# Chapter 2: LEAP Mathematics, Grade 4

This chapter provides specifications for the Mathematics test for grade 4 LEAP. It describes the content and format of the test, provides the number and types of items, and explains how the standards and benchmarks for each strand of Mathematics are assessed.

## Test Structure

The Mathematics test consists of three sessions. Students are allowed as much time as they need to complete each session, but suggested times are provided. The *Test Administration Manual* explains the procedures for allowing students additional time to complete a session of the test.

**Session 1:** 30 multiple-choice items without calculators

**Session 2:** 30 multiple-choice items with calculators

**Session 3:** 3 constructed-response items with calculators

## Item Types

The multiple-choice items consist of a stem and four answer options (A, B, C, and D). Response options that are numbers are shown in ascending or descending order of magnitude, unless such ordering cues the answer.

The constructed-response items require students to supply a numerical answer (a number sentence or an arithmetical solution), a short written answer, or some other type of constructed response.

## Test Description

### Sessions 1 and 2:

These multiple-choice items assess a student's knowledge and conceptual understanding in all strands of mathematics. Whenever possible, concepts and skills are assessed in realistic contexts.

Any benchmark assessed without calculators is also eligible for assessment in the session permitting calculators, with the exception of estimation.

### Session 3:

The three constructed-response items involve a number of separate steps and require application of multiple skills. They are designed to assess one or more of the strands and/or benchmarks, requiring students to demonstrate the connection of the strand to the other strands and to real-life situations.

The question format for this session is open-ended, including numerical answers, short written answers, and other types of constructed response (for example, draw a graph or geometrical pattern). Students may be required to explain in writing how they arrived at their answers.

Constructed-response items may have more than one possible solution or more than one path to the solution. Students' responses are scored for accuracy of the answer, proper operations used, and appropriate problem-solving approach or strategy. Partial credit is allowed, and calculators are permitted.

Whenever possible, test questions assess mathematical skills and knowledge in realistic contexts. These items are presented in terms of practical situations and problems that students are likely to encounter in their daily lives.

A test item may call upon skills related to more than one standard or benchmark. Nevertheless, for assessment purposes, each test item is keyed to a single standard or benchmark reflecting the *primary* skill it measures.

Readability level of test questions is minimized to the extent possible (except for necessary mathematical terms), so that students' reading ability does not interfere with their ability to demonstrate their mathematical knowledge and skills.

**Mathematical formulas and equivalencies:** Students are not required to recall formulas or unit conversions from memory. A separate Mathematics Reference Sheet containing grade-appropriate formulas and equivalencies needed to solve measurement or geometry items is provided. Students are expected to select the proper formula or conversion needed to solve a given problem. The Mathematics Reference Sheet can be found at the end of the Mathematics section of the guide. It is also available on the Louisiana Department of Education Web site in a version suitable for printing.

**Mathematical tools:** A ruler is provided during testing. School districts are responsible for making calculators available to all students for the appropriate sessions of the 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. The calculator that the student uses as part of his/her regular mathematics instruction is the calculator that should be used on the Mathematics portion of LEAP.

**Calculators recommended for instruction and assessment:**

K–4 students: a four-function calculator

**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

## Scoring the Mathematics Sessions

Multiple-choice items have four response options (A, B, C, and D) and are scored 1 if correct and 0 if incorrect.

Constructed-response items are scored according to an item-specific rubric, from 0 to 4 points. The specific rubric for each item is developed from the general 4-point scoring rubric for LEAP, GEE, and *i*LEAP.

### General Scoring Rubric for LEAP Mathematics Constructed-Response Items

| Score Level | Description of Score Level |
|---|---|
| **4** | • The response demonstrates in-depth understanding of the relevant content and/or procedures.<br>• The student completes all important components of the task accurately 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. |
| **3** | • The response demonstrates understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood.<br>• The student completes most important aspects of the task accurately and communicates clearly.<br>• The student's logic and reasoning may contain minor flaws. |
| **2** | • The student completes some parts of the task successfully.<br>• 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. |

## Mathematics Test Specifications

Sixty 1-point, multiple-choice items plus three 4-point items equals a 72-point test. The table below provides the test specifications for the multiple-choice sessions of the grade 4 LEAP Mathematics assessment. The values in the table do not include the constructed-response items. The three constructed-response items vary across test forms from year to year.

### Grade 4 Mathematics Test Specifications

| Strand | Distribution |
|---|---|
| Number and Number Relations | 40% |
| Algebra | 5% |
| Measurement | 10% |
| Geometry | 20% |
| Data Analysis, Probability, and Discrete Math | 10% |
| Patterns, Relations, and Functions | 15% |

# STRANDS, STANDARDS, AND BENCHMARKS ASSESSED

This section presents the strands/standards and benchmarks assessed on the grade 4 LEAP Mathematics assessment. The section includes the text of each benchmark, followed by a list of abilities that students **may** be expected to demonstrate to give evidence of facility with the concepts or skills described in the benchmark statement.

Each of the six Mathematics strands is associated with a single standard. The *strand* name serves as a label referring to the full text of its associated *standard*. Each strand has several benchmarks that describe what a student should know and be able to do in the context of the strand.

**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.

**Explanation of Benchmark Codes**

Mathematics benchmarks are coded by strand, benchmark number, and grade cluster. The first part of the code refers to the strand (for example, Number and Number Relations). The second part is the benchmark number. The third part refers to the grade cluster (E, M, H).

### Examples of Mathematics Codes

| Code | Translation |
|---|---|
| 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 |

## Content Limits

Grade 4 test items are subject to the following content limits. Depending on the particular benchmark assessed, items may involve:

- whole numbers through 10,000 (read the words or read/write standard notation)
- place value through ten thousands
- any of the four operations with whole numbers (see specific limits under benchmark N-6-E)
- calculating with monetary units up to $100.00
- fractions with denominators 2–12, but not computing with fractions
- decimal equivalents of tenths, fourths, and half
- decimal numbers through hundredths, but not computing with decimals except as expressed in dollars/cents
- percent equivalents of fourths

Calculating with monetary units (dollars and cents) and knowing monetary equivalents of coins (penny, nickel, dime, quarter, and half-dollar) and bills ($1, $5, $10, and $20) are assessed under Number and Number Relations, rather than under the Measurement strand.

## Strand N: Number and Number Relations

| Benchmark Assessed | |
|---|---|
| N-1-E | constructing number meaning and demonstrating that a number can be expressed in many different forms (for example, standard notation, number words, number lines, geometrical representation, fractions, and decimals) |

Assessment requires understanding and expressing numbers in various forms, including all examples in assessed benchmarks. The focus is on place value in whole numbers, factors and multiples of whole numbers, the concept of fractions, relative magnitude of fractions, decimals as written symbols for fractions for tenths, and the monetary value of U.S. coins and bills.

**Specifically, students may be required to:**

- read and write numbers up to 10,000 using standard notation (numerals)
- understand the concept of ones, tens, hundreds, thousands, and ten thousands place, including using expanded notation to rename whole numbers by place value (for example, 60 = 5 tens + 10 ones)
- represent whole numbers in various ways, including number words, number lines, geometrical (for example, illustrated sets of blocks) and numerical forms (for example, 7 = 4 + 2 + 1)
- recognize whether a number is divisible by 2, 3, 5, or 10, and recognize factors of composite numbers less than 50 (for example, that 1, 2, 4, 5, 10, and 20 are factors of 20)
- recognize multiples of natural numbers 2–12
- read/write fractions with denominators 2–12, including relating a fraction to the shaded area of a geometrical figure or parts of an illustrated object
- compare/order fractions using standard notation, geometric representation, or number line, and comparative terminology (for example, more, less, greater, same, between, about, almost)
- read and write decimal numbers to hundredths (two decimal places), particularly for expressions of dollars and cents
- relate fractions for tenths to their decimal equivalents (for example, .20 for 2/10)
- identify the value of U.S. coins (penny, nickel, dime, quarter, half-dollar) and U.S. bills ($1, $5, $10, and $20), and know symbols for dollars ($) and cents (¢)
- use ordinal numbers *1st* through *20th* in the context of real-world situations

| Benchmark Assessed | |
|---|---|
| N-2-E | demonstrating number sense and estimation skills, giving particular attention to common equivalent reference points (for example, ¼ = 25% = .25; ½ = 50% = .5; $1 = 100%, etc.) |

Items focus on using natural (counting) numbers to describe the real world in realistic terms or to estimate quantities for cases in which precise calculations cannot be made in the test setting. Questions are in the form: *"About how much," "About how many," "About how long,"* etc. Items may require estimating with whole or monetary values with rounding as needed or relating values to practical situations. Some items may require students to see and use the relationship between fractional and percentage parts of a whole.

