

## Chapter 2: iLEAP Math, Grade 7

This section describes the overall design of the iLEAP Math test to be administered to students in grade 7. Test specifications, sample test questions, and scoring rubrics are provided so that teachers may align classroom practices with the state assessment.

### Test Structure

The Math test consists of four parts, or subtests, and is administered in a single day.

Part 1: NRT (Estimation)

Part 3: CRT (Multiple Choice)

Part 2: NRT (Multiple Choice)

Part 4: CRT (Constructed Response)

The Math test includes:

- Norm-referenced test (NRT) items from the survey battery (short form) of the Iowa Tests of Basic Skills® (ITBS). Most of the items measure Louisiana Grade-Level Expectations (GLEs). The survey battery is used to provide national norms.
- Criterion-referenced test (CRT) items. These items are aligned with Louisiana GLEs and were specifically developed to measure GLEs not assessed by NRT items.

### Item Types

The test has sixty (60) multiple-choice items and two 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 will be 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/benchmarks/strands. These items are scored, according to an item-specific rubric, on a scale of 0 to 4 points.

### The NRT Component

The ITBS survey battery is the NRT component of the iLEAP Math assessment. Sample questions that show what the questions are like and show how to mark answers are provided at the beginning of each subtest. This part of the assessment measures aspects of the six Mathematics strands.

#### **Strand N: Number and Number Relations**

**Standard:** In problem-solving investigations, students demonstrate an understanding of the real number system and communicate the relationships within that system using a variety of techniques and tools.

**Strand A: Algebra**

**Standard:** In problem-solving investigations, students demonstrate an understanding of concepts and processes that allows them to analyze, represent, and describe relationships among variable quantities and to apply algebraic methods to real-world situations.

**Strand M: Measurement**

**Standard:** In problem-solving investigations, students demonstrate an understanding of the concepts, processes, and real-life applications of measurement.

**Strand G: Geometry**

**Standard:** In problem-solving investigations, students demonstrate an understanding of geometric concepts and applications involving one-, two-, and three-dimensional geometry, and justify their findings.

**Strand D: Data Analysis, Probability, and Discrete Math**

**Standard:** In problem-solving investigations, students discover trends, formulate conjectures regarding cause-and-effect relationships, and demonstrate critical thinking skills in order to make informed decisions.

**Strand P: Patterns, Relations, and Functions**

**Standard:** In problem-solving investigations, students demonstrate an understanding of patterns, relations, and functions that represent and explain real-world situations.

The survey battery is designed to 1) obtain information that can support instructional decisions made by teachers in the classroom, 2) provide information to students and their parents for monitoring student growth from grade to grade, and 3) examine the yearly progress of grade groups as they pass through the school's curriculum. All questions are in multiple-choice format and have four answer options each. The survey battery is a **timed** test. Table 9 presents the testing times and the number of questions for each part, or subtest.

**Table 9: Grade 7 Survey Battery Test Lengths and Times**

| Test                                   | Time (min.) | No. of Questions |
|--|-------------|------------------|
| <b>Part 1</b><br>Estimation            | 3           | 6                |
| <b>Part 2</b><br>Concepts and Problems | 22          | 27               |
| <b>Total</b>                           | <b>25</b>   | <b>33</b>        |

The descriptions that follow briefly summarize the content and skills measured by each test of the survey battery.

**Part 1** is a **timed** test on computational estimation and number sense. Problems are presented with and without an applied context, and each requires the use of one of several rounding or estimation methods. Calculators are **not** permitted on this part of the test.

**Part 2** consists of questions that test students’ understanding of mathematical concepts—number properties and operations, measurement, probability, and statistics—as well as problem solving and data interpretation. Word problems included in this **timed** test require one or more steps to solve, each involving somewhat different skills. In some cases, students select an appropriate method or approach rather than compute an answer. For some questions, data are presented in tables and graphs and students use the data displays to obtain information, compare quantities, and determine trends and relationships. Calculators may be used on this part of the test.

### **The CRT Component**

The CRT component of the Math assessment was developed specifically for Louisiana. Committees of Louisiana educators reviewed all items for content and alignment with Louisiana’s content standards, benchmarks, and GLEs. Separate committees reviewed the items for potential bias and sensitive material. The CRT component of the Math assessment includes both multiple-choice and constructed-response items. As does the NRT component, this part of the test measures aspects of the six mathematics strands. Students are given a Mathematics Reference Sheet to consult as a reference. Calculators may be used on parts 3 and 4 of the test.

**Part 3** consists of questions comparable to part 2. Multiple-choice items measuring students’ mathematical skills and knowledge in realistic contexts were developed specifically to address Louisiana GLEs.

This part of the Math test is **untimed**, but students should be given about seventy-five (75) minutes to answer the questions.

**Part 4** consists of two relatively complex constructed-response items that involve a number of separate steps and require application of multiple skills. The constructed-response items are designed to assess one or more of the strands, benchmarks, and/or GLEs that require students to *demonstrate the connection of the strand to the other strands and to real-life situations*. The response format for part 4 is open-ended and may include numerical answers, short written answers, and other types of constructed response (e.g., draw a graph or geometrical pattern). Students may be required to explain in writing how they arrived at their answers.

This part of the Math test is **untimed**, but students should be given about thirty (30) minutes to answer the questions.

## Scoring Information for Constructed-response Items

The constructed-response items are scored, according to an item-specific rubric, from 0 to 4 points.

### General Scoring Rubric for iLEAP Math Constructed-Response Items

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

## 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 not permitted on statewide assessment:

- handheld or laptop computers
- pocket organizers
- calculators with paper tape
- calculators that talk or make noise
- calculators with QWERTY (typewriter-style) keypads
- electronic writing pads or pen input devices

## Math Test Specifications

Table 10 provides the test specifications for parts 1, 2, and 3 of the grade 7 *iLEAP* Math assessment. The values in the table are approximations due to slight variations in the content across test forms at grade 7.

**Table 10: Grade 7 Math Test Specifications**

| <b>Strands</b>                                | <b>% of Total Points</b> |
|---|--------------------------|
| Number and Number Relations                   | 28                       |
| Algebra                                       | 17                       |
| Measurement                                   | 13                       |
| Geometry                                      | 17                       |
| Data Analysis, Probability, and Discrete Math | 13                       |
| Patterns, Relations, and Functions            | 12                       |
| <b>Total</b>                                  | <b>100</b>               |

Sixty 1-point MC items plus two 4-point constructed-response items equals a 68-point test.

### Key Concepts for the Grade 7 Assessment

Grade 7 is the year in which students consolidate their knowledge of arithmetic and begin the transition to approaching problems through algebraic means. In Number and Number Relations, students finish their study of fractions with mastery of multiplication and division of fractions and decimals and consider the ordering and representation of such numbers in practical settings. They extend their understanding of rates, ratios, and proportions and their applications to setting up and solving percent problems. They are able to distinguish between a unit rate and general ratio and can apply both. They can set up and solve simple proportion problems. Students select and discuss appropriate operations in solving real-life problems involving positive fractions, percents, mixed numbers, decimals, and integers. They also are able to determine the reasonableness of answers involving fractions and decimals by comparing them to estimates.

