4th Grade Math

Chapter 2: LEAP Mathematics, Grade 4

This section describes the overall design of the LEAP Mathematics test to be administered to students in grade 4. 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 3-item session that **allows** the use of calculators

Phase 2:
- Multiple Choice: a 36-item session that **does not** allow the use of calculators
- Multiple Choice: a 24-item session that **allows** the use of calculators

The suggested testing times for the Grade 4 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	3	60 minutes
2	Multiple Choice, no calculator	36	80 minutes
2	Multiple Choice, calculator	24	50 minutes
TOTAL		63	190 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 three 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., use measurements to calculate perimeter and area of rectangular objects in U.S. and metric units). 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 4 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 4 GLEs align to CCSS at other grade levels but

will continue to be taught and tested in grade 4 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	Read and write place value in word, standard, and expanded form through 1,000,000	4.NBT.1 4.NBT.2
2	Read, write, compare, and order whole numbers using place value concepts, standard notation, and models through 1,000,000	4.NBT.1 4.NBT.2
4	Know all basic facts for multiplication and division through 12 x 12 and 144 ÷ 12, and recognize factors of composite numbers less than 50	4.OA.4
5	Read, write, and relate decimals through hundredths and connect them with corresponding decimal fractions	4.NF.6
6	Model, read, write, compare, order, and represent fractions with denominators through twelfths using region and set models	4.NF.2
7	Give decimal equivalents of halves, fourths, and tenths	4.NF.6
9	Estimate fractional amounts through twelfths, using pictures, models, and diagrams	Retained[1]
10	Solve multiplication and division number sentences including interpreting remainders	Retained[1]
11	Multiply 3-digit by 1-digit numbers, 2-digit by 2-digit numbers, and divide 3-digit numbers by 1-digit numbers, with and without remainders	4.NBT.5 4.NBT.6
15	Write number sentences or formulas containing a variable to represent real-life problems	Retained
17	Use manipulatives to represent the distributive property of multiplication over addition to explain multiplying numbers	4.NBT.5
19	Solve one-step equations with whole number solutions	Retained[1]
22	Select and use the appropriate standard units of measure, abbreviations, and tools to measure length and perimeter (i.e., in., cm, ft., yd., mile, m, km), area (i.e., square inch, square foot, square centimeter), capacity (i.e., fl. oz., cup, pt., qt., gal., l, ml), weight/mass (i.e., oz., lb., g, kg, ton), and volume (i.e., cubic cm, cubic in.)	4.MD.1 4.MD.3
25	Use estimates and measurements to calculate perimeter and area of rectangular objects (including squares) in U.S. (including square feet) and metric units	4.MD.3
27	Use unit conversions within the same system to solve real-life problems (e.g., 60 sec. = 1 min., 12 objects = 1 dozen, 12 in. = 1 ft., 100 cm = 1 m, 1 pt. = 2 cups)	4.MD.1 4.MD.2
32	Draw, identify, and classify angles that are acute, right, and obtuse	4.G.1
36	Analyze, describe, interpret, and construct various types of charts and graphs using appropriate titles, axis labels, scales, and legends	4.MD.2 4.MD.4
43	Identify missing elements in a number pattern	Retained[1]

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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.

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 4 Mathematics Reporting Categories

Reporting Category	GLEs Covered
Number and Operations	1, 2, 4, 10, 11, 15, 17, 19, 43
Fractions	5, 6, 7, 9
Measurement, Data, and Geometry	22, 25, 27, 32, 36

Mathematics Test Specifications

Table 2.4 provides test specifications for the multiple-choice subtests of the grade 4 LEAP Mathematics assessment. The values in the table are approximations due to slight variations in the content across test forms at grade 4.

Table 2.4: Grade 4 Mathematics Test Specifications

Reporting Category	% of Total Points
Number and Operations	55
Fractions	30
Measurement, Data, and Geometry	15
Total	**100**

Sixty 1-point MC items plus three 4-point constructed-response items equals a 72-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 4 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. Hahn, Rashid, and Joe picked up litter at Arliss Park. The table below shows what each student removed.

