2010

FCAT 2.0

Florida Comprehensive Assessment Test®

FCAT 2.0 MATHEMATICS

Test Item Specifications

Grades 6–8

(Updated January 2012)

FLORIDA DEPARTMENT OF EDUCATION
www.fldoe.org

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Introduction

In recent years, two realities focused attention on the need to reevaluate Florida's Sunshine State Standards. First, in 2005, outside consultants reviewed the 1996 Standards and suggested that the benchmark language offer greater specificity to indicate clearly what teachers should teach and what students should be able to do. Second, federal legislation through the *No Child Left Behind Act of 2001* (NCLB) holds schools and school districts accountable for how well each child is learning, and further emphasizes the need to hone expectations for all students.

In January 2006, the Department of Education (DOE) committed to a six-year cycle of review and revision of the K–12 content standards. The mathematics standards were rewritten and the Next Generation Sunshine State Standards (NGSSS) for mathematics were adopted by the Florida State Board of Education in September 2007 (available online at: http://www.floridastandards.org/Standards/FLStandardSearch.aspx).

The NGSSS are divided into benchmarks that identify what a student should know and be able to do at each grade level. This document, *FCAT 2.0 Mathematics Test Item Specifications, Grades 6–8* (*Specifications*), provides information about the benchmarks, the stimulus types, and the test items.

The Florida Comprehensive Assessment Test® 2.0 (FCAT 2.0) measures achievement of Florida students in writing, reading, mathematics, and science. End-of-course (EOC) assessments measure achievement of Florida students who have completed coursework in Algebra 1, Biology 1, Geometry, and U.S. History.

Origin and Purpose of the *Specifications*

The Florida Department of Education and committees of experienced Florida educators developed and approved the specifications documents. The *Specifications* is a resource document that defines the content and format of the test and test items for item writers and reviewers. Each *Specifications* document indicates the alignment of items with the NGSSS. It also serves to provide all stakeholders with information about the scope and function of the FCAT 2.0 and end-of-course assessments.

Scope of this Document

The *Specifications* for Grades 6–8 provides general and grade-specific guidelines for the development of all test items used in the FCAT 2.0 Mathematics test for Grades 6–8. Three additional *Specifications* documents provide the same information for the FCAT 2.0 Mathematics Grades 3–5, Algebra 1 EOC Assessment, and Geometry EOC Assessment.

The Overall Considerations section in this Introduction provides an explanation of the mathematics elements assessed by the test. The Criteria for FCAT 2.0 Mathematics Test Items section addresses the quality of the stimuli and test items and selection and development of multiple-choice items. The Item Difficulty and Cognitive Complexity section addresses cognitive complexity levels as well as item difficulty and universal design. The Grade-Level Specifications section contains specific information about each benchmark. This section identifies the manner in which each benchmark is assessed at Grades 6–8, provides content limits and stimulus attributes for each benchmark, and gives specific information about content, item types, and response attributes.

Overall Considerations

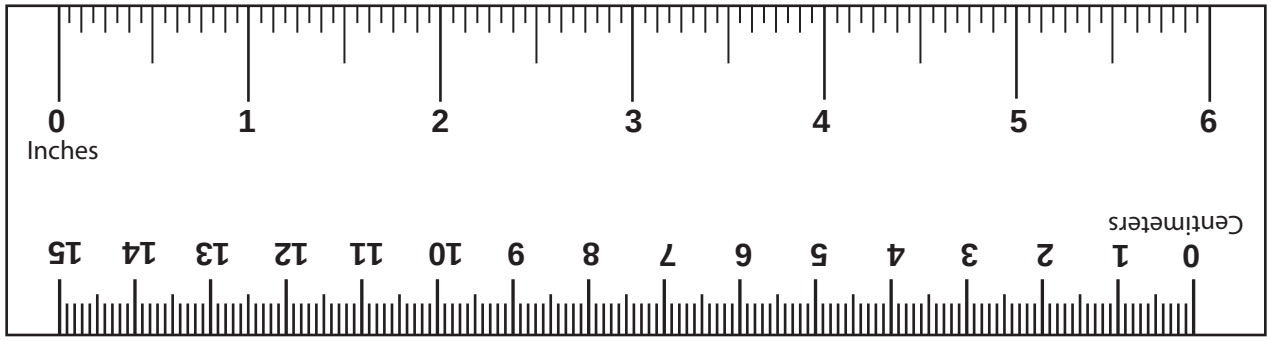
This section of the *Specifications* describes the guidelines that apply to all test items developed for the FCAT 2.0 Mathematics Grades 6–8.

