.html), the Mathematics test will include only items measuring GLEs aligned to the CCSS. Table 2.2 provides a list of GLEs eligible for assessment during the transition. The table identifies the GLEs and the corresponding CCSS alignment. Some grade 8 GLEs align to CCSS at other grade levels but will continue to be taught and tested in grade 8 to decrease the possibility that the transition will create curricular gaps.

Table 2.2: GLE Content to be Taught and Tested in 2012-13 and 2013-14

GLE #	Grade-Level Expectation Text	Aligned CCSS #
1	Compare rational numbers using symbols (i.e., $<, \leq, =, \geq, >$) and position on a number line	Retained[1]
2	Use whole number exponents (0-3) in problem-solving contexts	Retained[1]
4	Read and write numbers in scientific notation with positive exponents	8.EE.3 8.EE.4
7	Use proportional reasoning to model and solve real-life problems	Retained[1]
9	Find unit/cost rates and apply them in real-life problems	Retained[1]
11	Translate real-life situations that can be modeled by linear or exponential relationships to algebraic expressions, equations, and inequalities	8.F.4
12	Solve and graph solutions of multi-step linear equations and inequalities	8.EE.7
13	Switch between functions represented as tables, equations, graphs, and verbal representations, with and without technology	Retained[1]
14	Construct a table of x- and y-values satisfying a linear equation and construct a graph of the line on the coordinate plane	Retained[1]
15	Describe and compare situations with constant or varying rates of change	8.F.5 8.F.4 8.EE.5
17	Determine the volume and surface area of prisms and cylinders	8.G.9 6.G.2 7.G.6 G-GMD.3
24	Demonstrate conceptual and practical understanding of symmetry, similarity, and congruence and identify similar and congruent figures	8.G.2 8.G.4
25	Predict, draw, and discuss the resulting changes in lengths, orientation, angle measures, and coordinates when figures are translated, reflected across horizontal or vertical lines, and rotated on a grid	8.G.1 8.G.3 8.G.2 8.G.4
26	Predict, draw, and discuss the resulting changes in lengths, orientation, and angle measures that occur in figures under a similarity transformation (dilation)	8.G.3 8.G.4
28	Apply concepts, properties, and relationships of adjacent, corresponding, vertical, alternate interior, complementary, and supplementary angles	8.G.5
31	Use area to justify the Pythagorean theorem and apply the Pythagorean theorem and its converse in real-life problems	8.G.6 8.G.7 8.G.8
38	Sketch and interpret a trend line (i.e., line of best fit) on a scatterplot	8.SP.2

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[1] This GLE was moved to another grade but will be taught and tested in this grade to decrease the possibility that the transition will create curricular gaps.

GLE #	Grade-Level Expectation Text	Aligned CCSS #
46	Distinguish between and explain when real-life numerical patterns are linear/arithmetic (i.e., grows by addition) or exponential/geometric (i.e., grows by multiplication) NOTE: The focus here will be on recognizing real-life numerical patterns which are linear since the CCSS does not require eighth-grade students to work with exponential growth.	8.F.5

Reporting Categories

To be more reflective of the focus areas of the CCSS at each grade, the GLEs available for assessment have been grouped into the Reporting Categories shown in Table 2.3. During the transition, the Reporting Categories replace the mathematics strands (e.g., Number and Number Relations, Algebra, etc.) for assessment purposes.

Table 2.3: Grade 8 Mathematics Reporting Categories

Reporting Category	GLEs Covered
Ratio, Proportion, and Algebra	7, 9, 11, 12, 13, 14, 15, 46
Number System	1, 2, 4
Measurement, Data, and Geometry	17, 24, 25, 26, 28, 31, 38

Mathematics Test Specifications

Table 2.4 provides test specifications for the multiple-choice subtests of the grade 8 LEAP Mathematics assessment. The values in the table are approximations due to slight variations in the content across test forms at grade 8.

Table 2.4: Grade 8 Mathematics Test Specifications

Reporting Category	% of Total Points
Ratio, Proportion, and Algebra	60
Number System	15
Measurement, Data, and Geometry	25
Total	**100**

Sixty 1-point MC items plus four 4-point constructed-response items equals a 76-point test.