	Cans	Papers	Boxes	Total
Hahn	3	11	2	?
Rashid	5	?	?	18
Joe	?	7	5	15

A. How many cans did Joe remove?

_____

B. Write a number sentence using the letter n to represent the number of cans Joe removed.

_____

C. Rashid removed the same number of papers as Joe removed cans. How many **boxes** did Rashid remove? Show your work.

_____

D. Use one of the following symbols (=, <, >) to describe the relationship between the total number of items that Hahn and Rashid found.

_____

Match to GLE: This item measures GLE 15: Write number sentences or formulas containing a variable to represent real-life problems and GLE 19: Solve one-step equations with whole number solutions.

Scoring Rubric	
4	The student's response earns 4 points.
3	The student's response earns 3 or 3 ½ points.
2	The student's response earns 2 or 2 ½ points.
1	The student's response earns ½ to 1 ½ points. **OR** The student's response demonstrates minimal understanding of variables and mathematical symbols.
0	The student's response is incorrect, irrelevant to the skill or concept being measured, too brief to evaluate, or blank.
Points Assigned:	

Part A (1 point):

- 1 point for the correct answer of 3

Part B (1 point):

- 1 point for writing a correct number sentence ($n + 7 + 5 = 15$ or $15 - 5 - 7 = n$, or $n + 12 = 15$)

OR

- ½ point for correct number sentence with no indication of an unknown ($3 + 7 + 5 = 15$)

Part C (1 point):

- 1 point for giving the correct answer of 10 boxes (or answers consistent with an incorrect answer to part A) with correct process ($18 - 5 - 3 = 10$ or $18 - 8 = 10$ or $10 + 5 + 3 = 18$)

OR

- ½ point for an incorrect answer using a correct process with arithmetic error(s) **OR** for a correct answer (or answer consistent with an incorrect answer to part A) with no process

Part D (1 point):

- 1 point for correct number sentence ($16 < 18$ or $18 > 16$)

OR

- ½ point for correctly comparing the wrong people or for $18 \neq 16$

2.   Tom drew the diagram below to show the size of his closet.
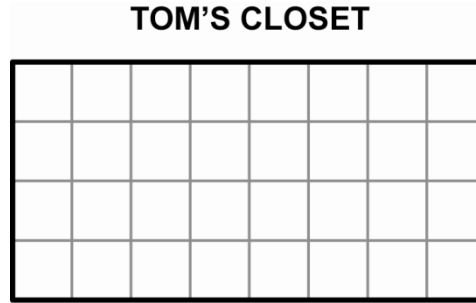
TOM'S CLOSET

Each square on the grid Tom used is 1 foot long and 1 foot wide.

A. What is the area in square feet of Tom's closet?

B. What is the perimeter in feet of Tom's closet?

C. What is the perimeter in inches of Tom's closet? Explain how you found your answer.

Match to GLE: This item measures GLE 25: Use estimates and measurements to calculate perimeter and area of rectangular objects (including squares) in U.S. (including square feet) and metric units and GLE 27: Use unit conversions within the same system to solve real-life problems (e.g., 60 sec. = 1 min., 12 objects = 1 dozen, 12 in. = 1 ft., 100 cm = 1 m, 1 pt. = 2 cups).

Scoring Rubric	
4	The student's response earns 4 points.
3	The student's response earns 3 points.
2	The student's response earns 2 points.
1	The student's response earns 1 point.
0	The student's response is incorrect or irrelevant to the skill or concept being measured or is blank.
Sample Answer:	
A. 32 square feet B. 24 feet C. 288 inches. I know there are 12 inches in 1 foot, so I multiplied 24 feet by 12 inches, and 24 × 12 = 288 inches.	
Points Assigned:	
1 point for each of the following: - Correctly determining the area of the closet. - Correctly determining the perimeter of the closet. - Correctly determining the perimeter of the closet in inches. - Providing a valid mathematical explanation of how the perimeter of the closet in inches was determined.	

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. Last season, a total of six hundred forty-two thousand one hundred forty people went to a baseball team's games. Which number shows another way to correctly write the number of people who went to the baseball team's games?

    A. 642,104

    B. 642,114

    C. 642,140

    D. 640,214

Correct response: C

Match to GLE: This item measures GLE 1: Read and write place value in word, standard, and expanded form through 1,000,000.