In Measurement, grade 7 students extend their knowledge of perimeter and area concepts to confront irregular figures composed of two or more simple shapes that they have worked with before. They compare and order measurements within and between the U.S. and metric systems in terms of common reference points. Students apply their work with ratio and proportion concepts to the conversion of area measures within systems for both U.S. and metric measures. Students also demonstrate an intuitive sense of comparisons between degrees Fahrenheit and Celsius. In Geometry, grade 7 students focus on circles and their subparts, including the development of  $\pi$  and its use in finding the circumference and area of circles. Students solidify their knowledge of angles and angle measures in a triangle. They are also able to draw the results of reflections and translations of geometric shapes on a coordinate grid.

In Data Analysis, Probability, and Discrete Math, grade 7 students study data distributions in terms of patterns (outliers, clusters, and gaps). They are able to analyze and interpret circle graphs and discrete and continuous data in real-life applications. Grade 7 students also

progress to the study of three-circle Venn diagram situations and the accompanying logical relationships. In dealing with probability, they move to the comparison of data resulting from experimental and theoretical analyses of similar situations and are able to apply the fundamental counting principal in real-life situations.

Grade 7 students extend their knowledge of algebraic equations and inequalities by translating and matching equivalent statements in verbal or written and symbolic forms. They evaluate algebraic expressions containing exponents and square roots using substitution. Students are able to determine the square root of perfect squares and mentally approximate other square roots by identifying the two whole numbers between which the number falls. Their solution strategies are extended from the arithmetic methods they have used previously to the use of mental math and more structured algebraic approaches. By the end of the year, students should be solving both one- and two-step linear equations and inequalities with ease. Students are also able to graph solution sets of one-step equations and inequalities as points or open and closed rays on a number line. In dealing with patterns and functions, they understand function machines, recognize the input-output natures of such representations, and know how to graph the resulting ordered pairs on a coordinate graph. As part of this, they should be dealing with the differences between arithmetic (additive/linear) and geometric (multiplicative/ exponential) growth situations.

## **Standards, Benchmarks, and GLEs Assessed**

Louisiana’s mathematics content standards encompass number and number relations; algebra; measurement; geometry; data analysis, probability, and discrete math; and patterns, relations, and functions. Each benchmark within a standard delineates what students should know and be able to do by the end of a grade cluster. GLEs further define the knowledge and skills students are expected to master by the end of each grade or high school course. The GLEs for each grade are developmentally appropriate and increase in complexity to build the knowledge and skills students need.

All of the grade 7 standards, most of the benchmarks, and all of the GLEs are eligible for assessment on the grade 7 *i*LEAP. It is important, therefore, that all the skills represented by the GLEs are taught at this grade level.

### **Explanation of Codes:**

GLEs are numbered consecutively at each grade level and grouped according to strand:

N—Number and Number Relations

A—Algebra

M—Measurement

G—Geometry

D—Data Analysis, Probability, and Discrete Math

P—Patterns, Relations, and Functions

Mathematics benchmarks are coded by strand, benchmark number, and grade cluster. The first part of the code refers to the strand (e.g., Number and Number Relations). The second

part refers to the benchmark number. The third part refers to the grade cluster (E, M, H). Table 11 provides three examples of mathematics codes.

**Table 11: Examples of Mathematics Codes**

| <b>Code</b> | <b>Translation</b>                                   |
|-------------|--|
| N-1-E       | Number and Number Relations, Benchmark 1, Elementary |
| G-5-M       | Geometry, Benchmark 5, Middle School                 |
| A-3-H       | Algebra, Benchmark 3, High School                    |

The following chart presents **all** grade 7 Mathematics standards, benchmarks, and GLEs.

GRADE 7  
MATHEMATICS STANDARDS, BENCHMARKS, AND GLES

**Number and Number Relations: In problem-solving investigations, students demonstrate an understanding of the real number system and communicate the relationships within that system using a variety of techniques and tools.**

| Benchmarks  | Grade-Level Expectations   |
|---|--|
| <b>N-1-M:</b> demonstrating that a rational number can be expressed in many forms, and selecting an appropriate form for a given situation (e.g., fractions, decimals, and percents)  | 1. Recognize and compute equivalent representations of fractions, decimals, and percents (i.e., halves, thirds, fourths, fifths, eighths, tenths, hundredths) (N-1-M)  |
| <b>N-2-M:</b> demonstrating number sense and estimation skills to describe, order, and compare rational numbers (e.g., magnitude, integers, fractions, decimals, and percents)  | 2. Compare positive fractions, decimals, percents, and integers using symbols (i.e., $<$ , $\leq$ , $=$ , $\geq$ , $>$ ) and position on a number line (N-2-M)   |
| <b>N-3-M:</b> reading, writing, representing, and using rational numbers in a variety of forms (e.g., integers, mixed numbers, and improper fractions)  | See GLE no. 7.   |
| <b>N-4-M:</b> demonstrating a conceptual understanding of the meaning of the basic arithmetic operations (add, subtract, multiply, and divide) and their relationships to each other  | 3. Solve order of operations problems involving grouping symbols and multiple operations (N-4-M)<br>4. Model and apply the distributive property in real-life applications (N-4-M)<br>Also see GLE no. 7.  |
| <b>N-5-M:</b> applying an understanding of rational numbers and arithmetic operations to real-life situations   | 5. Multiply and divide positive fractions and decimals (N-5-M)<br>6. Set up and solve simple percent problems using various strategies, including mental math (N-5-M) (N-6-M) (N-8-M)<br>7. Select and discuss appropriate operations and solve single- and multi-step real-life problems involving positive fractions, percents, mixed numbers, decimals, and positive and negative integers (N-5-M) (N-3-M) (N-4-M)<br>Also see GLE no. 9. |
| <b>N-6-M:</b> constructing, using, and explaining procedures to compute and estimate with rational numbers employing mental math strategies   | 8. Determine the reasonableness of answers involving positive fractions and decimals by comparing them to estimates (N-6-M) (N-7-M)<br>Also see GLE no. 6.   |
| <b>N-7-M:</b> selecting and using appropriate computational methods and tools for given situations involving rational numbers (e.g., estimation, or exact computation using mental arithmetic, calculator, computer, or paper and pencil) | 9. Determine when an estimate is sufficient and when an exact answer is needed in real-life problems using decimals and percents (N-7-M) (N-5-M)<br>Also see GLE no. 8.  |