Calculator Recommendations and Restrictions

It is recommended that a calculator be made available to **each** student for instructional and assessment purposes. As with all instructional materials, each individual district and school should determine which calculator best supports its mathematics curriculum and instructional program.

Calculators recommended for instruction and assessment:
- K–4 students: four-function calculator
- 5–8 students: scientific calculator
- 9–12 students: scientific calculator with graphing capabilities

Calculators <u>not</u> permitted on statewide assessment:
- handheld or laptop computers
- pocket organizers
- calculators with Computer Algebra Systems (CAS) or other symbolic manipulation capabilities
- calculators with paper tape
- calculators that talk or make noise
- calculators with QWERTY (typewriter-style) keypads
- electronic writing pads or pen input devices

Sample Test Items: Grade 8 Mathematics

Sample Mathematics Constructed-Response Items and Scoring Rubrics

Questions 1 and 2 show sample constructed-response items. Each item involves a number of separate steps and the application of multiple skills. The constructed-response items are designed to assess one or more of the GLEs. The items are scored using an item-specific rubric on a scale of 0 to 4 points.

1. Dani opened an account on a photo-sharing website. The website starts all new accounts with 20 stock photographs. Each week Dani uploads 25 of her photographs to the website without deleting any of the photographs in her account. Dani wrote the number pattern below to show how many photographs were in her account after each week.

$$45, 70, 95, 120 \dots$$

A. Explain why this number pattern is arithmetic.

B. Write an equation to relate y, the number of weeks since Dani opened her account, and x, the number of photographs uploaded to her account.

C. How would Dani's equation change if the website started each account with 40 stock photographs instead of 20?

D. How would Dani's equation from Part B change if she uploaded 50 photographs each week instead of 25?

Match to GLE: This item measures GLE 11: Translate real-life situations that can be modeled by linear or exponential relationships to algebraic expressions, equations, and inequalities, GLE 15: Describe and compare situations with constant or varying rates of change and GLE 46: Distinguish between and explain when real-life numerical patterns are linear/arithmetic (i.e., grows by addition) or exponential/geometric (i.e., grows by multiplication). NOTE: The focus here will be on recognizing real-life numerical patterns which are linear since the CCSS does not require eighth-grade students to work with exponential growth.

Scoring Rubric	
4	The student earns 4 points.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point.
0	The student's response is incorrect or irrelevant to the skill or concept being measured or is blank.
Sample Answer:	
Part A. I know the number pattern is arithmetic because each term is found by adding the same number to the previous term. Part B. $y = 25x + 20$ Part C. In Dani's equation the 20 would become 40. Part D. In Dani's equation the 25 would become 50.	
Points Assigned:	
Part A. 1 point 1 point for a valid mathematical explanation of how the student knows the number pattern is arithmetic, referring to the concept of adding the same number to each term Part B. 1 point 1 point for giving the correct linear equation for the pattern Part C. 1 point 1 point for correctly identifying that the 20 would change to 40. Part D. 1 point 1 point for correctly identifying that the 25 would change to 50.	

Note: Scorers should follow along with the student's work throughout. If student makes an error in a previous part and subsequent answers are correct based on the earlier error, student should not be penalized again.

2.   Kineetra plotted triangle JKL on the coordinate grid shown below.
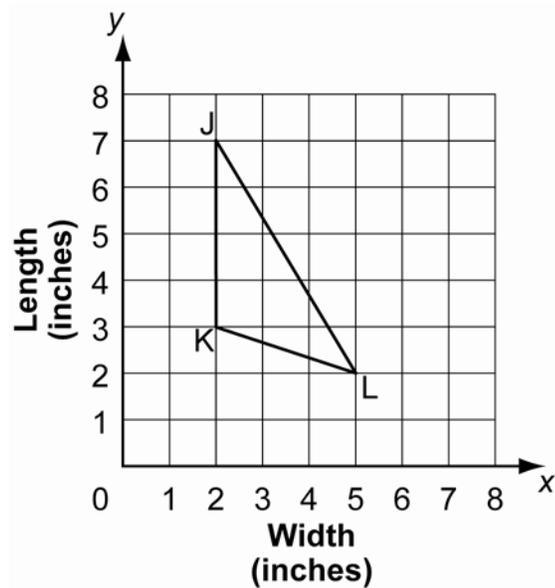
A.   Kineetra reflected triangle JKL across a line so the coordinates of point L do not change but the coordinates of points J and K do change. Draw two lines on the coordinate grid that she could have reflected triangle JKL across.