**Specifically, students may be required to:**

- use whole numbers to describe real-world situations and physical reality involving counting (for example, years of age; amounts of money; quantities such as 36 = 3 dozen; etc.). *Note:* Test items are restricted to applications of whole numbers involving *counting,* to distinguish them from similar items involving units of measure (for example, time, distance) under benchmark M-1-E. Wrong answers are unrealistic, not close in magnitude to the correct answer, to differentiate *number sense* from *estimating.*
- use common reference points, including relating fractions for half and fourths to their decimal and percent equivalents (for example, identify a value as "between ¼ and ½" or "about 50%"; or recognize that ¼ = 25%, ½ = .50, or ¾ is between 50% and 100%)
- identify equivalent relationships between U.S. coins and bills (for example, 100 pennies = $1.00; 10 dimes = $1.00)

| Benchmark Assessed | |
|---|---|
| N-3-E | reading, writing, representing, comparing, ordering, and using whole numbers in a variety of forms (for example, standard notation, number line, and geometrical representation) |

Test items focus on understanding the relative magnitude of whole numbers, rather than reading, writing, or representing numbers. Students are required to count, compare, or order whole numbers in a real-world context. Items do not require calculation. However, students should know the meaning of the terms *skip count, count on,* and *count back.*

**Specifically, students may be required to:**

- compare or order whole numbers to 10,000 using standard notation, number line, or geometrical representation
- use comparative terminology (for example, more, less, greater, same, between, about, almost) to compare whole numbers. *Note:* Understanding and using symbols for greater/less (>, <) is assessed under the Algebra strand.

- use such strategies as counting on, counting back, or skip counting by 2's through 10's to demonstrate understanding of the numeration system in practical contexts. *Note:* Understanding and using the concept of even and odd numbers is assessed under the Patterns, Relations, and Functions strand.

| **Benchmark Assessed** | |
|---|---|
| N-4-E | demonstrating a conceptual understanding of the meaning of the basic arithmetic operations (add, subtract, multiply, and divide) and their relationships to each other |

Items for this benchmark focus on *conceptual* understanding of the four basic operations. For example, students should understand that multiplication is repeated addition and division is repeated subtraction. They should also understand the commutative property for addition and multiplication ($a + b = b + a$, and $5 \times 3 = 3 \times 5$).

| **Benchmark Assessed** | |
|---|---|
| N-5-E | selecting appropriate operation(s) (add, subtract, multiply, and divide) for a given situation |

Test items for this benchmark are similar to those for benchmark N-6-E, except that students are not required to perform calculations. They are required to indicate the proper arithmetical operation(s) to solve a given problem and, in some cases, the values to be used in these operations. Problems may involve one or two steps. Where two steps are involved, students are required to know the correct order of operations.

**A test item might take one of the following general forms:**

- Which of these operations would you use to find the answer?
- What step(s) would you take to solve this problem?
- What step would you take <u>first</u> to solve this problem?

| **Benchmark Assessed** | |
|---|---|
| N-6-E | applying a knowledge of basic math facts and arithmetic operations to real-life situations |

Items for this benchmark focus mainly on addition, subtraction, multiplication, and division of whole numbers in practical problem-solving situations.

**Assessment Limits in the Noncalculator Session of the Test:**

*Addition:* up to three 3-digit numbers, with regrouping

*Subtraction:* up to two 4-digit numbers, with regrouping

*Multiplication:* up to a 3-digit number by a 1-digit number, with regrouping

*Division:* dividing a 2-digit number by a 1-digit number (with and without remainder)

**Specifically, students may be required to:**

- understand basic addition, subtraction, multiplication, and division facts and relate them to each other
- apply computational skills in the context of word problems
- count money and determine amount of change

| **Benchmark Assessed** | |
|---|---|
| N-9-E | demonstrating the connection of number and number relations to the other strands and to real-life situations |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

**Benchmarks Not Directly Assessed:**

The following benchmarks are *not* directly assessed on LEAP because it would not be possible to determine which method the student selected or used to answer a question (for example, mental math or scratch paper).

N-7-E constructing, using, and explaining procedures to compute and estimate with whole numbers (for example, mental math strategies)

N-8-E selecting and using appropriate computational methods and tools for given situations involving whole numbers (for example, estimation, mental arithmetic, calculator, or paper and pencil)

# Strand A: Algebra

| Benchmark Assessed | |
|---|---|
| A-1-E | demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (for example, use letters or boxes to represent values; understand =, ≠, <, and > symbols) |

**Specifically, students may be required to:**

- understand the concept of the unknown, using empty boxes or letters to represent unknown values
- understand and use symbols (=, ≠, <, >) to express algebraic relationships
- use number sentences or formulas containing a variable (letter) to represent real-world problems
- given an algebraic sentence, write a related story problem (or choose the corresponding story problem), and explain their thinking. *Note:* Algebraic sentences may involve addition, subtraction, multiplication, or division.

| Benchmark Assessed | |
|---|---|
| A-2-E | modeling and developing strategies for solving equations and inequalities |

**Specifically, students may be required to:**

- use numbers to replace unknowns
- use letters as variables in mathematical statements to express and solve real-world problems (for example, 3 nickels = 15 cents, $N$ = 5 cents, etc.)
- identify and create true/false and open/closed number sentences
- solve for a variable in a linear single-step equation

| Benchmark Assessed | |
|---|---|
| A-3-E | recognizing the connection of algebra to the other strands and to real-life situations (for example, number sentences or formulas to represent real-world problems) |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

## Strand M: Measurement

Students should be able to estimate, measure, record, and communicate the dimensions of objects, understand the concepts of perimeter and area, and calculate the perimeter and area of rectangles, selecting and using standard units (customary and metric) as well as nonstandard units of measurement. Test items require understanding and using units of linear measurement in a wide variety of practical contexts.

**Note:** Monetary measures (dollars/cents) are assessed under the Number and Number Relations strand.

| **Benchmark Assessed** | |
|---|---|
| M-1-E | applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences |

Test items focus on applications cited in the benchmark statement. Students should understand the concept of *volume* but are not required to solve problems using standard units of volume (that is, cubic inches, cubic feet, cubic yards, or cubic centimeters). They also are not expected solve complex problems involving *rate*. Some items may require measuring with a ruler.

**Specifically, students may be required to:**

- understand the concepts of linear measure (length, perimeter), area (square units), capacity, and weight/mass
- recognize the names of standard units of measure in the customary (English) and metric systems, and related abbreviations (for example, *cm* or *sq.*), in the context of word problems
- solve mathematical problems involving measurements in the customary and metric systems, including use of the following units:

  *Linear:* inches, feet, yards, miles, millimeters, centimeters, meters, kilometers

  *Capacity:* cups, liquid pints and quarts, gallons, milliliters, liters

  *Weight/Mass:* ounces, pounds, tons, grams, kilograms

  *Temperature:* degrees on the Fahrenheit or Celsius scale

  *Time:* seconds, minutes, hours, days, weeks, months, years
- measure length and read linear measurements accurately to the nearest centimeter or half inch, using a ruler demarcated in one or both systems

- understand the concept of measuring time, including 1 hour = 60 minutes, 1 minute = 60 seconds, and using calendar dates to measure time
- understand the Fahrenheit and Celsius scales as different approaches to measuring temperature, and recognize the practical range of each scale
- use addition to find perimeter of a geometric shape, given lengths of sides in a labeled illustration or word problem (customary or metric units)
- determine area of an illustrated square or rectangle by counting square units
- use multiplication to find area of a rectangle, given lengths of one side (square) or two sides (other rectangles) in a labeled illustration or word problem

| **Benchmark Assessed** | |
|---|---|
| M-2-E | selecting and using appropriate standard and nonstandard units of measure (for example, paper clips and Cuisenaire rods) and tools for measuring length, area, capacity, weight/mass, and time for a given situation by considering the purpose and precision required for the task |

Items on the state test involve selecting appropriate *units* of measure for particular situations. Selecting appropriate tools is not assessed.

**Specifically, students may be required to:**

- understand the concept of standard and nonstandard (for example, paper clips, hands) units of measure
- select the best unit to measure length, area, capacity, weight/mass, and time for a given situation, considering purpose of measurement and precision required

| **Benchmark Assessed** | |
|---|---|
| M-3-E | using estimation skills to describe, order, and compare measures of length, capacity, weight/mass, time, and temperature |

Assessment focuses on (a) estimation skills involving measurements in the customary and metric systems, and (b) understanding relative magnitude of *units* or measurements within and between the customary and metric systems. Some test items may require students to estimate the size of a familiar object in the real world. Other items may require comparing or ordering *units* or measurements and distinguishing the difference (for example, indicate which unit/measurement is greatest or smallest).