| <p><b>N-8-M:</b> demonstrating a conceptual understanding and applications of proportional reasoning (e.g., determining equivalent ratios, finding a missing term of a given proportion)</p>  | <p>10. Determine and apply rates and ratios (N-8-M)<br/> 11. Use proportions involving whole numbers to solve real-life problems (N-8-M)<br/> Also see GLE no. 6.</p>   |
|---|---|
|   |   |
| <p><b>Algebra: In problem-solving investigations, students demonstrate an understanding of concepts and processes that allows them to analyze, represent, and describe relationships among variable quantities and to apply algebraic methods to real-world situations.</b></p> |   |
|   |   |
| <b>Benchmarks</b>   | <b>Grade-Level Expectations</b>   |
| <p><b>A-1-M:</b> demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (e.g., symbolically represent real-world problems as linear terms, equations, or inequalities)</p>   | <p>12. Evaluate algebraic expressions containing exponents (especially 2 and 3) and square roots, using substitution (A-1-M)<br/> 13. Determine the square root of perfect squares and mentally approximate other square roots by identifying the two whole numbers between which they fall (A-1-M)<br/> 14. Write a real-life meaning of a simple algebraic equation or inequality and vice versa (A-1-M) (A-5-M)<br/> 15. Match algebraic inequalities with equivalent verbal statements and vice versa (A-1-M)</p> |
| <p><b>A-2-M:</b> modeling and developing methods for solving equations and inequalities (e.g., using charts, graphs, manipulatives, and/or standard algebraic procedures)</p>   | <p>16. Solve one- and two-step equations and inequalities (with one variable) in multiple ways (A-2-M)<br/> 17. Graph solutions sets of one-step equations and inequalities as points, or open and closed rays on a number line (e.g., <math>x = 5</math>, <math>x &lt; 5</math>, <math>x \leq 5</math>, <math>x &gt; 5</math>, <math>x \geq 5</math>) (A-2-M)</p>  |
| <p><b>A-3-M:</b> representing situations and number patterns with tables, graphs, and verbal and written statements while exploring the relationships among these representations (e.g., multiple representations for the same situation)</p>                                   | <p>18. Describe linear, multiplicative, or changing growth relationships (e.g., 1, 3, 6, 10, 15, 21, ...) verbally and algebraically (A-3-M) (A-4-M) (P-1-M)</p>  |
| <p><b>A-4-M:</b> analyzing tables and graphs to identify relationships exhibited by the data and making generalizations based upon these relationships</p>  | <p>19. Use <i>function machines</i> to determine and describe the rule that generates outputs from given inputs (A-4-M) (P-3-M)<br/> Also see GLE no. 18.</p>   |
| <p><b>A-5-M</b> demonstrating the connection of algebra to the other strands and to real-life situations.</p>   | <p>See GLEs no. 14 and no. 29.</p>  |

|   |  |
|---|--|
| <b>Measurement: In problem-solving investigations, students demonstrate an understanding of the concepts, processes, and real-life applications of measurement.</b>   |  |
|   |  |
| <b>Benchmarks</b>   | <b>Grade-Level Expectations</b>  |
| <b>M-1-M:</b> applying the concepts of length, area, surface area, volume, capacity, weight, mass, money, time, temperature, and rate to real-world experiences   | 20. Determine the perimeter and area of composite plane figures by subdivision and area addition (M-1-M) (G-7-M)   |
| <b>M-2-M:</b> demonstrating an intuitive sense of measurement (e.g., estimating and determining reasonableness of measures)   |  |
| <b>M-3-M:</b> selecting appropriate units and tools for tasks by considering the purpose for the measurement and the precision required for the task (e.g., length of a room in feet rather than inches)            |  |
| <b>M-4-M:</b> using intuition and estimation skills to describe, order, and compare formal and informal measures (e.g., ordering cup, pint, quart, gallon; comparing a meter to a yard)                             | 21. Compare and order measurements within and between the U.S. and metric systems in terms of common reference points (e.g., weight/mass and area) (M-4-M) (G-1-M)   |
| <b>M-5-M:</b> converting from one unit of measurement to another within the same system (Comparisons between systems, customary and metric, should be based on intuitive reference points, not formal computation.) | 22. Convert between units of area in U.S. and metric units within the <b>same</b> system (M-5-M)<br>23. Demonstrate an intuitive sense of comparisons between degrees Fahrenheit and Celsius in real-life situations using common reference points (M-5-M) |
| <b>M-6-M:</b> demonstrating the connection of measurement to the other strands and to real-life situations  | See GLE no. 28.  |
|   |  |
| <b>Geometry: In problem-solving investigations, students demonstrate an understanding of geometric concepts and applications involving one-, two-, and three-dimensional geometry, and justify their findings.</b>  |  |
|   |  |
| <b>Benchmarks</b>   | <b>Grade-Level Expectations</b>  |
| <b>G-1-M:</b> using estimation skills to describe, order, and compare geometric measures  | See GLE no. 21.  |
| <b>G-2-M:</b> identifying, describing, comparing, constructing, and classifying geometric figures and concepts  | 24. Identify and draw angles (using protractors), circles, diameters, radii, altitudes, and two-dimensional figures with given specifications (G-2-M)  |
| <b>G-3-M:</b> making predictions regarding transformations of geometric figures (e.g., make predictions regarding translations, reflections, and rotations of common figures)                                       | 25. Draw the results of reflections and translations of geometric shapes on a coordinate grid (G-3-M)  |

|   |   |
|---|---|
| <b>G-4-M:</b> constructing two- and three-dimensional models  |   |
| <b>G-5-M:</b> making and testing conjectures about geometric shapes and their properties  | <p>26. Recognize <math>\pi</math> as the ratio between the circumference and diameter of any circle (i.e., <math>\pi = C/d</math> or <math>\pi = C/2r</math>) (G-5-M)</p> <p>27. Model and explain the relationship between perimeter and area (how scale change in a linear dimension affects perimeter and area) and between circumference and area of a circle (G-5-M)</p> <p>28. Determine the radius, diameter, circumference, and area of a circle and apply these measures in real-life problems (G-5-M) (G-7-M) (M-6-M)</p> |
| <b>G-6-M:</b> demonstrating an understanding of the coordinate system (e.g., locate points, identify coordinates, and graph points in a coordinate plane to represent real-world situations)  | 29. Plot points on a coordinate grid in all 4 quadrants and locate the coordinates of a missing vertex in a parallelogram (G-6-M) (A-5-M)   |
| <b>G-7-M:</b> demonstrating the connection of geometry to the other strands and to real-life situations (e.g., applications of the Pythagorean Theorem)   | <p>30. Apply the knowledge that the measures of the interior angles in a triangle add up to 180 degrees (G-7-M)</p> <p>Also see GLEs no. 20 and no. 28.</p>   |
| <b>Data Analysis, Probability, and Discrete Math: In problem-solving investigations, students discover trends, formulate conjectures regarding cause-and-effect relationships, and demonstrate critical thinking skills in order to make informed decisions.</b>  |   |
|   |   |
| <b>Benchmarks</b>   | <b>Grade-Level Expectations</b>   |
| <b>D-1-M:</b> systematically collecting, organizing, describing, and displaying data in charts, tables, plots, graphs, and/or spreadsheets  |   |
| <b>D-2-M:</b> analyzing, interpreting, evaluating, drawing inferences, and making estimations, predictions, decisions, and convincing arguments based on organized data (e.g., analyze data using concepts of mean, median, mode, range, random samples, sample size, bias, and data extremes)                  | <p>31. Analyze and interpret circle graphs, and determine when a circle graph is the most appropriate type of graph to use (D-2-M)</p> <p>32. Describe data in terms of patterns, clustered data, gaps, and outliers (D-2-M)</p> <p>33. Analyze discrete and continuous data in real-life applications (D-2-M) (D-6-M)</p>  |
| <b>D-3-M:</b> describing informal thinking procedures (e.g., solving elementary logic problems using Venn diagrams, tables, charts, and/or elementary logic operatives to solve logic problems in real-life situations; reach valid conclusions in elementary logic problems involving “and, or, not, if/then”) | <p>34. Create and use Venn diagrams with three overlapping categories to solve counting logic problems (D-3-M)</p> <p>35. Use informal thinking procedures of elementary logic involving <i>if/then</i> statements (D-3-M)</p>  |
| <b>D-4-M:</b> analyzing various counting and enumeration procedures with and without replacement (e.g., find the total number of possible outcomes or possible choices in a given situation)  | 36. Apply the fundamental counting principle in real-life situations (D-4-M)  |