4. Richard saved 1,812 pennies. Which expression shows another way to represent 1,812?

    A. 1 thousand + 7 hundreds + 1 ten + 12 ones

    B. 10 thousands + 8 hundreds + 1 ten + 2 ones

    C. 1 hundred + 8 tens + 12 ones

    D. 1 thousand + 7 hundreds + 10 tens + 12 ones

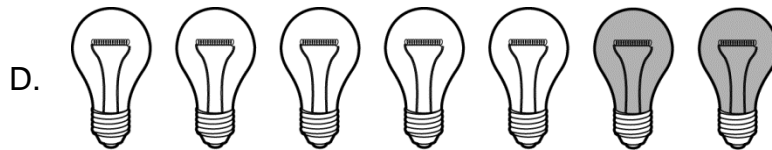**Correct response: D**

Match to GLE: This item measures GLE 2: Read, write, compare, and order whole numbers using place value concepts, standard notation, and models through 1,000,000.

5.   A gardener buys 9 packages of plants. Each package has 12 plants in it. How many total plants did the gardener buy?

    A.   92

    B.   98

    C. 101

    D. 108

Correct response: D

Match to GLE: This item measures GLE 4: Know all basic facts for multiplication and division through 12 × 12 and 144 ÷ 12, and recognize factors of composite numbers less than 50.

6. Ms. Carew asked what part of this hundred block is shaded.
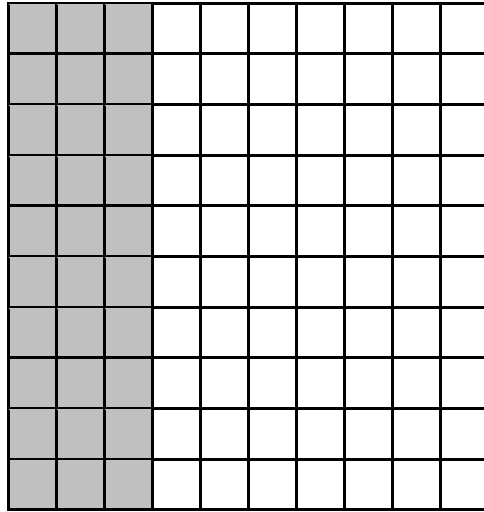
Whitney says that $\frac{3}{10}$ is shaded.

Adam says that 0.3 is shaded.

Sally says that 0.30 is shaded.

Colea says that 0.03 is shaded.

Who is **wrong**?

A. Whitney

B. Adam

C. Sally

D. Colea

Correct response: D

Match to GLE: This item measures GLE 5: Read, write, and relate decimals through hundredths and connect them with corresponding decimal fractions and GLE 6: Model, read, write, compare, order, and represent fractions with denominators through twelfths using region and set models.

7. The 12 chairs shown below are in a classroom.
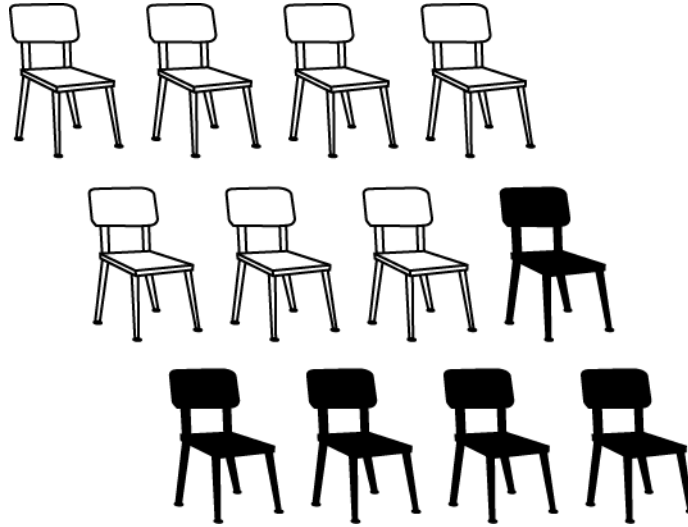
What fraction of the chairs are white?

A. $\dfrac{5}{12}$

B. $\dfrac{5}{7}$

C. $\dfrac{7}{12}$

D. $\dfrac{7}{5}$

Correct response: C

Match to GLE: This item measures GLE 6: Model, read, write, compare, order, and represent fractions with denominators through twelfths using region and set models.