**Specifically, students may be required to:**

- compare approximate relationships of units *across systems* in terms of intuitive reference points, not formal computation (for example, a liter is about a quart; a meter is a little longer than a yard)

- compare or order units or measurements *within the same system* (customary or metric), using any of the units cited below
- estimate *length* in customary or metric units: inches, feet, yards, miles, millimeters, centimeters, meters, kilometers
- estimate *capacity* in customary or metric units: cups, pints, quarts, gallons, milliliters, liters
- estimate *weight/mass* in customary or metric units: ounces, pounds, tons, grams, kilograms
- estimate *elapsed time* (or later point in time) using seconds, minutes, hours, days, weeks, months, years
- estimate *temperature* in degrees Fahrenheit or Celsius, using common reference points (for example, normal room and body temperature, freezing and boiling points of water, temperature of a "hot" vs. "cold" day)
- estimate *perimeter* and *area* of a square or rectangular object (for example, classroom door) in customary or metric units
- estimate area of an irregular shape shown in terms of square units

| **Benchmark Assessed** | |
|---|---|
| M-4-E | converting from one unit of measurement to another within the same system (customary and metric); comparisons between systems should be based on intuitive reference points, not formal computations (for example, a meter is a little longer than a yard) |

**Specifically, students may be required to:**

- make unit conversions within the same system (for example, 12 inches = 1 foot, 100 centimeters = 1 meter, 1 pint = 2 cups) in practical contexts. *Note:* Test items may require two-step conversions (for example, pints to gallons, inches to yards). A Mathematics Reference Sheet of unit conversions is provided.
- use intuitive reference points between the customary and metric systems to solve problems (for example, a meter is slightly longer than a yard, a liter is slightly more than a liquid quart, a centimeter is less than an inch)

| **Benchmark Assessed** | |
|---|---|
| M-5-E | demonstrating the connection of measurement to the other strands and to real-life situations |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

## Strand G: Geometry

| Benchmark Assessed | |
|---|---|
| G-1-E | determining the relationships among shapes |

**Specifically, students may be required to:**

- manipulate common figures to analyze and produce new figures (for example, create a figure from specified or given shapes)
- identify views of three-dimensional objects (top, side, bottom, etc.)

| Benchmark Assessed | |
|---|---|
| G-2-E | identifying, describing, comparing, constructing, and classifying two-dimensional and three-dimensional geometric shapes using a variety of materials |

**Specifically, students may be required to:**

- sort objects or shapes according to two or more attributes (for example, size, shape, color, pattern, function) or sort objects/shapes into given categories
- sequence or position shapes according to a given attribute (for example, size, sides)
- identify (or draw/name) and describe by attributes two-dimensional figures, including circle, triangle, rectangles (including squares), and parallelograms (including rhombuses)
- identify (or draw/name) and describe the properties of polygons (triangle, square, rectangle, pentagon, hexagon, octagon, etc.)
- compare/contrast two-dimensional shapes according to their properties (number of sides, angles, etc.)
- identify and name the following three-dimensional figures: cylinder, cube, cone, pyramid, sphere
- understand concepts of congruence, similarity, and symmetry and apply these concepts to given shapes

**Note:** Understanding, estimating, and determining perimeter and area of a square or rectangle is tested under the Measurement strand.

| Benchmark Assessed | |
|---|---|
| G-3-E | making predictions regarding combinations, subdivisions, and transformations (slides, flips, turns) of simple plane geometric shapes |

**Specifically, students may be required to:**

- understand the terms *clockwise* and *counterclockwise*
- visualize a given shape (for example, outline of an upright L shape) when turned 90° or 180° in clockwise or counterclockwise direction or when turned upside down
- visualize a three-dimensional shape (for example, a cylindrical can) when turned on its side or forward
- visualize the shape formed by the joining of two other given shapes
- visualize component shapes of a given geometrical shape (limit: 6 components and 4 different common shapes); for example, say how many or what shapes they see

**Note:** "Slides" are not reflected on the state test because coordinate geometry concepts are not tested at grade 4.

| Benchmark Assessed | |
|---|---|
| G-5-E | identifying and drawing lines and angles and describing their relationships to each other and to the real world |

**Specifically, students may be required to:**

- understand the concept of a point, straight line, line segment, length of line segment, and plane
- draw, identify, and label a line segment, horizontal or vertical line, and intersecting lines in geometric figures and drawings (including maps)
- draw, identify, and label parallel lines and perpendicular lines in real-world applications (for example, labeling a figure drawing containing these elements)
- understand properties of intersecting, parallel, and perpendicular lines
- draw or identify angles and name right angles in geometric figures or drawings.
- order angles by size (> or < 90°)

| Benchmark Assessed | |
|---|---|
| G-6-E | demonstrating the connection of geometry to the other strands and to real-life situations |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

**Benchmark Not Directly Assessed**

The following benchmark is *not* directly assessed on the state test.

G-4-E drawing, constructing models, and comparing geometric shapes with special attention to developing spatial sense

Assessment of benchmark G-4-E at the classroom level could include observation of tasks involving visualization skills (for example, drawing a map of the classroom as seen by a spider on the ceiling) or building with blocks.

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

| Benchmark Assessed | |
|---|---|
| D-1-E | collecting, organizing, and describing data based on real-life situations |

Items on the state test focus on organizing and describing data, not collecting data. At the classroom level, assessment of this benchmark could involve (a) collecting data using experiments, simulations, surveys or questionnaires; (b) writing a research report to describe findings; or (c) determining possible uses of long-term data collection.

**Specifically, students may be required to:**

- analyze and describe data in terms of absolute or relative frequency of occurrence, range (highest/lowest), etc.
- summarize information and relationships revealed by a graph
- add new data to a given chart, graph, or set of organized data
- extrapolate from obvious trends revealed by graphs in order to make predictions

| Benchmark Assessed | |
|---|---|
| D-2-E | constructing, reading, and interpreting data in charts, graphs, tables, etc. |

**Specifically, students may be required to:**

- obtain information from a bar graph, line graph, pictograph, chart/table (that is, read a graph accurately to answer a question)
- analyze, interpret, or draw conclusions based on data given in a bar graph, line graph, pictograph, chart/table
- match a graph to a described situation
- match a data set to a graph and vice versa (including matching data presented in a table/chart with a corresponding bar, line, or pictograph)
- plot data onto a bar or line graph when the axes labels and scales have been provided
- draw a bar graph showing data given in a chart/table or words

| Benchmark Assessed | |
|---|---|
| D-3-E | formulating and solving problems that involve the use of data |

**Specifically, students may be required to:**

- generate questions that can be answered by collecting and analyzing data

- use lists and tree diagrams to generate and record all possible combinations of a given set of objects; total number of combinations not to exceed 9 ($3 \times 3$)
- solve problems using data from various sources (tables, graphs, maps, advertisements, etc.)
- solve problems involving simple deductive reasoning (for example, "Tom finished the race after Sue but before John. In what order did they finish?")
- use elementary logic involving sets (*and, or,* and *is/is not* statements) by solving logic problems that can be formulated in Venn diagrams (limit: 2 circles)

| **Benchmark Assessed** | |
|---|---|
| D-5-E | predicting outcomes based on probability (for example, make predictions of same chance, more likely, or less likely; determine fair and unfair games) |

**Specifically, students may be required to:**

- understand and use the vocabulary of basic probability (chance, possible, impossible, likely, unlikely, certain, etc.)
- make predictions of same chance or more or less likely from given information
- determine fair and unfair (as in a game) based on probability
- predict outcomes based on simple (single event) probability

| **Benchmark Assessed** | |
|---|---|
| D-6-E | demonstrating the connection of data analysis, probability, and discrete math to other strands and real-life situations |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

**Benchmark Not Directly Assessed**

The following benchmark is *not* directly assessed on the state test.

D-4-E exploring, formulating, and solving sequence-of-pattern problems involving selection and arrangement of objects/numerals

## Strand P: Patterns, Relations, and Functions

Test items may require students to recognize, formulate, describe, or extend numbers, shapes, and patterns. Assessment may include multiplicative and additive patterns and sequences of transformations dealing with reflections.

| **Benchmark Assessed** | |
|---|---|
| P-1-E | recognizing, describing, extending, and creating a wide variety of numerical (for example, skip counting of whole numbers), geometrical, and statistical patterns |

**Specifically, students may be required to:**

- understand and use the concept of *even and odd* numbers (for example, repeat a pattern of even or odd numbers, or skip count by even or odd numbers). *Note:* Skip counting *not* involving even/odd numbers is tested under the Number and Number Relations strand.
- identify missing element(s) *within* a number pattern, sequence or display, or continue a given sequence or pattern of numbers or geometrical shapes
- describe the pattern evidenced by a sequence or display of numbers

| **Benchmark Assessed** | |
|---|---|
| P-2-E | representing and describing mathematical relationships using tables, variables, open sentences, and graphs |

**Specifically, students may be required to:**

- use function (input/output) machines to identify or continue numerical patterns, or to solve problems involving patterns
- complete input/output tables relative to increasing patterns
- relate function machines, function tables, and generalizing rules

**Note:** Traditional graph/table skills not involving *functions* are assessed under the Data Analysis, Probability, and Discrete Math strand (for example, creating a conventional graph, reading/interpreting data in a table or graph, matching a graph to a described situation).

| **Benchmark Assessed** | |
|---|---|
| P-3-E | recognizing the use of patterns, relations, and functions in other strands and in real-life situations |

This benchmark will not be directly assessed in the multiple-choice sessions of the test but is eligible for assessment in the constructed-response session of the test.

# Sample Test Items: Grade 4 Mathematics

## Sample Multiple-Choice Items

Questions 1 through 24 are sample multiple-choice items, arranged by standard and benchmark. 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.