|   |   |
|---|---|
| <b>D-5-M:</b> comparing experimental probability results with theoretical probability (e.g., representing probabilities of concrete situations as common fractions, investigating single-event and multiple-event probability, using sample spaces, geometric figures, tables, and/or graphs) | 37. Determine probability from experiments and from data displayed in tables and graphs (D-5-M)<br>38. Compare theoretical and experimental probability in real-life situations (D-5-M)   |
| <b>D-6-M:</b> demonstrating the connection of data analysis, probability, and discrete math to other strands and to real-life situations  | See GLE no. 33.   |
| <b>Patterns, Relations, and Functions: In problem-solving investigations, students demonstrate an understanding of patterns, relations, and functions that represent and explain real-world situations.</b>   |   |
| <b>Benchmarks</b>   |   |
| <b>Grade-Level Expectations</b>   |   |
| <b>P-1-M:</b> describing, extending, analyzing, and creating a wide variety of numerical, geometrical, and statistical patterns (e.g., skip counting of rational numbers and simple exponential number patterns)  | 39. Analyze and describe simple exponential number patterns (e.g., 3, 9, 27 or $3^1, 3^2, 3^3$ ) (P-1-M)<br>40. Analyze and verbally describe real-life additive and multiplicative patterns involving fractions and integers (P-1-M) (P-4-M)<br>Also see GLE no. 18. |
| <b>P-2-M:</b> describing and representing relationships using tables, rules, simple equations, and graphs   |   |
| <b>P-3-M:</b> analyzing relationships to explain how a change in one quantity results in a change in another (e.g., change in the dimensions of a rectangular solid affects the volume)   | 41. Illustrate patterns of change in length(s) of sides and corresponding changes in areas of polygons (P-3-M)<br>Also see GLE no. 19.  |
| <b>P-4-M:</b> demonstrating the pervasive use of patterns, relations, and functions in other strands and in real-life situations  | See GLE no. 40.   |

## Sample Test Items: Grade 7 Math

### 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/benchmarks/strands. The items are scored using an item-specific rubric on a scale of 0 to 4 points.

- 1 The table below shows the number of calories and grams of protein in different kinds of bagels sold at Barry’s Bagel Shop.

| Type of Bagel       | Calories | Grams of Protein |
|---------------------|----------|------------------|
| Plain               | 360      | 13 grams         |
| Cinnamon and Raisin | 360      | 12 grams         |
| Egg                 | 370      | 14 grams         |
| Wheat               | 390      | 16 grams         |
| Blueberry           | 370      | 11 grams         |
| Onion               | 360      | 13 grams         |

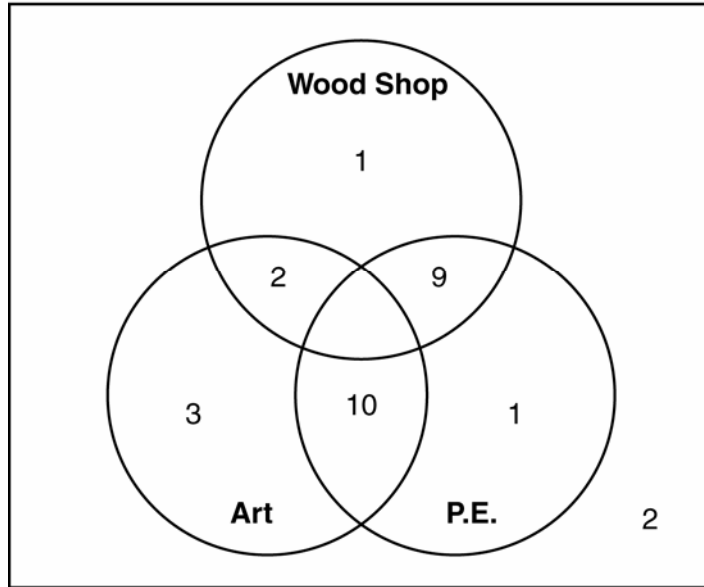
- A** Kenyatta keeps track of her calories to grams of protein intake for nutritional purposes. What is the ratio of calories to grams of protein in the cinnamon and raisin bagels?
- B** Kenyatta bought 4 wheat bagels and 3 egg bagels. How many total calories are in the 7 bagels? Show your work.
- C** Rachel bought an onion bagel but ate only  $\frac{3}{4}$  of it. How many calories are in the portion of the bagel that Rachel ate? Show or explain how you found your answer.
- D** Barry wants to introduce a new high-protein bagel but wants to keep the ratio of calories to grams of protein the same as the egg bagel. If the new bagel has 21 grams of protein, how many calories will it have? Show or explain how you found your answer.

*Match to GLE: This item measures GLE 11: Use proportions involving whole numbers to solve real-life problems (N-8-M). This item also measures GLE 7: Select and discuss appropriate operations and solve single- and multi-step real-life problems involving positive fractions, percents, mixed numbers, decimals, and positive and negative integers (N-5-M) (N-3-M) (N-4-M). It also measures GLE 10: Determine and apply rates and ratios (N-8-M).*