8. Kelly turned on the lights in his living room to see which bulbs were burned out, as shown below.
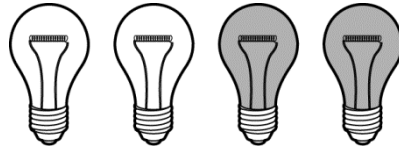
A **greater** fraction of light bulbs was burned out in Kelly's kitchen than in his living room. Which model could represent the light bulbs in Kelly's kitchen?

A.

B.

C.

D.
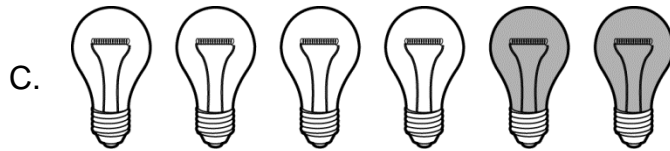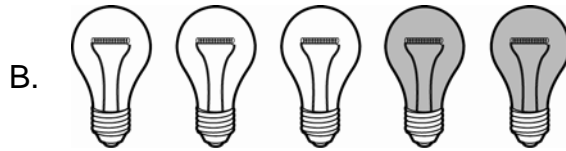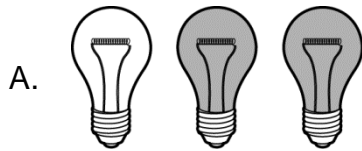
Correct response: A

Match to GLE: This item measures GLE 6: Model, read, write, compare, order, and represent fractions with denominators through twelfths using region and set models.

9. Kevin's mother told him to buy **seven-tenths** of a pound of hamburger. Each package is marked to show its weight. Kevin should buy the package marked

   A. 7.10 pounds.
   B. 1.70 pounds.
   C. 0.7 pound.
   D. 0.1 pound.

Correct response: C

Match to GLE: This item measures GLE 7: Give decimal equivalents of halves, fourths, and tenths.

10. A diagram of Seth's vegetable garden is shown below. He shaded the area in which he planted strawberries.

Seth's Garden
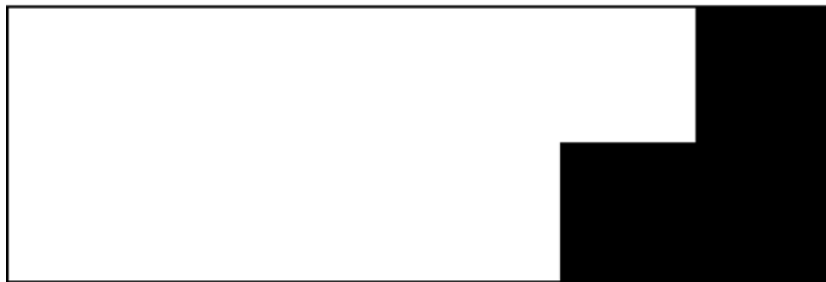
In what fraction of his garden did Seth plant strawberries?

   A. $\dfrac{1}{12}$

   B. $\dfrac{1}{6}$

   C. $\dfrac{1}{4}$

   D. $\dfrac{1}{3}$

Correct response: C

Match to GLE: This item measures GLE 9: Estimate fractional amounts through twelfths, using pictures, models, and diagrams.

11. Patty collected 26 eggs from her chickens to put them in egg cartons. Each carton holds 6 eggs. She filled as many empty cartons with eggs as possible and put the remaining eggs in the refrigerator. How many eggs did Patty put in the refrigerator?

A. 0

B. 2

C. 4

D. 5

Correct response: B

Match to GLE: This item measures GLE 10: Solve multiplication and division number sentences including interpreting remainders.

12. Curt has 108 books. He puts 8 books on each shelf in his office. The rest of the books he puts on his desk. The number sentence below can be used to help find the number of books Curt puts on his desk.

$$108 \div 8 = \boxed{}$$

How many books is Curt putting on his desk?

A. 0 books

B. 4 books

C. 5 books

D. 13 books

Correct response: B

Match to GLE: This item measures GLE 10: Solve multiplication and division number sentences including interpreting remainders.