Overall considerations are broad item-development issues that should be addressed during the development of test items. Other sections of Criteria for FCAT 2.0 Mathematics Test Items relate more specifically to one aspect of the development (for example, individual item types or content limits).

1. Each item should be written to measure primarily one benchmark; however, other benchmarks may also be reflected in the item content.
2. When benchmarks are combined for assessment, the individual specification indicates which benchmarks are combined.
3. Items should be appropriate for students in terms of grade-level difficulty, cognitive development, and reading level.
4. At a given grade, the test items will exhibit a varied range of difficulty.
5. For mathematics items, the reading level should be approximately one grade level below the grade level of the test, except for specifically assessed mathematical terms or concepts.
6. Items should not disadvantage or exhibit disrespect to anyone in regard to age, gender, race, ethnicity, language, religion, socioeconomic status, disability, or geographic region.
7. At Grades 3–6, all items should be written so they can be answered without using a calculator. At Grades 7 and 8, students are allowed to use a four-function calculator, although items should still be written to be answered without a calculator within the timing guidelines for each item type. For the Algebra 1 EOC Assessment, a four-function calculator will also be allowed. For the Geometry EOC Assessment, a scientific calculator will be used.
8. Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
9. Some items should provide information for students to analyze and use in order to respond to the items.
10. Items should provide clear and complete instructions to students.
11. Each item should be written clearly and unambiguously to elicit the desired response.
12. A reference sheet containing appropriate formulas and conversions is provided to students in Grades 5, 6–8, 10 (1996 Standards), Algebra 1 EOC, and Geometry EOC for use during testing. Copies of the reference sheets are included in Appendix G of this document.

13. Items on the FCAT 2.0 and EOC assessments should be written so that students are expected to select or provide the most accurate answer possible. Students should not round decimal equivalents and/or approximations until the final step of the item or task. Whenever possible, the item stem should specify the decimal place, equivalent fraction, and/or *pi* approximation needed for the answer. In most cases, front-end estimation and truncation are not accurate processes for estimation.

14. The FCAT 2.0 Mathematics Grades 3 and 4 tests will require the use of a six-inch ruler with both metric and standard units. The metric edge will be in millimeter and centimeter increments. The standard edge will be in $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, and one-inch increments.



Criteria for FCAT 2.0 Mathematics Test Items

FCAT 2.0 Mathematics includes two types of test items: multiple-choice items (MC) and gridded-response items (GR). The general specifications on pages 4 through 16 cover the following criteria for the FCAT 2.0:

- Use of Graphics
- Item Style and Format
- Scope of Items
- Guidelines for Item Writers
- Cognitive Complexity of FCAT 2.0 Mathematics Items
- Universal Design

Use of Graphics

Graphics are used extensively in the FCAT 2.0 to provide both necessary and supplemental information; that is, some graphics contain information that is necessary for answering the question, while other graphics illustrate or support the context of the question. The benchmarks assessed by the FCAT 2.0 require different levels of graphics and illustrations. For example, the standards involving geometry depend heavily upon graphics to present geometric concepts and/or properties required for answering a question. In contrast, items or tasks in other benchmarks may contain graphics or pictures that illustrate and enhance interest but are not necessary to answer the question.

All artwork must be high quality; clip art is not acceptable under any conditions.