| <b>Scoring Rubric</b>   |   |
|---|---|
| <b>4</b>  | The student earns 7 points.   |
| <b>3</b>  | The student earns 5 or 6 points.  |
| <b>2</b>  | The student earns 3 or 4 points.  |
| <b>1</b>  | The student earns 1 or 2 points.<br><b>OR</b><br>The student shows minimal understanding of equivalent representations of ratios and proportions. |
| <b>0</b>  | The student's response is incorrect or irrelevant to the skill or concept being measured or is blank.   |
| <b>Correct Answers:</b>   |   |
| <p>Part A. The ratio is <math>\frac{360}{12}</math> or <math>\frac{30}{1}</math>.</p> <p>Part B. This would be <math>4 \times 390 + 3 \times 370 = 1,560 + 1,110 = 2,670</math> calories.</p> <p>Part C. This would be <math>\frac{3}{4} = \frac{x}{360}</math>; <math>4x = 1,080</math>; <math>x = 270</math> calories.<br/><b>OR</b><br/><math>\frac{3}{4} \times 360 = 270</math> calories</p> <p>Part D. 555 calories. <math>\frac{14}{370} = \frac{21}{x}</math>; <math>(14)(x) = (21)(370)</math>; <math>14x = 7,770</math>; <math>x = 555</math>.</p>  |   |
| <b>Points Assigned:</b>   |   |
| <p>Part A. 1 point</p> <p>1 point for the correct ratio</p> <p>Part B. 2 points</p> <p>2 points for the correct answer with correct work shown<br/><b>OR</b><br/>1 point for the correct answer with no work or incorrect/incomplete work shown <b>OR</b> 1 point for an incorrect answer based on a minor arithmetic error with work shown</p> <p>Part C. 2 points</p> <p>2 points for the correct answer with correct work shown<br/><b>OR</b><br/>1 point for the correct answer with no work or incorrect/incomplete work shown <b>OR</b> 1 point for an incorrect answer based on a minor arithmetic error with work shown</p> <p>Part D. 2 points</p> <p>2 points for the correct answer with correct work shown<br/><b>OR</b><br/>1 point for the correct answer with no work or incorrect/incomplete work shown <b>OR</b> 1 point for an incorrect answer based on a minor arithmetic error with work shown</p> |   |

- 2** William surveyed seventh graders at King Middle School to find out which elective was the most popular. Of the students surveyed, 22 were in physical education (P.E.) class, 14 were in wood shop, and 17 were in art class. The Venn diagram indicates the classes in which students were or were not enrolled.

**King Middle School Seventh Grade Survey**



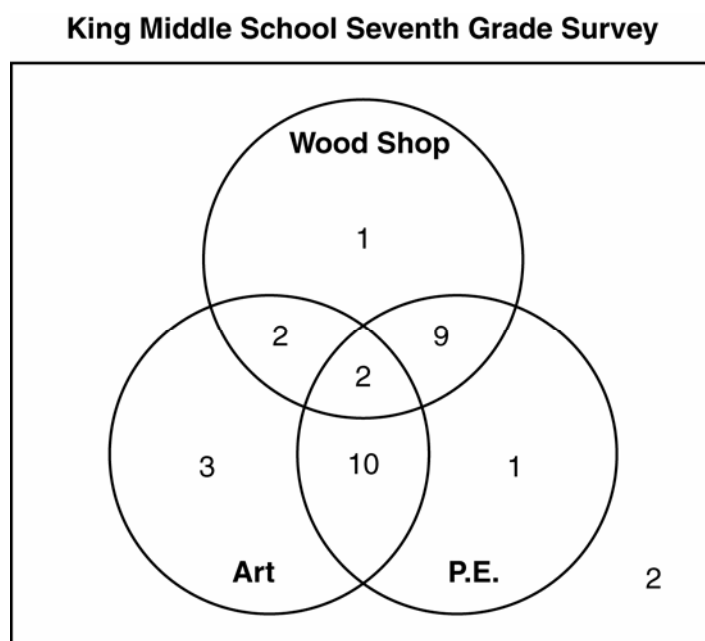
- A** Fill in the Venn diagram to show how many of the students surveyed were in all 3 classes.
- B** How many total students were in either art or P.E. class? Explain or show how you found your answer.
- C** How many total students were surveyed? Explain or show how you found your answer.
- D** If there are a total of 90 seventh grade students, how many of the students might be expected to be in all 3 of the classes? Explain or show how you found your answer.

*Match to GLE: This item measures GLE 34: Create and use Venn diagrams with three overlapping categories to solve counting logic problems (D-3-M). This item also measures GLE 11: Use proportions involving whole numbers to solve real-life problems (N-8-M).*

| <b>Scoring Rubric</b> |   |
|-----------------------|---|
| <b>4</b>              | The student earns 7 points.   |
| <b>3</b>              | The student earns 5 or 6 points.  |
| <b>2</b>              | The student earns 3 or 4 points.  |
| <b>1</b>              | The student earns 1 or 2 points.<br><b>OR</b><br>The student shows minimal understanding of how to create and use Venn diagrams.                  |
| <b>0</b>              | The student earns 0 points.<br><b>OR</b><br>The student's response is incorrect or irrelevant to the skill or concept being measured or is blank. |

**Correct Answers:**

Part A.



Part B.  $3 + 1 + 10 + 9 + 2 + 2 = 27$  or  $30 - 3 = 27$

Part C.  $3 + 1 + 1 + 10 + 9 + 2 + 2 + 2 = 30$

Part D. 6 students;  $\frac{1}{15}$  of 90 is 6.

**Points Assigned:**

Part A. 1 point  
1 point for the correct answer

Part B. 2 points  
2 points for the correct answer with the correct procedure  
**OR**  
1 point for the correct answer with an incorrect/incomplete procedure or no procedure or 1 point for an incorrect answer because of minor arithmetic errors with the correct procedure

Part C. 2 points

2 points for the correct answer with the correct procedure

**OR**

1 point for the correct answer with an incorrect/incomplete procedure or no procedure or 1 point for an incorrect answer because of minor arithmetic errors with the correct procedure

Part D. 2 points

2 points for the correct answer with the correct procedure

**OR**

1 point for the correct answer with an incorrect/incomplete procedure or no procedure or 1 point for an incorrect answer because of minor arithmetic errors with the correct procedure

**NOTE:** Scorer should read along with student. 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.

### Sample CRT Multiple-Choice Items

Questions 3 through 22 are sample CRT 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** The length of the longest side of a right triangle can be found by using the expression  $\sqrt{a^2 + b^2}$ , where  $a$  and  $b$  are the lengths of the two other sides. **If  $a = 6$  and  $b = 8$ , what is the length of the longest side?**

- A** 10
- B** 48
- C** 40
- D** 100

**Correct response: A**

*Match to GLE: This item measures GLE 12: Evaluate algebraic expressions containing exponents (especially 2 and 3) and square roots, using substitution (A-1-M).*

- 4** A hot air balloon was floating at a certain height,  $x$ , above the ground. Then the balloon rose 25 feet to a height of 6,000 feet above the ground. **Which algebraic equation can be used to find the height,  $x$ , of the balloon before it rose?**

- A**  $x - 25 = 6000$
- B**  $x + 25 = 6000$
- C**  $6000 = 25x$
- D**  $6000x = 25$

**Correct response: B**

*Match to GLE: This item measures GLE 14: Write a real-life meaning of a simple algebraic equation or inequality and vice versa (A-1-M) (A-5-M).*

- 5 Marvin and Jamal collected aluminum cans for recycling. Marvin collected 122 cans, which was more than twice the number of cans,  $j$ , Jamal collected. **Which inequality represents this statement?**