13. Each page on a website has 16 pictures on it. The website has 14 different pages. How many total pictures are on the website?

    A. 30
    B. 80
    C. 124
    D. 224

Correct response: D

Match to GLE: This item measures GLE 11: Multiply 3-digit by 1-digit numbers, 2-digit by 2-digit numbers, and divide 3-digit numbers by 1-digit numbers, with and without remainders.

14. Amanda earns $8 per hour at her job. Last week, she earned a total of $288. How many hours did she work last week?

    A. 28
    B. 31
    C. 36
    D. 40

Correct response: C

Match to GLE: This item measures GLE 11: Multiply 3-digit by 1-digit numbers, 2-digit by 2-digit numbers, and divide 3-digit numbers by 1-digit numbers, with and without remainders.

15. Tim wants to make 16 cards for his friends. If t stands for the time that Tim will spend making each card, which number sentence can you use to find out how long it is going to take Tim to make the 16 cards?
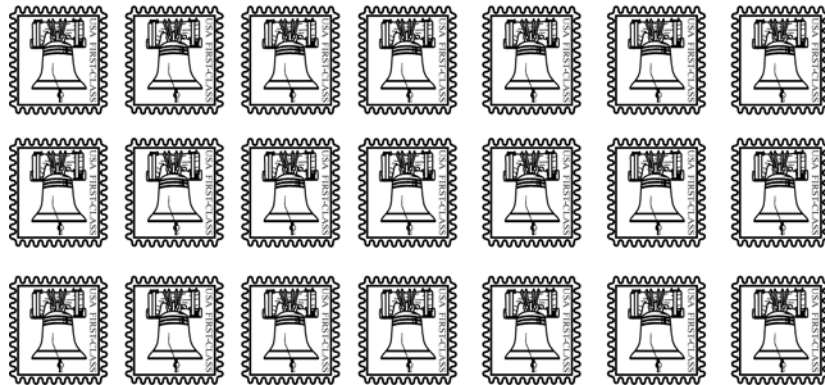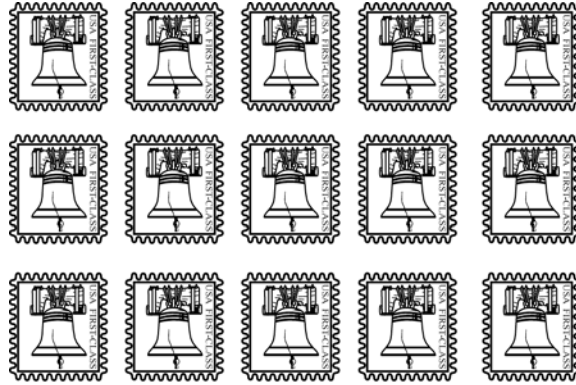
A. $t + 16 = \boxed{}$

B. $t - 16 = \boxed{}$

C. $t \times 16 = \boxed{}$

D. $t \div 16 = \boxed{}$

Correct response: C

Match to GLE: This item measures GLE 15: Write number sentences or formulas containing a variable to represent real-life problems.

16. The stamps on one page in Jeremy's stamp album are shown below.

Which of the following is equivalent to the number of stamps on the page of Jeremy's stamp album shown above?

A. $(3 \times 5) + 7$
B. $(3 \times 7) + 5$
C. $3 \times (5 + 7)$
D. $3 \times (5 \times 7)$

Correct response: C

Match to GLE: This item measures GLE 17: Use manipulatives to represent the distributive property of multiplication over addition to explain multiplying numbers.

17. Parents and students attended Back-to-School night in the school auditorium. In the front of the auditorium, there are 76 chairs arranged equally in 4 rows. How many chairs are in each row?

$$4 \times \boxed{} = 76$$

   A. 12
   B. 15
   C. 18
   D. 19

Correct response: D

Match to GLE: This item measures GLE 19: Solve one-step equations with whole number solutions.

**18.** The measurements of the tent floor that Tran and his brother will share are shown below.
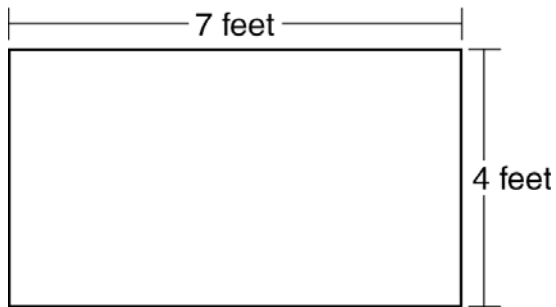
What is the area of the floor?