B.   After reflecting triangle JKL across the line, Kineetra dilates the figure by a factor of 3. What is the length of line segment JK after the dilation?

C.   The measure of angle K in the original triangle was 110°. What is the angle measure after the reflection and the dilation?

Match to GLE: This item measures GLE 25: Predict, draw, and discuss the resulting changes in lengths, orientation, angle measures, and coordinates when figures are translated, reflected across horizontal or vertical lines, and rotated on a grid and GLE 26: Predict, draw, and discuss the resulting changes in lengths, orientation, and angle measures that occur in figures under a similarity transformation (dilation).

Scoring Rubric	
4	The student earns 4 points.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point.
0	The student's response is incorrect or irrelevant to the skill or concept being measured or is blank.

Sample Answer:

Part A. The student can draw any two lines that pass through point L but do not also pass through points J or K.

Part B. 12 inches

Part C. 110°; when the triangle is reflected, the location of the figure changes, but the angle measure does not. When the triangle is dilated, the lengths of the sides increase, but the angle measure between the sides does not change.

Points Assigned:

Part A. 2 points
1 point for drawing a line through point L that does not pass through points J or K
AND
1 point for drawing a second line through point L that does not pass through points J or K

Part B. 1 point
1 point for correctly determining the length of line segment JK after the dilation

Part C. 1 point
1 point for correctly determining the angle measure of angle K

Sample Multiple-Choice Items

Questions 3 through 24 are sample multiple-choice items, arranged by GLE. The items test students' ability to solve math problems. Most items are provided in context and require students to use information from stories, graphs, or tables to solve a problem. Items may assess some of the skills of a GLE, while other items may measure all of the skills of the GLE.

3. There were 24 books on the summer reading list. Susan has read $\frac{5}{6}$ of the books on the list. Tom has read $\frac{11}{12}$ of the books on the list. Vicky has read $\frac{21}{24}$ of the books on the list. Which list correctly compares the fractions of books on the summer reading list that Susan, Tom, and Vicky have read?

A. $\frac{5}{6} < \frac{11}{12} < \frac{21}{24}$

B. $\frac{5}{6} < \frac{21}{24} < \frac{11}{12}$

C. $\frac{11}{12} < \frac{21}{24} < \frac{5}{6}$

D. $\frac{21}{24} < \frac{11}{12} < \frac{5}{6}$

Correct response: B

Match to GLE: This item measures GLE 1: Compare rational numbers using symbols (i.e., $<, \leq, =, \geq, >$) and position on a number line.

4. Robert graphed the thickness, in inches, of four different objects on the number line below.
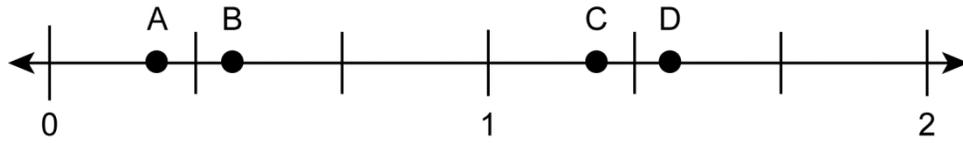
The thickness of the desk was $\dfrac{11}{8}$ inches. Which of Robert's points on the number line represents the thickness of the desk?

A. point A
B. point B
C. point C
D. point D

Correct response: D

Match to GLE: This item measures GLE 1: Compare rational numbers using symbols (i.e., <, ≤, =, ≥, >) and position on a number line.

5. Ramon writes the prime factorization of a number as $5^2 \times 2^3$. What number did Ramon write the prime factorization for?

    A.   60

    B.   80

    C.   150

    D.   200

Correct response: D

Match to GLE: This item measures GLE 2: Use whole number exponents (0-3) in problem-solving contexts.