- A  $122 < 2j$
- B  $122 > 2j$
- C  $122 < 2 + j$
- D  $122 > j - 2$

**Correct response: B**

*Match to GLE: This item measures GLE 15: Match algebraic inequalities with equivalent verbal statements and vice versa (A-1-M).*

- 6 Lori plans to go to the mall to buy earrings, which cost \$7 a pair. She has \$25 but wants to save \$4 for lunch. Lori needs to determine how many pairs of earrings,  $x$ , she can buy, so she uses the equation  $7x + 4 = 25$ . **How many pairs of earrings can Lori buy?**

- A 2 pairs
- B 3 pairs
- C 4 pairs
- D 5 pairs

**Correct response: B**

*Match to GLE: This item measures GLE 16: Solve one- and two-step equations and inequalities (with one variable) in multiple ways (A-2-M).*

- 7 Pat collects seashells. During week one he collected 2 seashells. During week two he collected 5 seashells. During week three he collected 8 seashells. During week four he collected 11 seashells. **If  $w$  is the week number, which expression can be used to find the number of seashells Pat collected each week?**

- A  $2.5w$
- B  $2w + 3$
- C  $2w$
- D  $3w - 1$

**Correct response: D**

*Match to GLE: This item measures GLE 18: Describe linear, multiplicative, or changing growth relationships (e.g., 1, 3, 6, 10, 15, 21, . . .) verbally and algebraically (A-3-M) (A-4-M) (P-1-M).*

- 8 The table below shows how many socks a company produces over time.

**Sock Production**

| Minutes | Number of Socks |
|---------|-----------------|
| 4       | 248             |
| 7       | 434             |
| 10      | 620             |
| 15      | 930             |

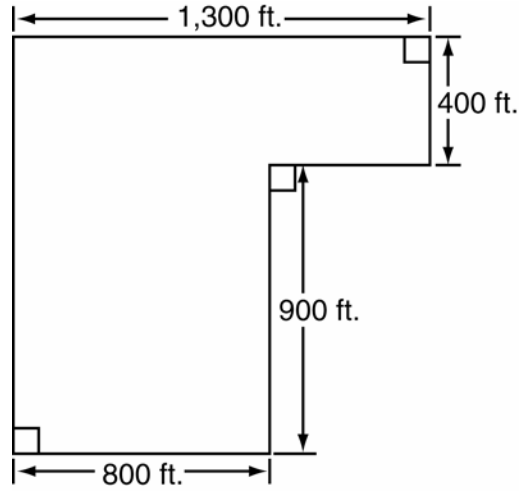
**If  $x$  represents the number of minutes, which rule is described in the table?**

- A  $62x$
- B  $\frac{62}{x}$
- C  $60x + 8$
- D  $63x - 4$

**Correct response: A**

*Match to GLE: This item measures GLE 19: Use function machines to determine and describe the rule that generates outputs from given inputs (A-4-M) (P-3-M).*

- 9 Brian likes to go bird-watching along the Harvest Park Trail in a nearby forest preserve. He wants to calculate the area enclosed by the trail, shown below.



Based on the diagram, what is the area of the land enclosed by the trail?

- A 1,690,000 sq. ft.
- B 1,240,000 sq. ft.
- C 5,200 sq. ft.
- D 2,600 sq. ft.

**Correct response: B**

*Match to GLE: This item measures GLE 20: Determine the perimeter and area of composite plane figures by subdivision and area addition (M-1-M) (G-7-M).*

- 10 Kara bought four different types of vegetables at the store. The weight of each type of vegetable she bought is shown in the table below.

|           |            |
|-----------|------------|
| Carrots   | 900 grams  |
| Celery    | 1 kilogram |
| Radishes  | 2.5 pounds |
| Cucumbers | 30 ounces  |

Which vegetable did she buy the greatest weight of?

- A Carrots
- B Celery
- C Radishes
- D Cucumbers

**Correct response: C**

*Match to GLE: This item measures GLE 21: Compare and order measurements within and between the U.S. and metric systems in terms of common reference points (e.g., weight/mass and area) (M-4-M) (G-1-M).*

- 11 The area of the basketball court at a neighborhood playground is 4,500 square feet. **What is the area of the basketball court in square yards?**

- A 300 square yards
- B 500 square yards
- C 1,500 square yards
- D 13,500 square yards

**Correct response: B**

*Match to GLE: This item measures GLE 22: Convert between units of area in U.S. and metric units within the same system. (M-5-M)*

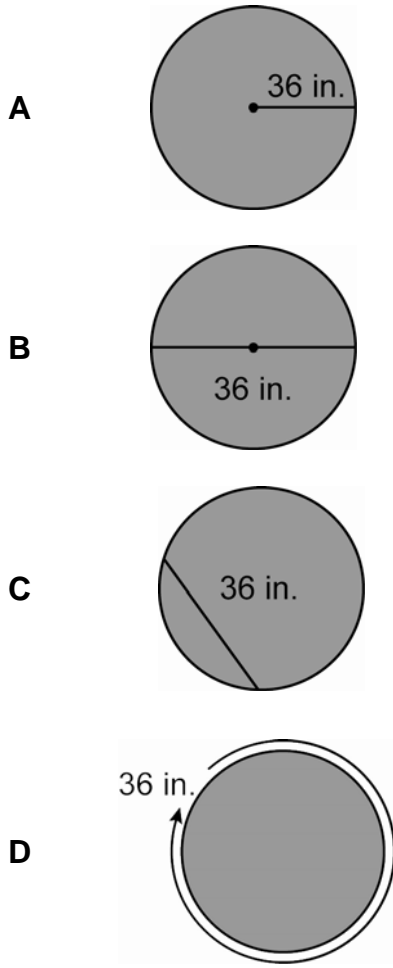
**12** The weather forecast for tomorrow calls for a high temperature of 50° Fahrenheit.  
**About what temperature is this in degrees Celsius?**

- A**    -5°C
- B**    10°C
- C**    30°C
- D**    70°C

**Correct response: B**

*Match to GLE: This item measures GLE 23: Demonstrate an intuitive sense of comparisons between degrees Fahrenheit and Celsius in real-life situations using common reference points (M-5-M).*

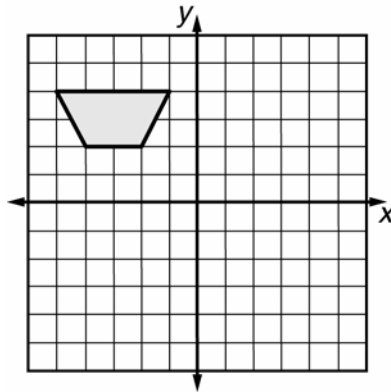
- 13 Rocky's Tunnel Company makes tunnels for playgrounds. Each tunnel has a circular opening with a diameter of 36 in. **Which diagram shows a tunnel opening with a diameter of 36 in.?**