Most of the individual benchmark specifications in the *Specifications* indicate the extent to which graphics should be used to support test items developed for the benchmark. When no reference is made to the use of graphics, graphics are not required, even though they may be used.

Item Style and Format

This section presents stylistic guidelines and formatting directions that should be followed while developing test items. Guidelines are provided separately for each item type to be developed.

General Guidelines

1. Items should be clear and concise, and they should use vocabulary and sentence structure appropriate for the assessed grade level.
2. The final sentence of any MC or GR item stem must be expressed as a question.
3. If an item or task asks a question involving the word *not*, the word *not* should be emphasized by all uppercase letters (e.g., "Which of the following is NOT an example of . . .").
4. For MC and GR items that refer to an estimate (noun), lowercase letters should be used.
5. As appropriate, boldface type should be used to emphasize key words in GR items (e.g., **least**, **most**, **greatest**, **percent**, **mode**, **median**, **mean**, **range**, etc.).

6. Masculine pronouns should NOT be used to refer to both sexes. Plural forms should be used whenever possible to avoid gender-specific pronouns (e.g., instead of "The student will make changes so that he . . . ," use "The students will make changes so that they . . .").
7. An equal balance of male and female names should be used, including names representing different ethnic groups appropriate for Florida.
8. For clarity, operation symbols, equality signs, and ordinates should be preceded and followed by one space.
9. Decimal numbers between -1 and 1 (including currency) should have a leading zero.
10. Metric numbers should be expressed in a single unit when possible (e.g., 1.4 kilograms instead of 1 kilogram 400 grams). At Grade 3, there is an exception for MA.3.G.5.1 and MA.3.G.5.2.
11. Decimal notation should be used for numbers with metric units (e.g., 1.2 grams instead of $1\frac{1}{5}$ grams).
12. The comma should be used in a number greater than or equal to 1,000 unless the number indicates a metric unit. Metric numbers with four digits should be presented without a comma or a space (e.g., 9960 meters). For metric numbers with more than four digits, a thin space should be inserted in place of a comma (e.g., 10 123 kilograms). For all grades, dollar amounts of $1,000 or more should include commas.
13. Units of measure should be spelled out, except in graphics, where an abbreviation may be used (e.g., *ft* or *yd*). Abbreviations that also spell a word must be punctuated to avoid confusion. For example, to avoid confusion with the preposition *in*, the abbreviation *in*. should include a period and should be used for the unit of measure *inches*. If an abbreviation is used in a graphic, an explanation of the meaning of the abbreviation should be included in the stem.
14. In titles for tables and charts and in labels for axes, the units of measure should be included, preferably in lowercase and in parentheses, e.g., *height (in inches)*.
15. Fractions should be typed with a horizontal fraction bar. The numerator and denominator should be centered with respect to each other. The bar should cover all portions (superscripts, parentheses, etc.) of the numerator and denominator. In a mixed number, a half space should appear between the whole number and the fraction. If a variable appears before or after a fraction bar, the variable should be centered with respect to the fraction bar. If a stimulus, stem, or set of responses contains a fraction in fractional notation, that portion of the item should be 1.5-spaced.
16. In general, numbers zero through nine should be presented as words, and numbers 10 and above should be presented as numerals. In the item stem, any numbers needed to compute answers should be presented as numerals.

Multiple-Choice (MC) Items

1. MC items should take an average of one minute per item to solve.
2. MC items are worth one point each.
3. MC items should have four answer choices (A, B, C, D or F, G, H, I for alternating items).
4. During item development and review, the correct response should be indicated with a star next to the answer choice letter.
5. During item development and review, the rationale for options (incorrect answer choices) should be indicated and set off in brackets.
6. In most cases, answer choices should be arranged vertically beneath the item stem.
7. If four graphics are labeled horizontally or vertically and horizontally, the labeling should be as follows:

A. B. C. D.	**or**	A. C. B. D.	
Figure 1 Figure 2 Figure 3 Figure 4	**or**	Figure 1 Figure 2	Figure 3 Figure 4

8. If the answer choices for an item are strictly numerical, they should be arranged in ascending or descending order, with the place values of digits aligned. When the item requires the identification of relative size or magnitude, choices should be arranged as they are presented in the item stem.
9. If the answer choices for an item are neither strictly numerical nor denominate numbers, the choices should be arranged by the logic presented in the question, by alphabetical order, or by length.
10. Distractors should represent computational or procedural errors commonly made by students who have not mastered the assessed concepts. Each distractor should be a believable answer for someone who does not really know the correct answer.
11. Outliers (i.e., answer choices that are longer phrases or sentences than the other choices, or choices with significantly more/fewer digits than the other choices) should NOT be used.
12. Responses such as “None of the Above,” “All of the Above,” and “Not Here” should NOT be used.
13. Responses such as “Not Enough Information” or “Cannot Be Determined” should NOT be used unless they are a part of the benchmark being assessed. They should not be used as distractors for the sake of convenience.
14. If a response is a phrase, the phrase should start with a lowercase letter. No period should be used at the end of a phrase.
15. If a response is a sentence, the sentence should be conventionally capitalized and punctuated.

Gridded-Response (GR) and Fill-In Response (FR) Items

1. Grades 4–8 use GR items, while the Algebra 1 EOC and Geometry EOC use FR items.
2. GR and FR items should take an average of 1.5 minutes per item to complete.
3. GR and FR items are worth one point each.
4. The bubble grids used with GR items contain four, five, six, or seven columns. Columns in which students may bubble a numeral contain the digits 0 through 9 enclosed in bubbles. Appendix H provides examples of the various FCAT 2.0 Mathematics grids.
5. The GR format is designed for items that require a positive numeric solution (whole numbers, decimals, percents, or fractions) at Grades 4–7. GR items in two benchmarks in Grade 7 and all GR items in Grade 8 may require a negative numeric solution. A seventh column is added to these grids to allow for the negative sign. Note: The only benchmarks in Grade 7 that will use negative grids are MA.7.A.3.2 and MA.7.A.3.3.
6. Multiple formats (e.g., equivalent fractions and decimals) are acceptable for items as long as each form of the correct response can be recorded in the grid.
7. Four- or five-column grids are used for Grades 4 and 5 and may be preceded with a dollar sign ($) or followed by a percent sign (%), as appropriate.
8. Special grids are provided at Grades 4 and 5 for gridding decimal numbers. The decimal grid is six columns wide with a fixed decimal point in the third column from the left. That is, there are two columns preceding the column with the decimal and three columns following it.
9. There are two types of currency grids for Grades 4 and 5. One includes a decimal point for dollars and cents, and one does not. Both grids have a dollar sign preceding the grid.
10. Grades 6 and 7 use a six-column grid that includes the digits 0 through 9 plus two symbols: a decimal point (.) and a fraction bar (/) for gridding fractions. The fraction bar cannot be used in the first or the sixth column.
11. Gridded items assessing two Grade 7 benchmarks and all gridded items in Grade 8 use a seven-column grid. The first column of the grid is used for only a negative sign, and the remaining columns include the digits 0 through 9 plus two symbols: the decimal point (.) and the fraction bar (/) for gridding fractions. The fraction bar cannot be used in the second or the seventh column.
12. All grids include light shading in alternate columns. Shading should not interfere with students' ability to read the numbers inside each column.
13. GR/FR items should include instructions that specify the unit in which the answer is to be provided (e.g., inches). If several units of measure are in the item (e.g., in an item involving a conversion), the final unit needed for the answer should be written in boldface.
14. GR/FR items are written with consideration for the number of columns in the grid.
15. The Algebra 1 and Geometry EOC will be computer based and will use a seven-column FR for items not assessed by multiple choice.