**1.** 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**

*This item measures benchmark **N-1-E:** constructing number meaning and demonstrating that a number can be expressed in many different forms (for example, standard notation, number words, number lines, geometrical representation, fractions, and decimals).*

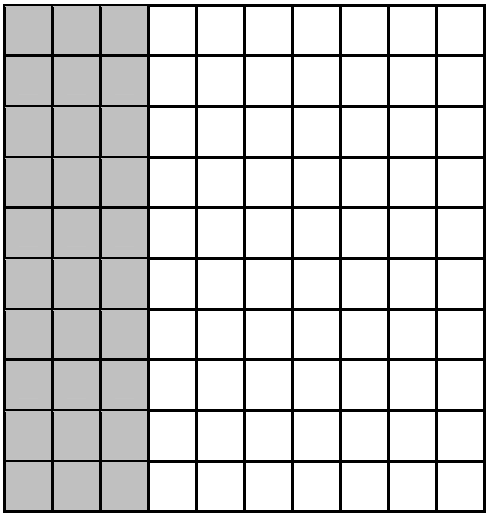
**2.** Kevin's mother told him to buy **seven-tenths** of a pound of hamburger. Each package is marked to show its weight. Kevin should buy the package marked

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

**Correct response: C**

*This item measures benchmark **N-1-E**: constructing number meaning and demonstrating that a number can be expressed in many different forms (for example, standard notation, number words, number lines, geometrical representation, fractions, and decimals).*

**3.** 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**

*This item measures benchmark **N-1-E:** constructing number meaning and demonstrating that a number can be expressed in many different forms (for example, standard notation, number words, number lines, geometrical representation, fractions, and decimals).*

**4.** Bobby mowed 18 lawns in April, 21 lawns in May, and 23 lawns in June. Which of the following expressions should he use to estimate how many lawns he mowed during these three months?

A. 10 + 20 + 20

B. 20 + 20 + 20

C. 20 + 20 + 30

D. 20 + 30 + 30

**Correct response: B**

*This item measures benchmark **N-2-E:** demonstrating number sense and estimation skills, giving particular attention to common equivalent reference points (for example, ¼ = 25% = .25; ½ = 50% = .5; $1 = 100%, etc.).*

**The table below represents the number of people who saw a movie at the Ritz Theater last week. Use this table to answer question 5.**

## RITZ THEATER ATTENDANCE

| Day | People |
|---|---|
| Sunday | 294 |
| Monday | 200 |
| Tuesday | 187 |
| Wednesday | 218 |
| Thursday | 245 |
| Friday | 300 |
| Saturday | 326 |

**5.** If each movie theater ticket costs $7.50, what steps would you take to find out how much money the movie theater made in ticket sales from Friday and Saturday?

A. Add 300 and 326, then multiply the sum by $7.50
B. Add 300 + 326 + $7.50
C. Multiply 300 by $7.50 three times and add $326
D. Divide 300 by $7.50 and add $326

**Correct response: A**

*This item measures benchmark **N-5-E**: selecting appropriate operation(s) (add, subtract, multiply, and divide) for a given situation.*

**6.** If Daisy puts her 28 horse statues into rows with 4 statues in each row, how many rows will she have?

A. 7
B. 8
C. 24
D. 32

**Correct response: A**

*This item measures benchmark **N-6-E:** applying a knowledge of basic math facts and arithmetic operations to real-life situations.*

**7.** 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. $t + 16 =$ ☐
B. $t - 16 =$ ☐
C. $t \times 16 =$ ☐
D. $t \div 16 =$ ☐

**Correct response: C**

*This item measures benchmark **A-1-E**: demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (for example, use letters or boxes to represent values; understand =, ≠, <, and > symbols).*

**8.** Pat is 23 years old. How old with Pat will be in $N$ years?

A. $N \times 23$
B. $N - 23$
C. $N \div 23$
D. $N + 23$

**Correct response: D**

*This item measures benchmark **A-1-E**; demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (for example, use letters or boxes to represent values; understand =, ≠, <, and > symbols).*

**9.** 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 × ☐ = 76**

A. 12

B. 15

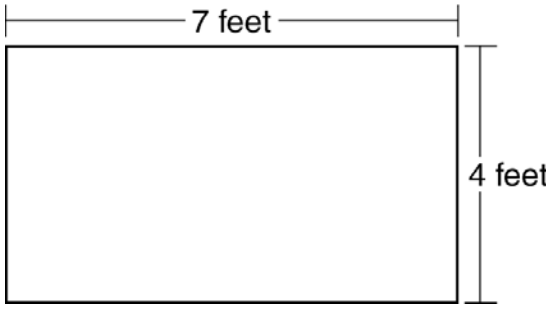
C. 18

D. 19

**Correct response: D**

*This item measures benchmark **A-2-E:** modeling and developing strategies for solving equations and inequalities.*

**10.** 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.

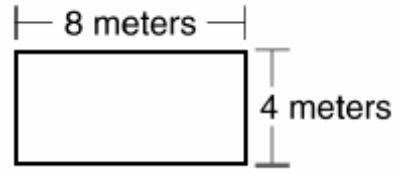
C. 22 sq. ft.

D. 28 sq. ft.

**Correct response: D**

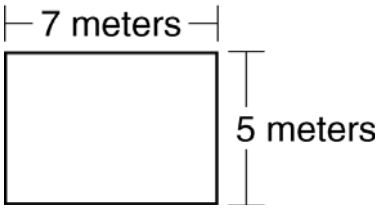
*This item measures benchmark **M-1-E:** applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences.*

**11.** A diagram of Tameka's garden, which is a rectangle, is shown below.

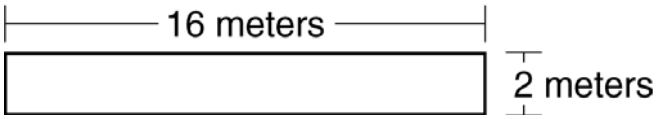



Which of these rectangular figures has a perimeter that is equal to the perimeter of Tameka's garden?

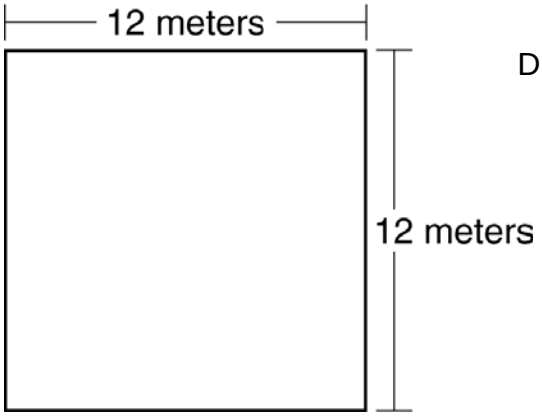
A.



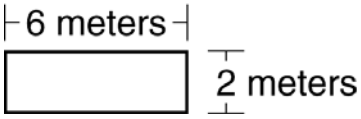

B.




C.



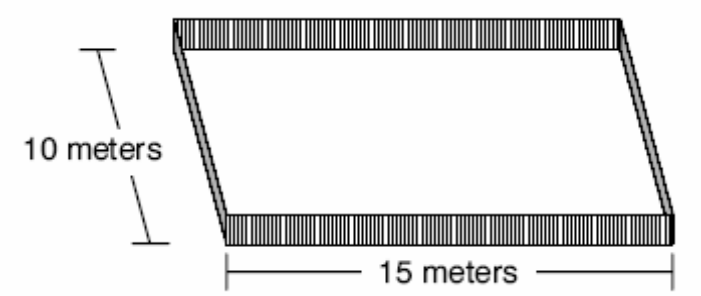

D.




**Correct response: A**

*This item measures benchmark **M-1-E:** applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences.*

**Use the diagram below to answer question 12.**




**12.** Mr. Rollins put a fence all the way around her rectangular yard for her dog. What is the perimeter of her yard?

A. 25 meters
B. 50 meters
C. 150 meters
D. 250 meters

**Correct response: B**

*This item measures benchmark **M-1-E:** applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences.*

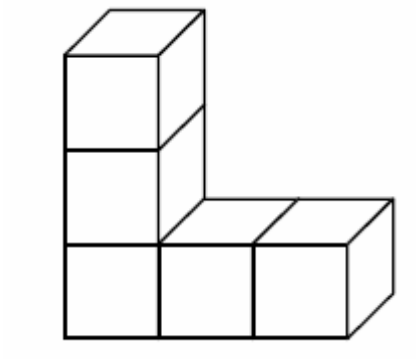
**13.** About how much juice will a one-liter pitcher hold?

A. 1 cup
B. 1 pint
C. 1 quart
D. 1 gallon

**Correct response: C**

*This item measures benchmark **M-4-E:** converting from one unit of measurement to another within the same system (customary and metric); comparisons between systems should be based on intuitive reference points, not formal computations (for example, a meter is a little longer than a yard).*

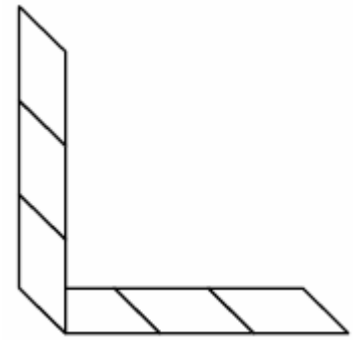
**14.** Jennifer made this shape using five cubes.