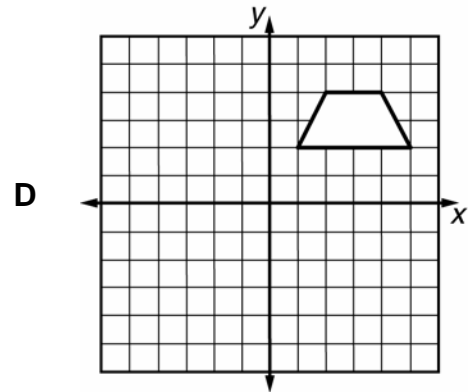
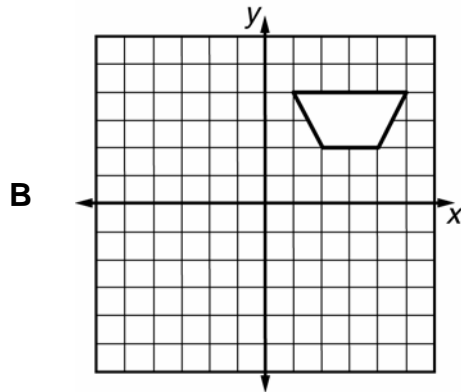
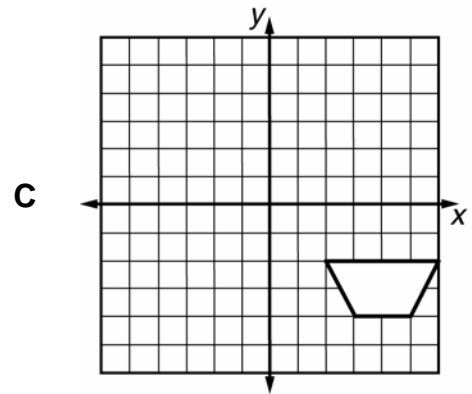
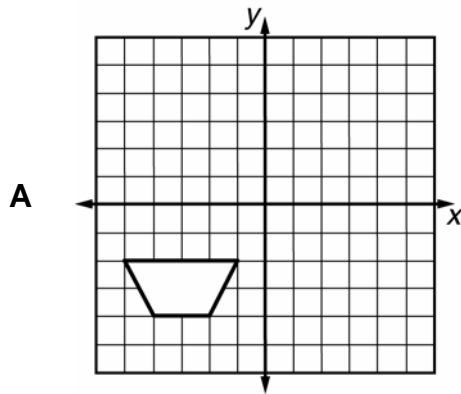
**Correct response: B**

*Match to GLE: This item measures GLE 24: Identify and draw angles (using protractors), circles, diameters, radii, altitudes, and two-dimensional figures with given specifications (G-2-M).*

- 14 Samuel sketched a shape. The shape is shown below.



Which coordinate grid shows a reflection of the shape over the  $y$ -axis?



**Correct response: B**

*Match to GLE: This item measures GLE 25: Draw the results of reflections and translations of geometric shapes on a coordinate grid (G-3-M).*

- 15** Sandy and her friends went to the park and marked off a rectangular area 8 feet wide and 12 feet long to play badminton. They decided the area was not large enough, so they doubled the length. **By how many square feet did they increase the area?**
- A** 12 square feet
  - B** 24 square feet
  - C** 96 square feet
  - D** 192 square feet

**Correct response: C**

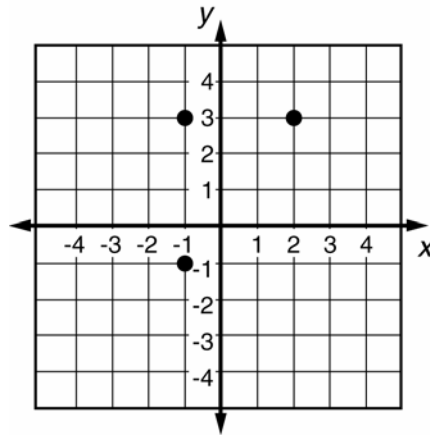
*Match to GLE: This item measures GLE 27: Model and explain the relationship between perimeter and area (how scale change in a linear dimension affects perimeter and area) and between circumference and area of a circle (G-5-M).*

- 16** Alex buys a basketball. He reads on its packaging that the basketball has a circumference of 30 inches. **What is the approximate diameter of the basketball?**
- A** 3.0 inches
  - B** 4.75 inches
  - C** 6.0 inches
  - D** 9.5 inches

**Correct response: D**

*Match to GLE: This item measures GLE 28: Determine the radius, diameter, circumference, and area of a circle and apply these measures in real-life problems (G-5-M) (G-7-M) (M-6-M).*

- 17 Reena placed her rectangular notebook on a coordinate grid and drew points where three of the notebook's corners rested.



What are the coordinates of the location of the notebook's fourth corner?

- A (2, -1)
- B (-1, 2)
- C (-2, 2)
- D (-2, -1)

**Correct response: A**

*Match to GLE: This item measures GLE 29: Plot points on a coordinate grid in all 4 quadrants and locate the coordinates of a missing vertex in a parallelogram (G-6-M) (A-5-M).*

- 18 Stella has a triangular table next to her bed. The tabletop is a right triangle with one acute angle measuring  $45^\circ$ . **What is the measure of the other acute angle?**

- A  $45^\circ$
- B  $60^\circ$
- C  $75^\circ$
- D  $90^\circ$

**Correct response: A**

*Match to GLE: This item measures GLE 30: Apply the knowledge that the measures of the interior angles in a triangle add up to 180 degrees (G-7-M).*

- 19 In its first year of business, a company had 5 employees. In its second year, there were 25 employees, and in its third year, there were 125 employees. **If the pattern continues, how many employees will the company have in the fourth year?**

- A 250
- B 625
- C 3,125
- D 15,625

**Correct response: B**

*Match to GLE: This item measures GLE 39: Analyze and describe simple exponential number patterns (e.g., 3, 9, 27 or  $3^1, 3^2, 3^3$ ) (P-1-M).*

- 20 Sarah dropped a small ball from a ledge and recorded the height the ball reached after each bounce.

| Initial Height | 1st Bounce | 2nd Bounce | 3rd Bounce |
|----------------|------------|------------|------------|
| 320 cm         | 80 cm      | 20 cm      | 5 cm       |

Which rule **best** describes how high the ball reached after each bounce?

- A The ball reached  $\frac{1}{2}$  of its previous height.
- B The ball reached  $\frac{1}{3}$  of its previous height.
- C The ball reached  $\frac{1}{4}$  of its previous height.
- D The ball reached  $\frac{1}{5}$  of its previous height.