Scope of Items

The scope of FCAT 2.0 Mathematics test items for Grades 6–8 is presented in Appendix B, which gives the benchmarks for Grades 6–8. The benchmarks serve as the objectives to which the test items are written. There may be additional specifications or restrictions by grade level; these are given in the General Content Limits by Grade Level section of the *Specifications* for Grades 6–8.

Some of the benchmarks are assessed across Grades 3–8. These benchmarks are introduced at one grade with the understanding that they will be assessed at higher levels of difficulty in each succeeding grade. Florida's NGSSS are available at: http://www.floridastandards.org/Standards/FLStandardSearch.aspx.

Guidelines for Item Writers

FCAT 2.0 Mathematics item writers must have a comprehensive knowledge of the assessed mathematics curriculum and a strong understanding of the cognitive abilities of the students taking the test. Item writers should know and consistently apply the guidelines established in these *Specifications* as well as contribute to the goal of developing test content that allows students to perform at their best. Item writers are also expected to use their best judgment in writing items that measure the mathematics benchmarks of the NGSSS without introducing extraneous elements that reflect bias for or against a group of students.

Item writers for FCAT 2.0 Mathematics must submit items in a particular format and must include the following information about each item. Because items are rated by committees of Florida educators following submission to the DOE, familiarity with the directions for rating items (found in Appendix E) would prove useful to all item writers.

Format

Item writers must submit items in the agreed-upon template. All appropriate sections of the template should be completed before the items are submitted.

Sources

Item writers are expected to provide sources of all verifiable information included in the item. Acceptable sources include up-to-date textbooks, magazines, and journals respected by the mathematics community, and Internet sites maintained by reputable organizations such as universities. It may be necessary to provide sources verifying why a correct answer is correct, as well as why other responses are incorrect.

Correct Response

Item writers must supply the correct response.

- For multiple-choice items, this includes an explanation of why each of the distractors is incorrect.
- For gridded-response items, this includes explanations of why the correct answer is correct and an explanation of additional possible correct answers.
- For fill-in response items, this includes explanations of why the correct answer is correct and an explanation of additional possible correct answers.

Submission of Items

When submitting items, item writers must balance several factors. Item submissions should:

- include items of varying difficulty;
- include items of varying cognitive complexity;
- have an approximate balance, for multiple-choice items, of the correct response among the four answer options;
- have an equal balance of male and female names; and
- include names representing different ethnic groups in Florida.

Item Difficulty and Cognitive Complexity of FCAT 2.0 Mathematics Items

Educational standards and assessments can be aligned based on the category of content covered and also on the complexity of knowledge required. The FCAT 2.0 items, while assessing Florida's NGSSS, must also reflect this goal and standard. It is important to develop items that elicit student responses that demonstrate the complexity of knowledge and skills required to meet these objectives. The degree of challenge of FCAT 2.0 items is currently categorized in two ways: **item difficulty** and **cognitive complexity.**

Item Difficulty

The difficulty of FCAT 2.0 items is initially estimated by committees of educators participating in Item Content Review meetings each year. As each test item is reviewed, committee members make a prediction of difficulty based upon their knowledge of student performance at the given grade level. The classification scheme used for this prediction of item difficulty is based on the following:

Easy	More than 70 percent of the students are likely to respond correctly.
Average	Between 40 percent and 70 percent of the students are likely to respond correctly.
Challenging	Fewer than 40 percent of the students are likely to respond correctly.

After an item appears on a test, item difficulty refers to the actual percentage of students who chose the correct answer.

Cognitive Complexity

Cognitive complexity refers to the cognitive demand associated with an item. In the early years of the FCAT program, the DOE used Bloom's Taxonomy[1] to classify test items; however, Bloom's Taxonomy is difficult to use because it requires an inference about the skill, knowledge, and background of the students responding to the item. Beginning in 2004, the DOE implemented a new cognitive classification system based upon Dr. Norman L. Webb's Depth of Knowledge (DOK) levels.[2] The rationale for classifying an item by its DOK level of complexity focuses on the *expectations made of the item*, not on the *ability of the student*. When classifying an item's demands on thinking (i.e., what the item requires the student to recall, understand, analyze, and do), it is assumed that the student is familiar with the basic concepts of the task. Items are chosen for the FCAT 2.0 based on the NGSSS and their grade-level appropriateness, but the complexity of the items remains independent of the particular curriculum a student has experienced. On any given assessment, the cognitive complexity of a multiple-choice item may be affected by the distractors (incorrect answer options). The cognitive complexity of an item depends on the grade level of the assessment; an item that has a high level of cognitive complexity at one grade may not be as complex at a higher grade.