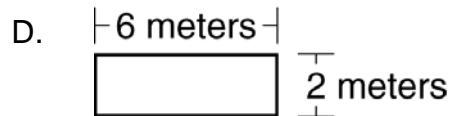A. 11 sq. ft.

B. 14 sq. ft.

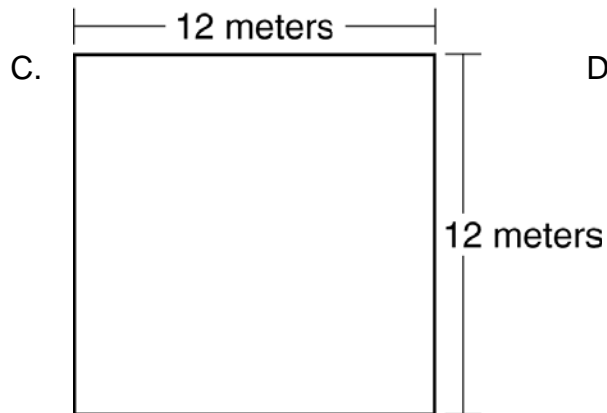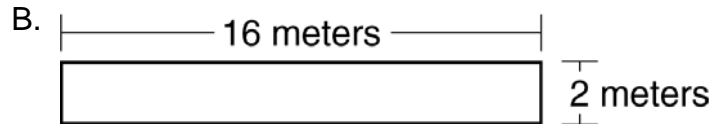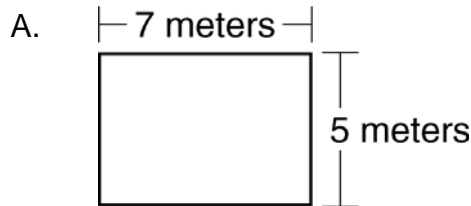C. 22 sq. ft.

D. 28 sq. ft.

Correct response: D

Match to GLE: This item measures GLE 22: Select and use the appropriate standard units of measure, abbreviations, and tools to measure length and perimeter (i.e., in., cm, ft., yd., mile, m, km), area (i.e., square inch, square foot, square centimeter), capacity (i.e., fl. oz., cup, pt., qt., gal., l, ml), weight/mass (i.e., oz., lb., g, kg, ton), and volume (i.e., cubic cm, cubic in.).

**19.** Tameka has a garden in the shape of a rectangle. A model of her garden is shown below
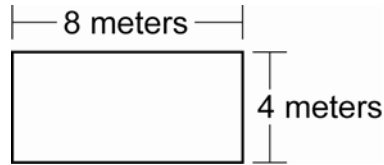
Eli also has a garden in the shape of a rectangle. His garden has the same area as Tameka's garden. Which rectangle could model Eli's garden?

A.

B.

C.

D.

Correct response: B

Match to GLE: This item measures GLE 22: Select and use the appropriate standard units of measure, abbreviations, and tools to measure length and perimeter (i.e., in., cm, ft., yd., mile, m, km), area (i.e., square inch, square foot, square centimeter), capacity (i.e., fl. oz., cup, pt., qt., gal., l, ml), weight/mass (i.e., oz., lb., g, kg, ton), and volume (i.e., cubic cm, cubic in.).

Use the diagram below to answer question 20.
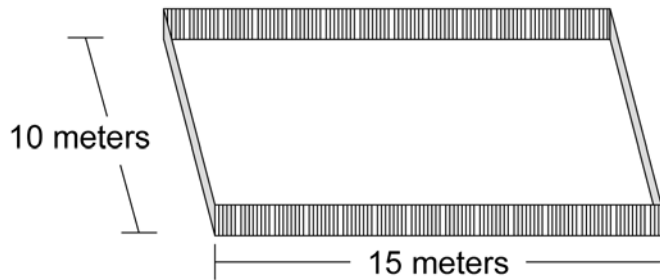
10 meters