6. Ayan has a box of 6 square pieces of glass. Each piece of glass has a side length of 4 inches. Ayan also has 2 other square pieces of glass each with a side length of 5 inches. She knows that to find the area of a single square piece of glass, she should multiply the length of the glass by its width. Which expression is equal to the total area of these 8 pieces of glass that Ayan has?

    A. $6(2^4) + 2(2^5)$

    B. $6(4^2) + 2(5^2)$

    C. $(6 \times 2)^4 + (2 \times 2)^5$

    D. $(6 \times 4)^2 + (2 \times 5)^2$

Correct response: B

Match to GLE: This item measures GLE 2: Use whole number exponents (0-3) in problem-solving contexts.

7. One of the planet Saturn's rings has a diameter of approximately 2.5×10^5 kilometers. What is the diameter of the ring, in kilometers, written in standard notation?

    A.   2,500

    B.   25,000

    C.   250,000

    D. 2,500,000

Correct response: C

Match to GLE: This item measures GLE 4: Read and write numbers in scientific notation with positive exponents.

8. The closest star to Earth is approximately 3.99×10^{13} kilometers away. When written in standard notation, how many zeros does this number contain before the decimal point?

    A. 11

    B. 12

    C. 13

    D. 15

Correct response: A

Match to GLE: This item measures GLE 4: Read and write numbers in scientific notation with positive exponents.

9.   Debbie keeps her marble collection in a jar. Of the 50 marbles in the jar, 15 are red, 10 are blue, 20 are green, and 5 are yellow. Debbie randomly chooses 30 marbles from the jar. How many of these marbles can she expect to be red?

A.   3 marbles

B.   6 marbles

C.   9 marbles

D. 12 marbles

Correct response: C

Match to GLE: This item measures GLE 7: Use proportional reasoning to model and solve real-life problems.

10.   Henry bought a bag of 5 onions for a total cost of $4.75. At that rate, how much would Henry pay for 12 onions?

A. $ 9.75

B. $11.40

C. $11.75

D. $16.75

Correct response: B

Match to GLE: This item measures GLE 9: Find unit/cost rates and apply them in real-life problems.

11. A package of 6 water bottles costs $7.74. How much does each water bottle cost?

   A. $0.74
   B. $0.80
   C. $1.29
   D. $1.74

Correct response: C

Match to GLE: This item measures GLE 9: Find unit/cost rates and apply them in real-life problems.

12. A restaurant has small tables (s) and large tables (l). Small tables seat four people each, and large tables seat eight people each. Which inequality shows the maximum number of people (p) that can be seated at the restaurant?

   A. $p \geq 8l + 4s$
   B. $p \leq 8l + 4s$
   C. $p > 8l + 4s$
   D. $p < 8l + 4s$

Correct response: B

Match to GLE: This item measures GLE 11: Translate real-life situations that can be modeled by linear or exponential relationships to algebraic expressions, equations, and inequalities.

13. Which of the following graphs represents this linear equation?

$$y = 2x - 5$$

A.

B.

C.

D.
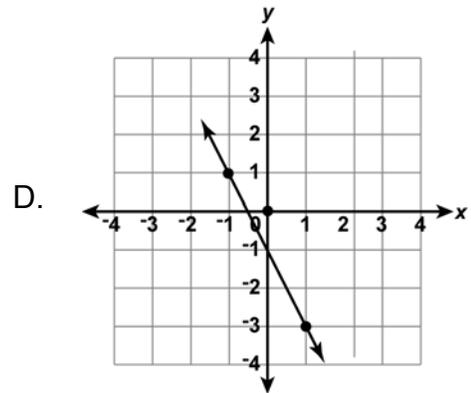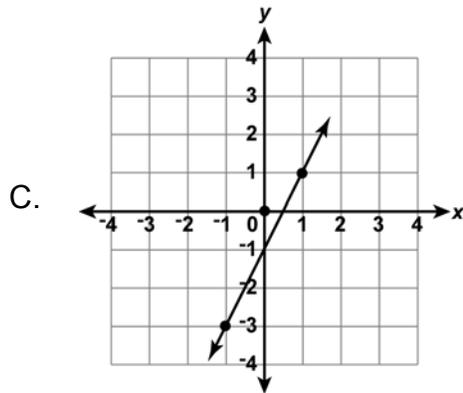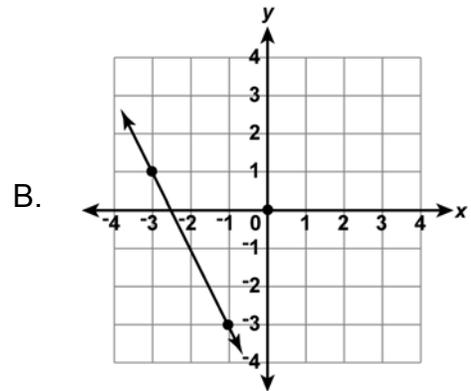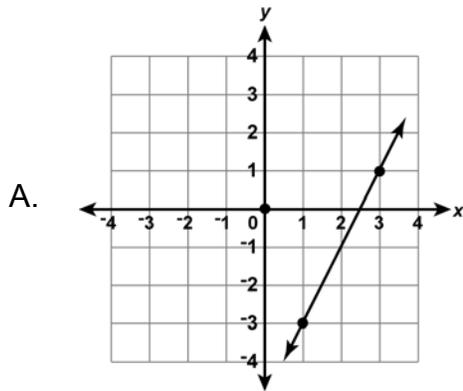
Correct response: A