The categories—low complexity, moderate complexity, and high complexity—form an ordered description of the demands an item may make on a student. For example, low-complexity items may require a student to solve a one-step problem. Moderate-complexity items may require multiple steps. High-complexity items may require a student to analyze and synthesize information. The distinctions made in item complexity ensure that items will assess the depth of student knowledge at each benchmark. The intent of the item writer weighs heavily in determining the complexity of an item.

The pages that follow illustrate some of the varying demands that items might make at each complexity level for FCAT 2.0 Mathematics. Note that items may fit one or more descriptions. In most instances, these items are classified at the highest level of complexity demanded by the item. Caution must be used in referring to the chart of descriptors that is provided for each cognitive complexity level. This chart is provided for ease of reference, but the ultimate determination of item complexity should be made considering the overall cognitive demand placed on a student. A table also provides the breakdown of the percentage of points by cognitive complexity level.

Item writers are expected to evaluate their items in terms of cognitive complexity and include this on the item template. Items should be written to the highest level of complexity as appropriate to the assessed benchmark.

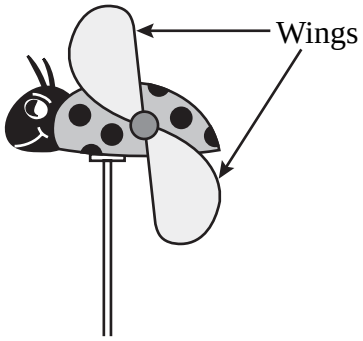
[1] Bloom, B.S. et al. *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain.* New York: McKay, 1956.
[2] Webb, Norman L. and others. "Webb Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. http://www.wcer.wisc.edu/WAT/index.aspx.

Low Complexity

FCAT 2.0 Mathematics low-complexity items rely heavily on the recall and recognition of previously learned concepts and principles. Items typically specify what the student is to do, which often is to carry out some procedure that can be performed mechanically. It is not left to the student to come up with an original method or solution.

Below is an example of a low-complexity item that is based on Benchmark MA.7.G.4.2. For more information about this item, see page 115.

A *whirligig* is an object, or part of an object, that spins or whirls. Josette created this ladybug whirligig as an ornament for her front lawn.



The congruent wings of the ladybug will spin around the circle between them. Which transformation of the wings would make the ladybug appear exactly as it does in the picture?

A. a clockwise rotation of 90°
★ **B.** a clockwise rotation of 180°
C. a counterclockwise rotation of 45°
D. a counterclockwise rotation of 270°

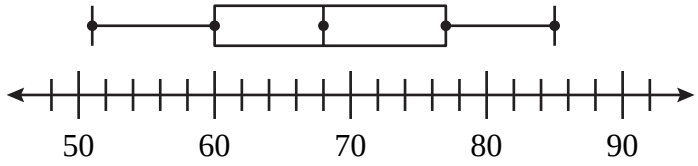
Moderate Complexity

FCAT 2.0 Mathematics moderate-complexity items involve more flexible thinking than low-complexity items. Items require a response that goes beyond the habitual, is not explicitly specified in the text, and ordinarily has more than a single step. The student is expected to decide what to do—using informal methods of reasoning and problem-solving strategies—and to bring together skill and knowledge from various domains.

Below is an example of a moderate-complexity item that is based on Benchmark MA.8.S.3.1. For more information about this item, see page 155.