15 meters

20.   Mr. Rollins put a fence all the way around his rectangular yard for his dog. What is the perimeter of his yard?

    A.   25 meters

    B.   50 meters

    C.   150 meters

    D.   250 meters

Correct response: B

Match to GLE: This item measures GLE 22: Select and use the appropriate standard units of measure, abbreviations, and tools to measure length and perimeter (i.e., in., cm, ft., yd., mile, m, km), area (i.e., square inch, square foot, square centimeter), capacity (i.e., fl. oz., cup, pt., qt., gal., l, ml), weight/mass (i.e., oz., lb., g, kg, ton), and volume (i.e., cubic cm, cubic in.).
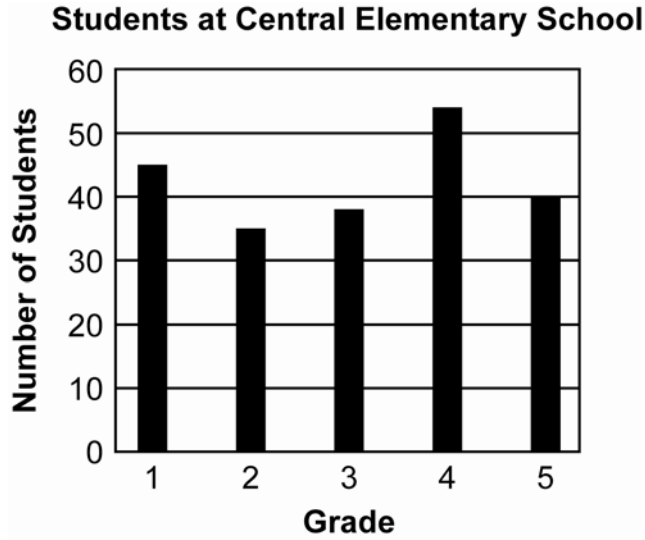
21. One part of a railing is shown below.
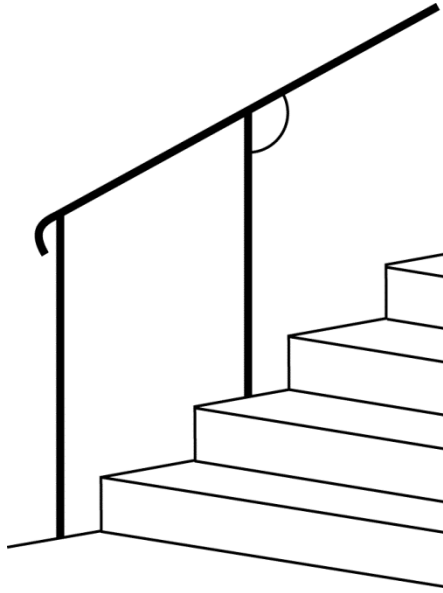
Which word **best** describes the marked angle of the railing?

A. Acute
B. Obtuse
C. Right
D. Straight

Correct response: B

Match to GLE: This item measures GLE 32: Draw, identify, and classify angles that are acute, right, and obtuse.

22. Jerome made the graph below.

Students at Central Elementary School

Which question can be answered using the graph Jerome made?

A. Which grade has the greatest number of girls?

B. Which grade will have the most students next year?

C. How many more students are in grade 5 than in grade 2?

D. How many classrooms are at Central Elementary School?

Correct response: C

Match to GLE: This item measures GLE 36: Analyze, describe, interpret, and construct various types of charts and graphs using appropriate titles, axis labels, scales, and legends.

23. Bettina noticed that the numbers on the front of the floats in the parade followed the pattern shown below. What number was on the 4th float?

$$1, \ 3, \ 7, \ \boxed{}, \ 21, \ 31$$

A. 9
B. 11
C. 13
D. 14

Correct response: C

Match to GLE: This item measures GLE 43: Identify missing elements in a number pattern.

24. Megan is increasing the number of minutes she exercises each day according to the pattern shown below.

Number of Minutes of Exercise

Monday	Tuesday	Wednesday	Thursday
2	4	8	16

How many minutes should she exercise on Friday?

A. 18
B. 20
C. 24
D. 32

Correct response: D

Match to GLE: This item measures GLE 43: Identify missing elements in a number pattern.