Match to GLE: This item measures GLE 12: Solve and graph solutions of multi-step linear equations and inequalities.

14. The cost of Jake's cell phone bill is determined by how many megabytes of data he uses each month, as shown in the graph below.

Jake's Cell Phone Bill
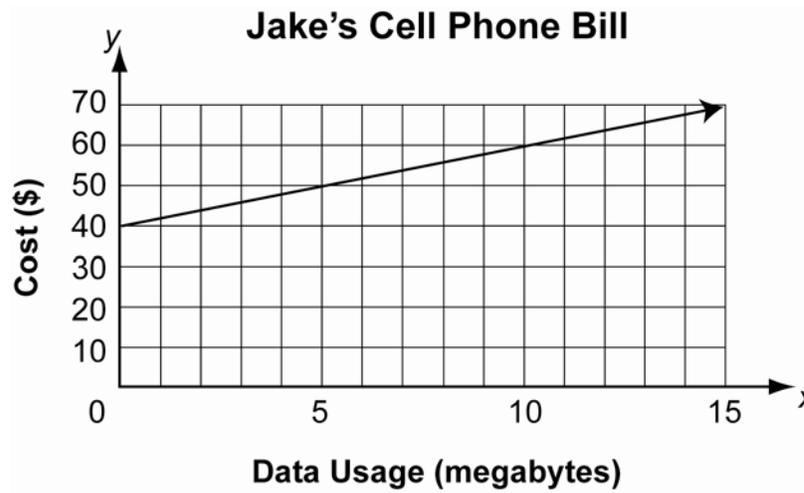
Which equation represents the cost of Jake's cell phone bill, y, based on his data usage in megabytes, x?

A. $y = 0.5x + 40$

B. $y = 2x + 40$

C. $y = 40x + 0.5$

D. $y = 40x + 2$

Correct response: B

Match to GLE: This item measures GLE 13: Switch between functions represented as tables, equations, graphs, and verbal representations, with and without technology.

15. The cost, in dollars (*y*), to exchange *x* US dollars for Brazilian reales at an airport can be found using the equation below.

$$y = 0.102x$$

Which table shows the cost, *y*, to exchange *x* US dollars for Brazilian reales at the airport?

A.

**Cost to Exchange
US Dollars
for Brazilian Reales**

US dollars exchanged (*x*)	Cost (*y*)
50	$ 4.90
150	$14.71
375	$36.76
400	$39.22

B.

**Cost to Exchange
US Dollars
for Brazilian Reales**

US dollars exchanged (*x*)	Cost (*y*)
50	$ 5.10
150	$15.10
375	$37.60
400	$40.10

C.

**Cost to Exchange
US Dollars
for Brazilian Reales**

US dollars exchanged (*x*)	Cost (*y*)
50	$ 5.00
150	$15.00
375	$37.50
400	$40.00

D.