A baseball team played 28 games last season. The box-and-whisker plot below represents the temperatures in degrees Fahrenheit (°F) at the start of each game.

BASEBALL GAME TEMPERATURES



If the data set has no mode, what is the maximum number of times that the temperature was 60°F or greater at the start of a baseball game last season?

Correct Answer: 21

High Complexity

FCAT 2.0 Mathematics high-complexity items make heavy demands on student thinking. Students must engage in more abstract reasoning, planning, analysis, judgment, and creative thought. Items require that the student think in an abstract and sophisticated way.

Below is an example of a high-complexity item that is based on Benchmark MA.6.A.2.1. For more information about this item, see page 57.

A local amusement park sells tickets for either 1 day, 3 days, or 7 days. The equation below shows the cost of a 3-day ticket, where d equals the cost per day of the 3-day ticket.

$$3d = \$171$$

The total cost of a 7-day ticket costs $28 more than a 3-day ticket. To the nearest cent, how much less is the cost per day of a 7-day ticket than the cost per day of a 3-day ticket?

A. $28.43
★ **B.** $28.57
C. $57.00
D. $57.28

The following chart is provided for ease of reference; however, caution must be used in referring to this chart of descriptors for each cognitive complexity level. The ultimate determination of an item's cognitive complexity should be made considering the intent of the overall cognitive demand placed on a student.

Examples of FCAT 2.0 Mathematics Activities Across Cognitive Complexity Levels		
Low Complexity	**Moderate Complexity**	**High Complexity**
• Recall or recognize a fact, term, or property. • Identify appropriate units or tools for common measurements. • Compute a sum, difference, product, or quotient. • Recognize or determine an equivalent representation. • Calculate the value of an expression, given specific values for the variables. • Solve a one-step problem. • Retrieve information from a graph, table, or figure. • Perform a single-unit conversion (e.g., feet to inches).	• Solve a problem requiring multiple operations. • Solve a problem involving multiple transformations of a figure or spatial visualization or reasoning. • Retrieve information from a graph, table, or figure and use it to solve a problem. • Compare figures or statements. • Determine a reasonable estimate. • Extend an algebraic or geometric pattern. • Explain steps of a solution process. • Translate and solve a routine problem, given data and conditions. • Represent a situation mathematically in more than one way.	• Solve real-world problems using multiple steps and multiple decision points. • Describe how different representations can be used for different purposes. • Solve a nonroutine problem (as determined by grade-level appropriateness). • Analyze similarities and differences between procedures and concepts. • Generalize an algebraic or geometric pattern. • Formulate an original problem, given a situation. • Solve a problem in more than one way. • Provide a mathematical explanation and/or justification to a problem. • Describe, compare, and contrast solution methods. • Formulate a mathematical model for a complex situation. • Analyze or produce a deductive argument.

Items are classified on the cognitive demand inherent in the test item, not on assumptions about the student's approach to the item. Low-complexity items rely heavily on recall and recognition. Moderate-complexity items require more flexible thinking and may require informal reasoning or problem solving. High-complexity items are written to elicit analysis and abstract reasoning. The table below presents the range for the percentage of raw-score points by cognitive complexity level on each FCAT 2.0 Mathematics test.

Percentage of Points by Cognitive Complexity Level for FCAT 2.0 Mathematics

Assessment	Low	Moderate	High
3–4	25–35	50–70	5–15
5	10–20	55–75	10–20
6–8	10–20	60–80	10–20
Algebra 1 EOC	10–20	60–80	10–20
Geometry EOC	10–20	60–80	10–20

Universal Design

The application of universal design principles helps develop assessments that are usable by the greatest number of test takers, including those with disabilities and nonnative speakers of English. To support the goal of providing access to all students, the test maximizes readability, legibility, and compatibility with accommodations, and test development includes a review for potential bias and sensitivity issues.