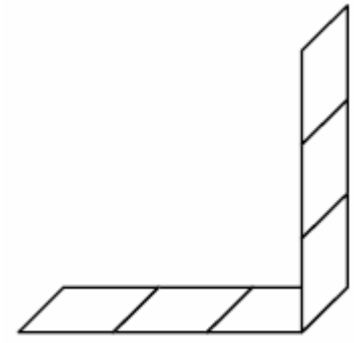


If you look at the shape from above, which might you see?

A. 

B. 

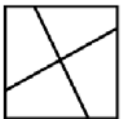
C. 

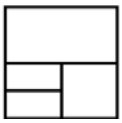
D. 

**Correct response: A**

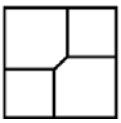
*This item measures benchmark **G-1-E:** determining the relationships among shapes.*

**15.** Which figure is divided into 4 congruent shapes?

A. 

B. 

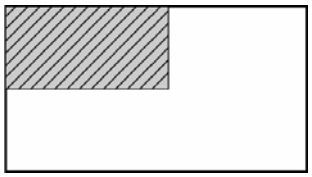
C. 

D. 

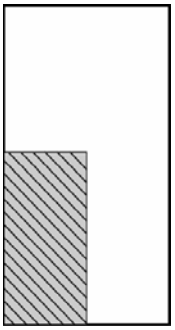
**Correct response: A**

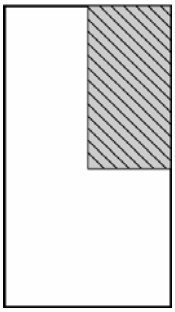
*This item measures benchmark **G-2-E:** identifying, describing, comparing, constructing, and classifying two-dimensional and three-dimensional geometric shapes using a variety of materials.*

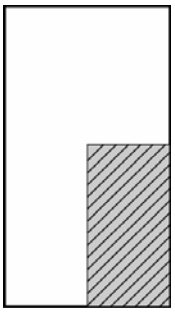
**16.** Darlene designed the flag below.

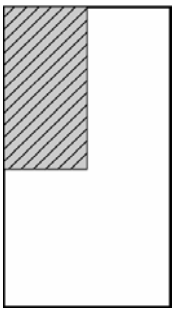


Which of the following shows Darlene's flag turned 90º **counterclockwise**?

A. 

B. 

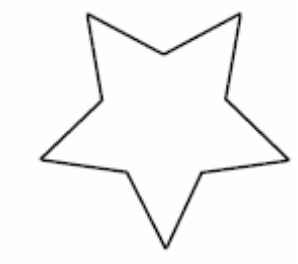
C. 

D. 

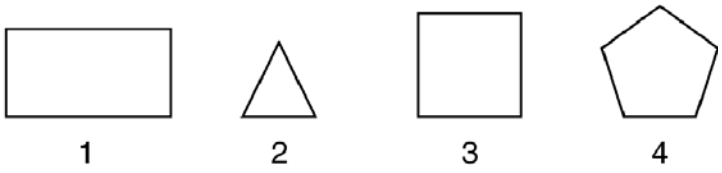
**Correct response: A**

*This item measures benchmark **G-3-E:** making predictions regarding combinations, subdivisions, and transformations (slides, flips, turns) of simple plane geometric shapes.*

**Use the figure below to answer question 17.**



**17.** Sarah wants to bake a cake with the shape of a 5-pointed star, as shown above. Which two different pans can she use to make her star-shaped cake?

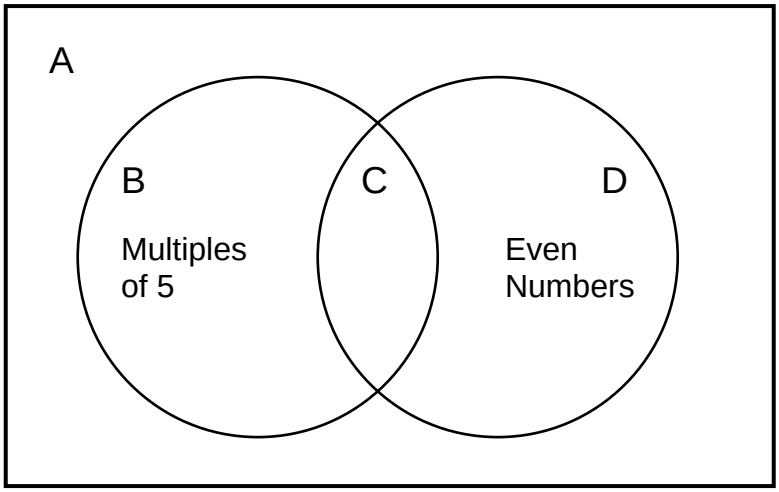



A. 1 and 2
B. 1 and 3
C. 2 and 3
D. 2 and 4

**Correct response: D**

*This item measures benchmark **G-3-E:** making predictions regarding combinations, subdivisions, and transformations (slides, flips, turns) of simple plane geometric shapes.*

**Use the Venn diagram below to answer question 18.**



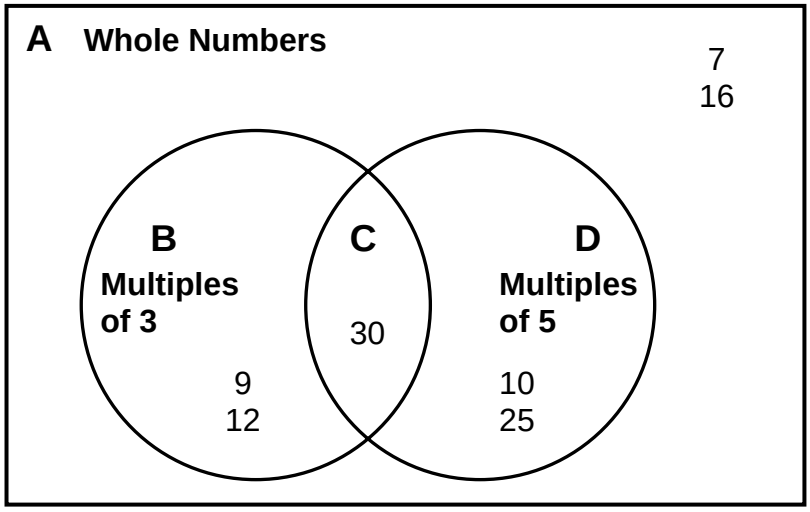

**18.** In which section of the Venn diagram does the number 52 belong?

A. section A
B. section B
C. section C
D. section D

**Correct response: D**

*This item measures benchmark **D-3-E**: formulating and solving problems that involve the use of data.*

**Use the diagram below to answer question 19.**




**19.** In which section of the Venn diagram does the number 15 belong?

A. section A
B. section B
C. section C
D. section D

**Correct response: C**

*This item measures benchmark **D-3-E**: formulating and solving problems that involve the use of data.*

**20.** Vanessa's fourth-grade class went to the zoo. They visited some animals and recorded their heights as shown in the chart below.

**Zoo Animals**

| Animal | Height (in centimeters) |
|---|---|
| Black bear | 150 |
| Bobcat | 60 |
| Gray wolf | 80 |
| Mountain lion | 100 |

The mountain lion is how many centimeters taller than the bobcat?

A. 40 centimeters
B. 60 centimeters
C. 100 centimeters
D. 160 centimeters

**Correct response: A**

*This item measures benchmark **D-3-E**: formulating and solving problems that involve the use of data.*

**21.** 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, ☐, 21, 31**

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

**Correct response: C**

*This item measures benchmark **P-1-E**: recognizing, describing, extending, and creating a wide variety of numerical (for example, skip counting of whole numbers), geometrical, and statistical patterns.*

**22.** 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**

*This item measures benchmark **P-1-E**: recognizing, describing, extending, and creating a wide variety of numerical (for example, skip counting of whole numbers), geometrical, and statistical patterns.*

**23.** Freda was playing the “Plants Are Fun” computer counting game. Each time she entered a number of plants, a different number was printed. The table shows the results.

| Input Number | Output Number |
|---|---|
| 2 | 4 |
| 6 | 12 |
| 7 | 14 |
| 11 | 22 |

What did the computer do to each input number?

A. added 2
B. added 6
C. multiplied by 2
D. divided by 2

**Correct response: C**

*This item measures benchmark **P-2-E:** representing and describing mathematical relationships using tables, variables, open sentences, and graphs.*

**24.** Mariah is selling marbles for 8¢ each. Which price list is correct?

A.

| Number of Marbles | Total Cost of Marbles |
|---|---|
| 2 | 8¢ |
| 3 | 24¢ |
| 6 | 32¢ |

B.

| Number of Marbles | Total Cost of Marbles |
|---|---|
| 2 | 16¢ |
| 3 | 24¢ |
| 6 | 40¢ |

C.

| Number of Marbles | Total Cost of Marbles |
|---|---|
| 2 | 8¢ |
| 3 | 16¢ |
| 6 | 32¢ |

D.

| Number of Marbles | Total Cost of Marbles |
|---|---|
| 2 | 16¢ |
| 3 | 24¢ |
| 6 | 48¢ |

**Correct response: D**

*This item measures benchmark **P-2-E:** representing and describing mathematical relationships using tables, variables, open sentences, and graphs.*

## Sample Constructed-Response Items

Questions 25 through 29 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 benchmarks/strands. The items are scored using an item-specific rubric on a scale of 0 to 4 points.