**Cost to Exchange
US Dollars
for Brazilian Reales**

US dollars exchanged (*x*)	Cost (*y*)
50	$ 5.10
150	$15.30
375	$38.25
400	$40.80

Correct response: D

Match to GLE: This item measures GLE 14: Construct a table of x- and y-values satisfying a linear equation and construct a graph of the line on the coordinate plane.

16. The cost per ticket to a baseball game depends on the number of tickets purchased by one person. If more tickets are purchased, the cost per ticket will be lower. The cost to purchase up to 5 tickets is $12 per ticket. For every 5 additional tickets purchased (up to 50 tickets), the price per ticket is reduced by $0.50. Which statement about the price per ticket is true?

    A.   The price per ticket is the same for 3 tickets as it is for 9 tickets.

    B.   The price per ticket is the same for 43 tickets as it is for 45 tickets.

    C.   The price per ticket is $0.50 lower for 23 tickets than it is for 29 tickets.

    D.   The price per ticket is $1.00 higher for 33 tickets than it is for 45 tickets.

Correct response: A

Match to GLE: This item measures GLE 15: Describe and compare situations with constant or varying rates of change.

17. Jose is painting the entire wooden cylinder shown below.

├1 ft┤

8 ft
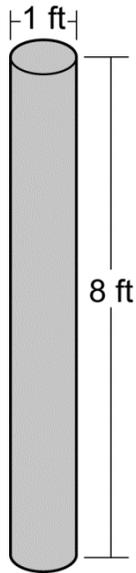
How many square feet does Jose have to paint?

A. 2π

B. $8\dfrac{1}{4}\pi$

C. $8\dfrac{1}{2}\pi$

D. 18π

Correct response: C

Match to GLE: This item measures GLE 17: Determine the volume and surface area of prisms and cylinders.
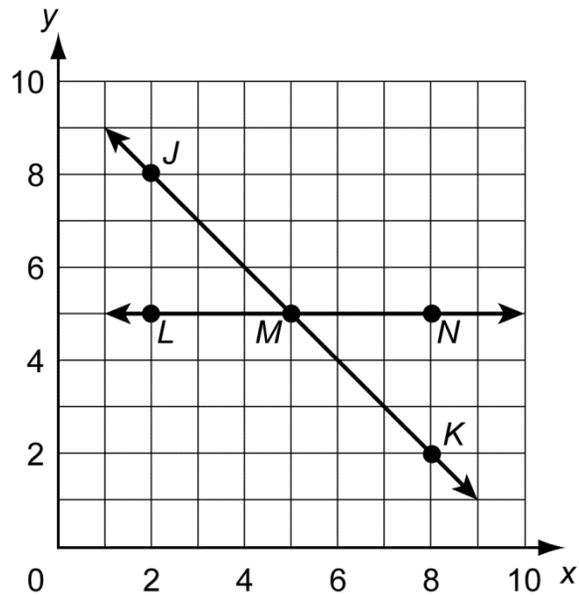
18.   Which figure has exactly one line of symmetry?

A.

B.

C.

D.
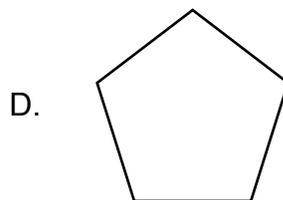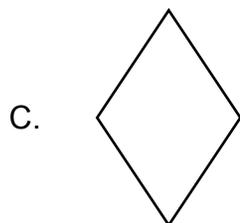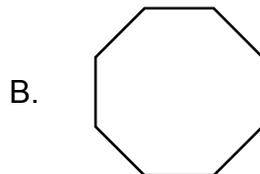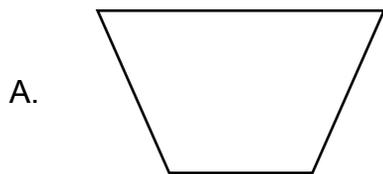
Correct response: A

Match to GLE: This item measures GLE 24: Demonstrate conceptual and practical understanding of symmetry, similarity, and congruence and identify similar and congruent figures.

19.   The coordinate grid below shows line JK and line LN, which intersect at point M.

The figure is reflected across a vertical line that passes through point M. Which point will be reflected onto the original location of point N?