**Correct response: C**

*Match to GLE: This item measures GLE 40: Analyze and verbally describe real-life additive and multiplicative patterns involving fractions and integers (P-1-M) (P-4-M).*

- 21** Roderick’s fish-tank hose has a tear that is slowly growing longer. On Monday the tear was 1 mm long, on Tuesday it was  $1\frac{1}{4}$  mm long, on Wednesday it was  $1\frac{1}{2}$  mm long, and on Thursday it was  $1\frac{3}{4}$  mm long. **If this pattern continues, on which day will the tear be exactly  $2\frac{1}{2}$  mm long?**
- A** Friday
  - B** Saturday
  - C** Sunday
  - D** Monday

**Correct answer: C**

*Match to GLE: This item measures GLE 40: Analyze and verbally describe real-life additive and multiplicative patterns involving fractions and integers (P-1-M) (P-4-M).*

- 22** Mrs. Larson wants to expand her square-shaped sunroom. Each side of the room measures 6 feet. **If Mrs. Larson increases the length of each side by 3 feet, by how much will the area increase?**
- A** 3 square feet
  - B** 9 square feet
  - C** 45 square feet
  - D** 81 square feet

**Correct response: C**

*Match to GLE: This item measures GLE 41: Illustrate patterns of change in length(s) of sides and corresponding changes in areas of polygons (P-3-M).*

### Sample NRT Multiple-Choice Items

Questions 23 through 31 are sample multiple-choice items representative of those used on the norm-referenced parts of the *iLEAP* test. The survey battery of the Iowa Tests of Basic Skills (ITBS) is designed to measure a wide range of student achievement. Some items address Louisiana GLEs at the specified grade level, while other items address Louisiana GLEs at other grade levels.

**23** How should you write .02 as a percent?

- A .02%
- B .20%
- C 2.0%
- D 20%

**Correct Response: C**

*Match to GLE: This item measures GLE 1: Recognize and compute equivalent representations of fractions, decimals, and percents (i.e., halves, thirds, fourths, fifths, eighths, tenths, hundredths) (N-1-M).*

**24** Which fraction is greater than  $\frac{1}{6}$  but less than  $\frac{1}{3}$ ?

- A  $\frac{1}{9}$
- B  $\frac{1}{2}$
- C  $\frac{1}{4}$
- D  $\frac{1}{8}$

**Correct Response: C**

*Match to GLE: This item measures GLE 2: Compare positive fractions, decimals, percents, and integers using symbols (i.e., <, ≤, =, ≥, >) and position on a number line (N-2-M).*

**25** What is the value of  $8 - 3 \times 2$ ?

- A** 2
- B** 5
- C** 10
- D** 22

**Correct Response: A**

*Match to GLE: This item measures GLE 3: Solve order of operations problems involving grouping symbols and multiple operations (N-4-M).*

**26** A honeybee colony that contains 50,000 bees in late fall may have only 10,000 bees at the end of winter. **What percent of the bees live through the winter season?**

- A** 5%
- B** 20%
- C** 25%
- D** 50%

**Correct Response: B**

*Match to GLE: This item measures GLE 6: Set up and solve simple percent problems using various strategies, including mental math (N-5-M) (N-6-M) (N-8-M).*

- 27** Snow Mountain has a snow-making machine that will lay down an inch of snow per hour over an area of 40,000 square feet. **Which expression shows how to find the number of hours this machine takes to lay down 1 inch of new snow on a ski run that is 800 feet long and 150 feet wide?**

**A**  $\frac{(800 \times 150)}{40,000}$

**B**  $\frac{40,000}{(800 \times 150)}$

**C**  $\frac{(150 \times 40,000)}{800}$

**D**  $\frac{(800 \times 40,000)}{150}$

**Correct Response: A**

*Match to GLE: This item measures GLE 7: Select and discuss appropriate operations and solve single- and multi-step real-life problems involving positive fractions, percents, mixed numbers, decimals, and positive and negative integers (N-5-M) (N-3-M) (N-4-M).*

- 28** The dimensions of four rectangles are given below. **Which rectangle does not have the same ratio of length to width as the other three?**

**A** 14 inches  $\times$  10 inches

**B**  $3\frac{1}{2}$  inches  $\times$   $2\frac{1}{2}$  inches

**C** 7 inches  $\times$  5 inches

**D**  $4\frac{1}{2}$  inches  $\times$   $2\frac{3}{4}$  inches

**Correct Response: D**

*Match to GLE: This item measures GLE 10: Determine and apply rates and ratios (N-8-M).*

- 29** Mr. Rogers bought a small motorboat. Traveling at a speed of 20 miles per hour, he could go 50 miles on a 6-gallon tank of fuel. **At that rate, how many gallons of fuel would he need for a 75-mile trip?**

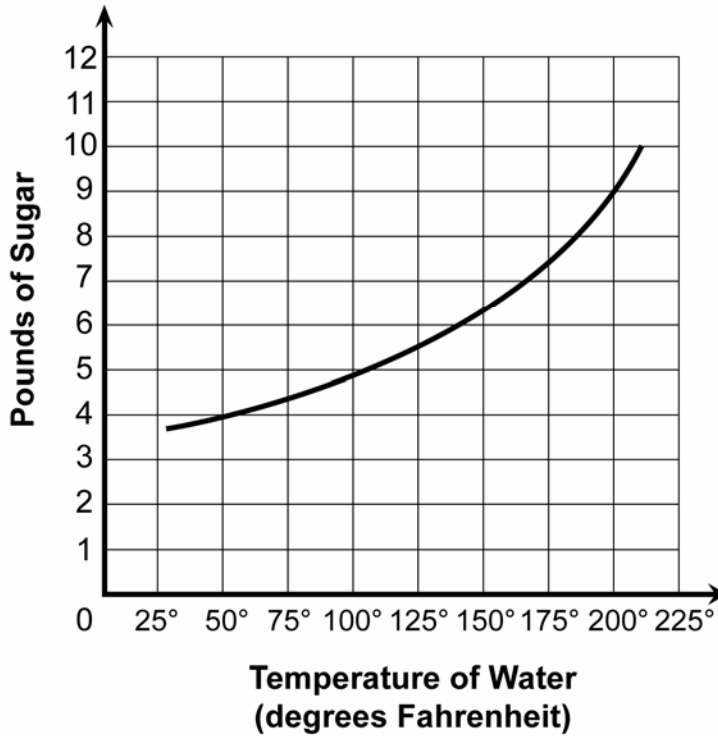
- A**      $7\frac{1}{2}$
- B**     9
- C**     12
- D**     20

**Correct Response: B**

*Match to GLE: This item measures GLE 11: Use proportions involving whole numbers to solve real-life problems (N-8-M).*

Directions: Use the graph below to answer questions 30 and 31.

**Amount of Sugar That Will Dissolve  
in One Quart of Water at Different Temperatures**



**30** About how many pounds of sugar will dissolve in one quart of water at 140 °F?

- A** 5
- B** 6
- C** 7
- D** 8

**Correct Response: B**

*Match to GLE: This item measures GLE 33: Analyze discrete and continuous data in real-life applications (D-2-M) (D-6-M).*

**31**    **What conclusion can be drawn from the graph?**

- A**    Sugar raises the temperature of water.
- B**    Sugar will not dissolve in cold water.
- C**    The hotter the water, the more sugar it will dissolve.
- D**    A given amount of water will dissolve an equal amount of sugar.

**Correct Response: C**

*Match to GLE: This item measures GLE 33: Analyze discrete and continuous data in real-life applications (D-2-M) (D-6-M).*