**25.** 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.

_____

*The content standard for this item is **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.*

**Scoring Rubric:**

| Score | Description |
|---|---|
| **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.<br>**OR**<br>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 $18 \neq 16$

**26.** Marie's mother made a cake. She put the cake in the oven at 9:45 A.M. The cake took 40 minutes to bake, 30 minutes to cool, and 35 minutes to decorate.

**A.** How many minutes in all did it take Marie's mother to bake, cool, and decorate the cake? Show your work.

_____

**B.** What time was Marie's mother finished decorating the cake? Show your work.

_____

**C.** Marie's mother made 4 cakes in all. She put 2 cups of milk in each cake. How many **quarts** of milk did she use? Show how you got your answer.

Number of quarts of milk _____

*The content standard for this item is **Measurement**. In problem-solving investigations, students demonstrate an understanding of the concepts, processes, and real-life applications of measurement.*

**Scoring Rubric:**

| Score | Description |
|---|---|
| **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 or 1 ½ points.<br>**OR**<br>The student's response demonstrates minimal understanding of the use of units of measurement of time or capacity. |
| **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 giving the correct answer of **105 minutes** or **1 hour and 45 minutes** and showing the correct process (**40 minutes + 30 minutes + 35 minutes = 105 minutes**)

**OR**

- ½ point for correct process with incorrect answer resulting from an arithmetic error **OR** correct answer with no work shown

*Part B (1 point):*

- 1 point for giving the correct answer of **11:30 A.M.** and showing the correct process (**9:45 A.M. + 1 hour 45 minutes = 11:30 A.M.**) **OR** correct process with incorrect time (based on incorrect answer from part A)

**OR**

- ½ point for correct answer with no work shown **OR** correct process with incorrect time resulting from an arithmetic error **OR** for an answer correctly based on an incorrect answer from part A with no work shown

*Part C (2 points):*

- 2 points for giving the correct answer of **2 quarts** and for showing correct process of **4 cakes multiplied by 2 cups of milk equals 8 cups of milk; 8 cups = 2 quarts**

**OR**

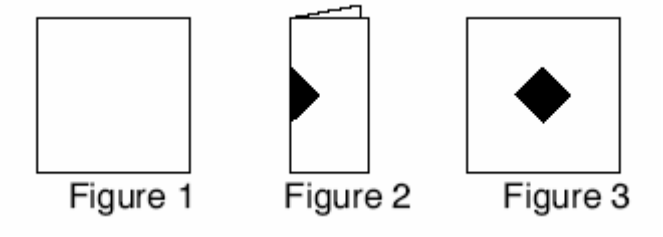
- 1 point for giving the equivalent of **8 cups OR 2 quarts** only with no work shown **OR** for giving an incorrect answer using the correct process containing an arithmetic error

**OR**

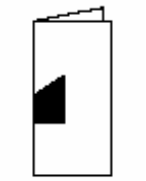
- ½ point for the correct process for the number of cups, with no units ($4 \times 2 = 8$)

**27.** Ms. Wagner's class is making cutouts.

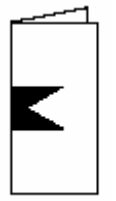
Amy started with a square piece of paper as shown in Figure 1 below. She folded the paper once and cut out a shape as shown in Figure 2. Figure 3 shows how the paper in Figure 2 looked when Amy opened it.



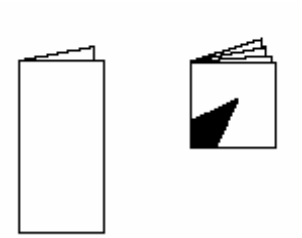

**A.** Brittany's cutout is shown below. Draw how it will look when it is opened.



**B.** Kevin's cutout is shown below. Draw how it will look when it is opened.



**C.** Cody folded his paper once as shown in the first figure below. He folded it a second time and then made a cutout as shown in the second figure below. Draw how Cody's paper will look when it is completely opened.



*The content standard for this item is **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.*

**Scoring Rubric:**

| Score | Description |
|---|---|
| **4** | The student's response earns 6 points. |
| **3** | The student's response earns 4 or 5 points. |
| **2** | The student's response earns 2 or 3 points. |
| **1** | The student's response earns 1 point.<br>**OR**<br>The student's response demonstrates minimal understanding. |
| **0** | The student's response is incorrect, irrelevant to the skill or concept being measured, too brief to evaluate, or blank. |

**Scoring information:**

*Part A:* Score 2 points for accurate drawing, taking into account abilities for fourth graders.

Score 1 point for partially correct drawing, for example, correct general shape but does not meet all characteristics for each shape.

*Part B:* Score same way as part A.

*Part C:* Score same way as part A.

**Characteristics of the shape in part A:**

1. The left and right sides are parallel and vertical.
2. The bottom side is horizontal.
3. The top two lines should meet approximately halfway towards the center of the shape.

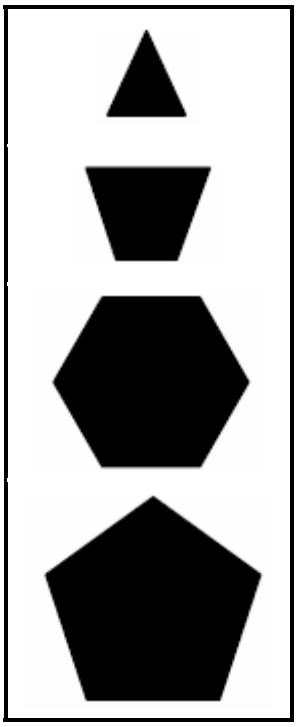
**Characteristics of the shape in part B:**

1. The top and bottom lines should be horizontal and parallel.
2. The left and right sides each have two lines that meet to make a "V."

**Characteristics of the shape in part C:**

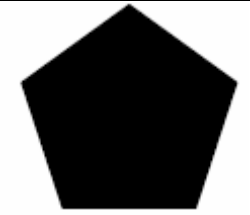
1. The shape should have 4 points.
2. Each corner should point to the corner of the paper.
3. The shape should be fat in the middle.
4. The two sides of each point are diagonal lines.

**28.** Jacob tossed **six** beanbags onto the board below.



**A.** Use these clues to find how many beanbags landed on each shape.
**Write your answer on the chart on page X.**

- The beanbags all landed on two of the shapes.
- The two shapes were not next to each other.
- The same number of beanbags landed on each of the two shapes.
- No beanbags landed on the pentagon.

| Shapes | Number of Beanbags |
|---|---|
|  | |
|  | |
|  | |
|  | |

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.

**B.** How many points did Jacob earn? _____ points
Show or explain how you found your answer.

*The content standard for this item is **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.*

**Scoring Rubric:**

| Score | Description |
|---|---|
| **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 1 ½ to 2 ½ points. |
| **1** | The student's response earns ½ or 1 point. |
| **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 (maximum 2 points):*

- ½ point for each clue correctly followed (student must clearly indicate how many landed on each shape; 0 or blank is acceptable for trapezoid and pentagon)

*Part B (2 points):*

- 1 point for correct answer based on part A (if A is correct, answer is 48)

**AND**

- 1 point for correct strategy or explanation
  [36 + 12 = 48 **OR** (3 × 12) + (3 × 4) = 48 **OR** 12 + 12 + 12 + 4 + 4 + 4 = 48]

**Note:** If total number of beanbags tossed does not equal 6, do not award a score of 4; otherwise do not penalize.

**Sample response, part A:**

| Shapes | Number of Beanbags |
|---|---|
|  | 3 |
|  | 0 |
|  | 3 |
|  | 0 |

**29.** Mary works at a video rental store. She is making a table to show the fines for one overdue movie.

## Overdue Movie Fines

| **Number ($n$) of Days** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Amount of Fine** | $2.99 | $5.98 | $8.97 | | | | |

**A**. Complete the table for Mary by continuing the pattern.

e

**B.** Joe rented a movie for $3.95. If he returned the movie 5 days overdue, how much did he spend in total for the movie rental?

Answer: $_____

**C.** Could the following rule be used to find what the fine would be for a movie that is $n$ days overdue? Explain your answer.

Fine = $2.99 + $n$

Answer: _____

Explanation: _____

_____

_____

_____

*The content standard for this item is* ***Patterns, Relations, and Functions.*** *In problem-solving investigations, students demonstrate an understanding of patterns, relations, and functions that represent and explain real-world situations.*

**Scoring Rubric:**

| Score | Description |
|---|---|
| **4** | The student correctly answers all parts. |
| **3** | The student correctly answers three parts (but does not give a complete explanation for part C).<br>**OR**<br>The student correctly answers either part A or part B and correctly answers part C and includes a complete explanation for this part. |
| **2** | The student correctly answers parts A and B.<br>**OR**<br>The student correctly answers part C and gives a complete explanation.<br>**OR**<br>The student correctly answers part A or part B and correctly answers part C (no valid explanation is given). |
| **1** | The student correctly answers part A or part B.<br>**OR**<br>The student makes an error in the chart in part A, but all other answers are correct based on this error. |
| **0** | The student's response is incorrect, irrelevant to the skill or concept being measured, too brief to evaluate, or blank. |

**Exemplary responses:**

*Part A:*

**Overdue Movie Fines**

| **Number (*n*) of Days** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Amount of Fine** | $2.99 | $5.98 | $8.97 | $11.96 | $14.95 | $17.94 | $20.93 |

*Part B:* $18.90

*Part C:* No.
Rule does not work: 2.99 + 2 = 4.99, not 5.98.
(Other examples are acceptable.)