A.   Point J
B.   Point K
C.   Point L
D.   Point N

Correct response: C

Match to GLE: This item measures GLE 25: Predict, draw, and discuss the resulting changes in lengths, orientation, angle measures, and coordinates when figures are translated, reflected across horizontal or vertical lines, and rotated on a grid.

20.   In quadrilateral JKLM, the measure of angle K is 10°. Quadrilateral JKLM is dilated by a factor of $\frac{1}{2}$ to become quadrilateral J′K′L′M′. What is the measure of angle K′?

A.   5°

B. $9\frac{1}{2}$°

C.   10°

D.   20°

Correct response: C

Match to GLE: This item measures GLE 26: Predict, draw, and discuss the resulting changes in lengths, orientation, and angle measures that occur in figures under a similarity transformation (dilation).

21. In a town, some of the streets change names when they intersect with Broadway. Broadway is a straight road. In the map below, two of the intersections are shown.
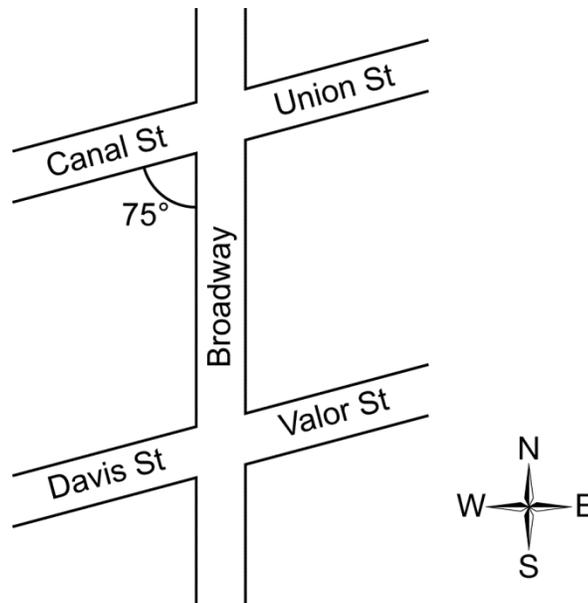
Canal St. and Davis St. are parallel to each other. The angle measure from the southern edge of Canal St. to Broadway is 75°. What is the angle measure from the northern edge of Davis St. to Broadway?

A.   75°

B.   105°

C.   115°

D.   285°

Correct response: B

Match to GLE: This item measures GLE 28: Apply concepts, properties, and relationships of adjacent, corresponding, vertical, alternate interior, complementary, and supplementary angles.

22. Helen's cat, Kitty, is stuck in the tree. In order to rescue Kitty, Helen must lean a five foot ladder against the tree, as shown in the diagram below. The distance between the bottom of the tree and the ladder is three feet.
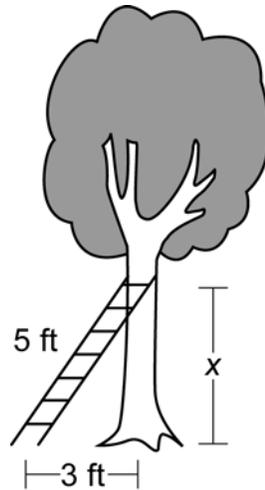
How high above the ground is the top of the ladder, represented by the variable X?

A. 3 feet
B. 4 feet
C. 5 feet
D. 6 feet

Correct response: B

Match to GLE: This item measures GLE 31: Use area to justify the Pythagorean theorem and apply the Pythagorean theorem and its converse in real-life problems.
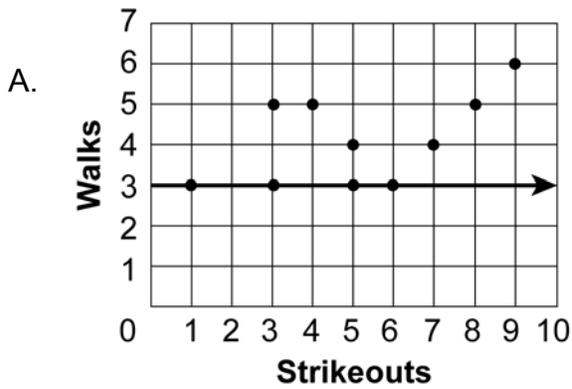
23. Kara made the scatterplot below to represent the number of strikeouts and walks each of 10 baseball players had last week.
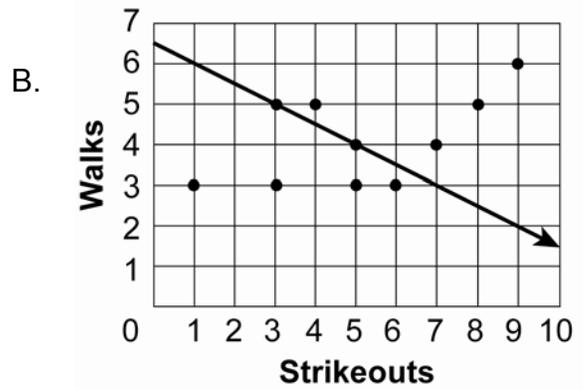
Comparing Strikeouts and Walks
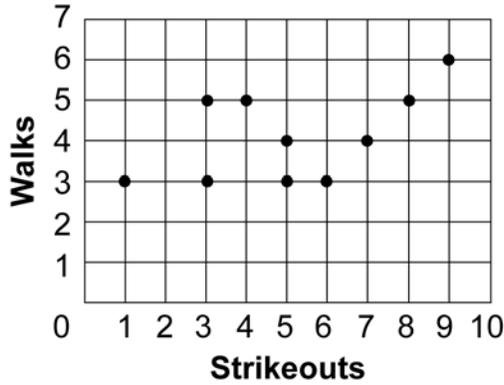
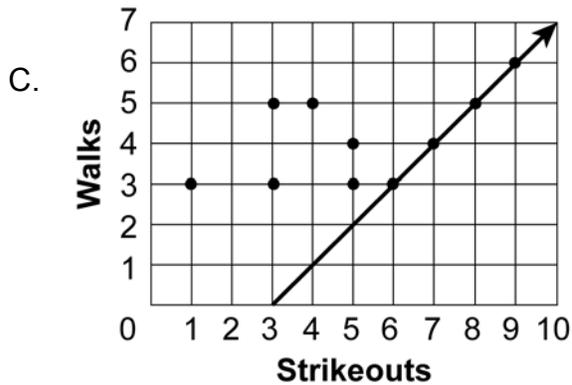Which scatterplot shows the **best** line of best fit for Kara's scatterplot?
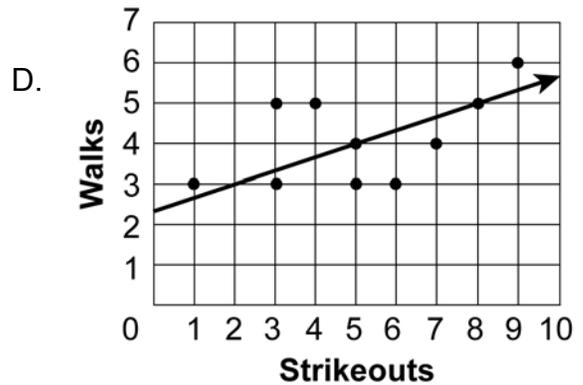
A.

Comparing Strikeouts and Walks

B.

Comparing Strikeouts and Walks

C.

Comparing Strikeouts and Walks

D.

Comparing Strikeouts and Walks

Correct response: D

Match to GLE: This item measures GLE 38: Sketch and interpret a trend line (i.e., line of best fit) on a scatterplot.

24.   Each spring Josh adds 3 tomato plants to the number of tomato plants he planted the year before. Which statement **best** describes the pattern of the number of tomato plants Josh has each year?

    A.   The pattern is linear because each year Josh has 3 more tomato plants than the year before.

    B.   The pattern is exponential because each year Josh has 3 more tomato plants than the year before.

    C.   The pattern is linear because each year the number of tomato plants Josh has increases from the year before.

    D.   The pattern is exponential because each year the number of tomato plants Josh has increases from the year before.

Correct response: A

Match to GLE: This item measures GLE 46: Distinguish between and explain when real-life numerical patterns are linear/arithmetic (i.e., grows by addition) or exponential/geometric (i.e., grows by multiplication) NOTE: The focus here will be on recognizing real-life numerical patterns which are linear since the CCSS does not require eighth-grade students to work with exponential growth.