**Note:** If a student incorrectly answers parts A and B but answers "No" for part C without an explanation, no points are given.

# Standards and Benchmark Statements, across Grades

**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.

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **N-1-E**<br>constructing number meaning and demonstrating that a number can be expressed in many different forms (for example, standard notation, number words, number lines, geometrical representation, fractions, and decimals)<br><br>**N-2-E**<br>demonstrating number sense and estimation skills, giving particular attention to common equivalent reference points (for example, 1/4 = 25% = .25; 1/2 = 50% = .5; $1 = 100%, etc.)<br><br>**N-3-E**<br>reading, writing, representing, comparing, ordering, and using whole numbers in a variety of forms (for example, standard notation, number line, and geometrical representation)<br><br>**N-4-E**<br>demonstrating a conceptual understanding of the meaning of the basic arithmetic operations (add, subtract, multiply, and divide) and their relationships to each other<br><br>**N-5-E**<br>selecting appropriate operation(s) (add, subtract, multiply, and divide) for a given situation | **N-1-M**<br>demonstrating that a rational number can be expressed in many forms, and selecting an appropriate form for a given situation (for example, fractions, decimals, and percents)<br><br>**N-2-M**<br>demonstrating number sense and estimation skills to describe, order, and compare rational numbers (for example, magnitude, integers, fractions, decimals, and percents)<br><br>**N-3-M**<br>reading, writing, representing, and using rational numbers in a variety of forms (for example, integers, mixed numbers, and improper fractions)<br><br>**N-4-M**<br>demonstrating a conceptual understanding of the meaning of the basic arithmetic operations (add, subtract, multiply, and divide) and their relationships to each other<br><br>**N-5-M**<br>applying an understanding of rational numbers and arithmetic operations to real-life situations | **N-1-H**<br>demonstrating an understanding of the real number system<br><br>**N-2-H**<br>demonstrating that a number can be expressed in many forms, and selecting an appropriate form for a given situation (for example, fractions, decimals, percents, and scientific notation)<br><br>**N-3-H**<br>using number sense to estimate and determine if solutions are reasonable<br><br>**N-4-H**<br>determining whether an exact or approximate answer is necessary<br><br>**N-5-H**<br>selecting and using appropriate computational methods and tools for given situations (for example, estimation, or exact computation using mental arithmetic, calculator, symbolic manipulator, or paper and pencil)<br><br>**N-6-H**<br>applying ratios and proportional thinking in a variety of situations (for example, finding a missing term of a proportion) |

**Strand N: Number and Number Relations (continued)**

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **N-6-E**<br>applying a knowledge of basic math facts and arithmetic operations to real-life situations<br><br>**N-7-E**<br>constructing, using, and explaining procedures to compute and estimate with whole numbers (for example, mental math strategies)<br><br>**N-8-E**<br>selecting and using appropriate computational methods and tools for given situations involving whole numbers (for example, estimation, mental arithmetic, calculator, or paper and pencil)<br><br>**N-9-E**<br>demonstrating the connection of number and number relations to the other strands and to real-life situations | **N-6-M**<br>constructing, using, and explaining procedures to compute and estimate with rational numbers employing mental math strategies<br><br>**N-7-M**<br>selecting and using appropriate computational methods and tools for given situations involving rational numbers (for example, estimation, or exact computation using mental arithmetic, calculator, computer, or paper and pencil)<br><br>**N-8-M**<br>demonstrating a conceptual understanding and applications of proportional reasoning (for example, determining equivalent ratios, finding a missing term of a given proportion) | **N-7-H**<br>justifying reasonableness of solutions and verifying results |

**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.

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **A-1-E**<br>demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (for example, use letters or boxes to represent values; understand =, ≠, <, and > symbols)<br><br>**A-2-E**<br>modeling and developing strategies for solving equations and inequalities<br><br>**A-3-E**<br>recognizing the connection of algebra to the other strands and to real-life situations (for example, number sentences or formulas to represent real-world problems) | **A-1-M**<br>demonstrating a conceptual understanding of variables, expressions, equations, and inequalities (for example, symbolically represent real-world problems as linear terms, equations, or inequalities)<br><br>**A-2-M**<br>modeling and developing methods for solving equations and inequalities (for example, using charts, graphs, manipulatives, and/or standard algebraic procedures)<br><br>**A-3-M**<br>representing situations and number patterns with tables, graphs, and verbal and written statements, while exploring the relationships among these representations (for example, multiple representations for the same situation)<br><br>**A-4-M**<br>analyzing tables and graphs to identify relationships exhibited by the data and making generalizations based upon these relationships<br><br>**A-5-M**<br>demonstrating the connection of algebra to the other strands and to real-life situations. | **A-1-H**<br>demonstrating the ability to translate real-world situations (for example, distance-versus-time relationships, population growth, growth functions for diseases, growth of minimum wage, auto insurance tables) into algebraic expressions, equations, and inequalities and vice versa<br><br>**A-2-H**<br>recognizing the relationship between operations involving real numbers and operations involving algebraic expressions<br><br>**A-3-H**<br>using tables and graphs as tools to interpret algebraic expressions, equations, and inequalities<br><br>**A-4-H**<br>solving algebraic equations and inequalities using a variety of techniques with the appropriate tools (for example, handheld manipulatives, graphing calculator, symbolic manipulator, or pencil and paper) |

**Strand M: Measurement**

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

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **M-1-E**<br>applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences<br><br>**M-2-E**<br>selecting and using appropriate standard and non-standard units of measure (for example, paper clips and Cuisenaire rods) and tools for measuring length, area, capacity, weight/mass, and time for a given situation by considering the purpose and precision required for the task<br><br>**M-3-E**<br>using estimation skills to describe, order, and compare measures of length, capacity, weight/mass, time, and temperature | **M-1-M**<br>applying the concepts of length, area, surface area, volume, capacity, weight, mass, money, time, temperature, and rate to real-world experiences<br><br>**M-2-M**<br>demonstrating an intuitive sense of measurement (for example, estimating and determining reasonableness of measures)<br><br>**M-3-M**<br>selecting appropriate units and tools for tasks by considering the purpose for the measurement and the precision required for the task (for example, length of a room in feet rather than inches)<br><br>**M-4-M**<br>using intuition and estimation skills to describe, order, and compare formal and informal measures (for example, ordering cup, pint, quart, gallon; comparing a meter to a yard)<br><br>**M-5-M**<br>converting from one unit of measurement to another within the same system<br><br>**M-6-M**<br>demonstrating the connection of measurement to the other strands and to real-life situations | **M-1-H**<br>selecting and using appropriate units, techniques, and tools to measure quantities in order to achieve specified degrees of precision, accuracy, and error (or tolerance) of measurements<br><br>**M-2-H**<br>demonstrating an intuitive sense of measurement (for example, estimating and determining reasonableness of results as related to area, volume, mass, rate, and distance)<br><br>**M-3-H**<br>estimating, computing, and applying physical measurement using suitable units (for example, calculate perimeter and area of plane figures, surface area and volume of solids presented in real-world situations)<br><br>**M-4-H**<br>demonstrating the concept of measurement as it applies to real-world experiences |

**Strand M: Measurement (continued)**

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **M-4-E**<br>converting from one unit of measurement to another within the same system (customary and metric); comparisons between systems should be based on intuitive reference points, not formal computations (for example, a meter is a little longer than a yard)<br><br>**M-5-E**<br>demonstrating the connection of measurement to the other strands and to real-life situations | | |

**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.

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **G-1-E**<br>determining the relationships among shapes<br><br>**G-2-E**<br>identifying, describing, comparing, constructing, and classifying two-dimensional and three-dimensional geometric shapes using a variety of materials<br><br>**G-3-E**<br>making predictions regarding combinations, subdivisions, and transformations (slides, flips, turns) of simple plane geometric shapes<br><br>**G-4-E**<br>drawing, constructing models, and comparing geometric shapes with special attention to developing spatial sense<br><br>**G-5-E**<br>identifying and drawing lines and angles and describing their relationships to each other and to the real world<br><br>**G-6-E**<br>demonstrating the connection of geometry to the other strands and to real-life situations | **G-1-M**<br>using estimation skills to describe, order, and compare geometric measures<br><br>**G-2-M**<br>identifying, describing, comparing, constructing, and classifying geometric figures and concepts<br><br>**G-3-M**<br>making predictions regarding transformations of geometric figures (for example, make predictions regarding translations, reflections, and rotations of common figures)<br><br>**G-4-M**<br>constructing two- and three-dimensional models<br><br>**G-5-M**<br>making and testing conjectures about geometric shapes and their properties<br><br>**G-6-M**<br>demonstrating an understanding of the coordinate system (for example, locate points, identify coordinates, and graph points in a coordinate plane to represent real-world situations) | **G-1-H**<br>identifying, describing, comparing, constructing, and classifying geometric figures in two and three dimensions using technology where appropriate to explore and make conjectures about geometric concepts and figures<br><br>**G-2-H**<br>representing and solving problems using geometric models and the properties of those models (for example, Pythagorean Theorem or formulas involving radius, diameter, and circumference)<br><br>**G-3-H**<br>solving problems using coordinate methods, as well as synthetic and transformational methods (for example, transform on a coordinate plane a design found in real-life situations)<br><br>**G-4-H**<br>using inductive reasoning to predict, discover, and apply geometric properties and relationships (for example, patty paper constructions, sum of the angles in a polygon)<br><br>**G-5-H**<br>classifying figures in terms of congruence and similarity and applying these relationships |

**Strand G: Geometry (continued)**

| K–4 | 5–8 | 9–12 |
|---|---|---|
| | **G-7-M**<br>demonstrating the connection of geometry to the other strands and to real-life situations (for example, applications of the Pythagorean Theorem) | **G-6-H**<br>demonstrating deductive reasoning and mathematical justification (for example, oral explanation, informal proof, and paragraph proof) |

**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.

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **D-1-E**<br>collecting, organizing, and describing data based on real-life situations<br><br>**D-2-E**<br>constructing, reading, and interpreting data in charts, graphs, tables, etc.<br><br>**D-3-E**<br>formulating and solving problems that involve the use of data<br><br>**D-4-E**<br>exploring, formulating, and solving sequence-of-pattern problems involving selection and arrangement of objects/numerals<br><br>**D-5-E**<br>predicting outcomes based on probability (for example, make predictions of same chance, more likely, or less likely; determine fair and unfair games)<br><br>**D-6-E**<br>demonstrating the connection of data analysis, probability, and discrete math to other strands and real-life situations | **D-1-M**<br>systematically collecting, organizing, describing, and displaying data in charts, tables, plots, graphs, and/or spreadsheets<br><br>**D-2-M**<br>analyzing, interpreting, evaluating, drawing inferences, and making estimations, predictions, decisions, and convincing arguments based on organized data (for example, analyze data using concepts of mean, median, mode, range, random samples, sample size, bias, and data extremes)<br><br>**D-3-M**<br>describing informal thinking procedures (for example, 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")<br><br>**D-4-M**<br>analyzing various counting and enumeration procedures with and without replacement (for example, find the total number of possible outcomes or possible choices in a given situation) | **D-1-H**<br>designing and conducting statistical experiments that involve the collection, representation, and analysis of data in various forms<br><br>**D-2-H**<br>recognizing data that relate two variables as linear, exponential, or otherwise in nature (for example, match a data set, linear or non-linear, to a graph and vice versa)<br><br>**D-3-H**<br>using simulations to estimate probabilities (for example, lists and tree diagrams)<br><br>**D-4-H**<br>demonstrating an understanding of the calculation of finite probabilities using permutations, combinations, sample spaces, and geometric figures<br><br>**D-5-H**<br>recognizing events as dependent or independent in nature and demonstrating techniques for computing multiple-event probabilities<br><br>**D-6-H**<br>recognizing and answering questions about data that are normally or non-normally distributed |

**Strand D: Data Analysis, Probability, and Discrete Math (continued)**

| K–4 | 5–8 | 9–12 |
|---|---|---|
| | **D-5-M**<br>comparing experimental probability results with theoretical probability (for example, representing probabilities of concrete situations as common fractions, investigating single-event and multiple-event probability, using sample spaces, geometric figures, tables, and/or graphs)<br><br>**D-6-M**<br>demonstrating the connection of data analysis, probability, and discrete math to other strands and to real-life situations | **D-7-H**<br>making inferences from data that are organized in charts, tables, and graphs (for example, pictograph; bar, line, or circle graph; stem-and-leaf plot or scatter plot)<br><br>**D-8-H**<br>using logical thinking procedures, such as flow charts, Venn diagrams, and truth tables<br><br>**D-9-H**<br>using discrete math to model real-life situations (for example, fair games or elections, map coloring) |

**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.

| K–4 | 5–8 | 9–12 |
|---|---|---|
| **P-1-E**<br>recognizing, describing, extending, and creating a wide variety of numerical (for example, skip counting of whole numbers), geometrical, and statistical patterns<br><br>**P-2-E**<br>representing and describing mathematical relationships using tables, variables, open sentences, and graphs<br><br>**P-3-E**<br>recognizing the use of patterns, relations, and functions in other strands and in real-life situations | **P-1-M**<br>describing, extending, analyzing, and creating a wide variety of numerical, geometrical, and statistical patterns (for example, skip counting of rational numbers, and simple exponential number patterns)<br><br>**P-2-M**<br>describing and representing relationships using tables, rules, simple equations, and graphs<br><br>**P-3-M**<br>analyzing relationships to explain how a change in one quantity results in a change in another (for example, change in the dimensions of a rectangular solid affects the volume)<br><br>**P-4-M**<br>demonstrating the pervasive use of patterns, relations, and functions in other strands and in real-life situations | **P-1-H**<br>modeling the concepts of variables, functions, and relations as they occur in the real world, and using the appropriate notation and terminology<br><br>**P-2-H**<br>translating between tabular, symbolic, or graphic representations of functions<br><br>**P-3-H**<br>recognizing behavior of families of elementary functions, such as polynomial, trigonometric, and exponential functions, and, where appropriate, using graphing technologies to represent them<br><br>**P-4-H**<br>analyzing the effects of changes in parameters (for example, coefficients and constants) on the graphs of functions, using technology whenever possible<br><br>**P-5-H**<br>analyzing real-world relationships that can be modeled by elementary functions |

# Louisiana Educational Assessment Program
# Mathematics Achievement Level Descriptors: Grade 4

**Note:** These descriptors have been modified slightly from the 1999 publication to match the condensed descriptors on the updated 2006 Individual Student Reports.

| Achievement Level | Descriptors |
|---|---|
| **Advanced** | Students scoring at this level generally exhibit the ability to<br>• solve complex and nonroutine, real-world problems in all the Louisiana mathematics content strands;<br>• display mastery in the use of four-function calculators, rulers, and geometric shapes;<br>• draw logical conclusions and justify answers and solution processes by explaining the procedures and the rationale for using them;<br>• go beyond the obvious in their interpretations; and<br>• communicate their thoughts clearly and concisely. |
| **Mastery** | Students scoring at this level generally exhibit the ability to<br>• use whole numbers to estimate, compute, and determine whether results are reasonable;<br>• conceptually understand fractions, decimals, and percents and their relationships;<br>• solve real-world problems in all the Louisiana mathematics content strands;<br>• accurately use four-function calculators, rulers, and geometric shapes appropriately;<br>• employ problem-solving strategies such as identifying and using appropriate information; and<br>• organize and present written solutions with both supporting information and explanations of how they were achieved. |
| **Basic** | Students scoring at this level generally exhibit the ability to<br>• estimate and use basic facts to perform simple computations with whole numbers;<br>• show some understanding of fractions, decimals, and percents and their relationships;<br>• solve some simple real-world problems in all the Louisiana mathematics content strands;<br>• use—with some degree of accuracy—four-function calculators, rulers, and geometric shapes; and<br>• provide written responses that are often minimal and presented without supporting information. |

## Mathematics Achievement Level Descriptors: Grade 4 (continued)

| | |
|---|---|
| **Approaching Basic** | Students scoring at this level generally exhibit the ability to<br>• use basic facts to perform simple computations with whole numbers;<br>• recognize fractions, decimals, and percents;<br>• exhibit difficulty applying conceptual knowledge in solving real-world problems;<br>• use—with some degree of accuracy—four-function calculators, rulers, and geometric shapes; and<br>• provide, at best, only minimal written responses. |
| **Unsatisfactory** | Students scoring at this level have not demonstrated the fundamental knowledge and skills needed for the next level of schooling. Students at this level generally have not exhibited the ability to<br>• use basic facts to perform simple computations with whole numbers;<br>• recognize fractions, decimals, and percents;<br>• apply conceptual knowledge in solving real-world problems;<br>• use—with some degree of accuracy—four-function calculators, rulers, and geometric shapes; or<br>• provide relevant written responses. |

LEAP

# MATHEMATICS REFERENCE SHEET

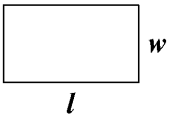
## Grade 4

**Use the information below to answer questions on the Mathematics test.**

| |
|---|
| 1 foot = 12 inches |
| 1 yard = 3 feet |
| 1 pound = 16 ounces |

| |
|---|
| 1 meter = 1,000 millimeters |
| 1 meter = 100 centimeters |
| 1 kilometer = 1,000 meters |
| 1 liter = 1,000 milliliters |
| 1 kilogram = 1,000 grams |

Rectangle




Area = $l \times w$

Perimeter = $l + l + w + w$

| |
|---|
| 1 pint = 2 cups |
| 1 quart = 2 pints |
| 1 gallon = 4 quarts |

**Note:** The Mathematics Reference Sheet has been reduced in size for this document. A version suitable for printing can be found on the Louisiana Department of Education Web site.