The DOE trains both internal and external reviewers to revise items, allowing for the widest possible range of student participation. Item writers must attend to the best practices suggested by universal design including, but not limited to,

- reduction of wordiness;
- avoidance of ambiguity;
- selection of reader-friendly construction and terminology; and
- consistently applied concept names and graphic conventions.

Universal design principles also inform decisions about test layout and design including, but not limited to, type size, line length, spacing, and graphics.

Review Procedures for FCAT 2.0 Mathematics

Prior to appearing on any assessment, all mathematics items must pass several levels of review as part of the development process. Florida educators and citizens, in conjunction with the DOE and assessment contractors, scrutinize all material prior to accepting it for placement on the tests.

Review for Potential Bias

Mathematics items are reviewed by groups of Florida educators generally representative of Florida's geographic regions and culturally diverse population. Items are reviewed for the following kinds of bias: gender, racial, ethnic, linguistic, religious, geographic, and socioeconomic. Item reviews also include consideration of issues related to individuals with disabilities.

Review for Community Sensitivity

Florida citizens associated with a variety of organizations and institutions review all items for issues of potential concern to members of the community at large. The purpose of this review is to ensure that the primary purpose of assessing mathematics achievement is not undermined by inadvertently including in the test any materials that parents and other stakeholders may deem inappropriate. Reviewers are asked to consider the variety of cultural, regional, philosophical, political, and religious backgrounds throughout Florida, and then to determine whether the subject matter will be acceptable to Florida students, their parents, and other members of Florida communities. Test items are written to meet FCAT 2.0 criteria.

Review of Test Items

The DOE and the assessment contractors review all test items during the item development process.

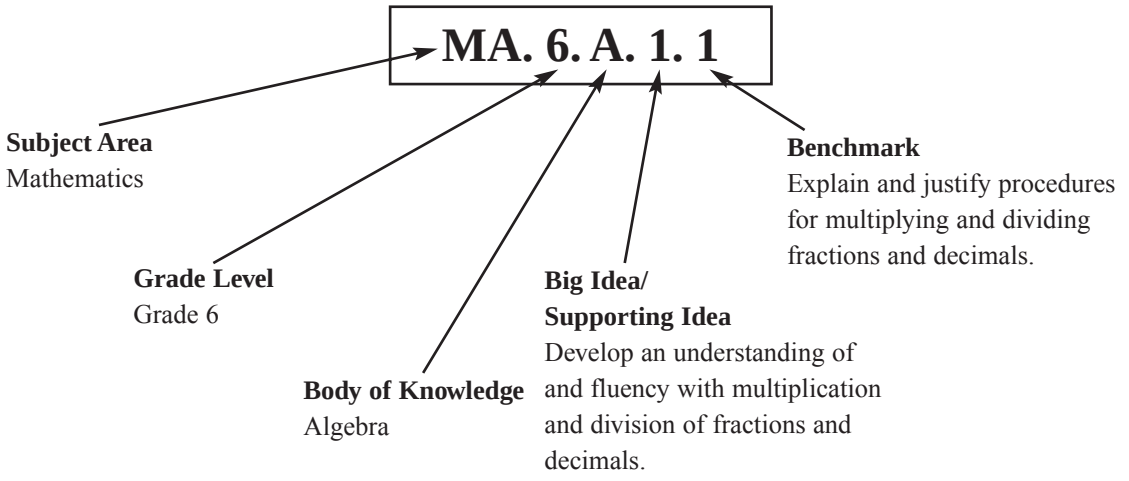
Groups of Florida educators and citizens are subsequently convened to review the items for content characteristics and item specifications. The content review focuses on validity, determining whether each item is a valid measure of the designated NGSSS benchmark, as defined by the grade-level specifications for test items. Separate reviews for bias and sensitivity issues are also conducted as noted above.

FCAT 2.0 items are field tested with a large group of students in Florida to ensure clarity of items before they count toward a student's score. In the event an item does not test well, it is either deleted or revised. Revised items will again require field testing prior to being scored.

Benchmark Classification System

Each benchmark in the NGSSS is labeled with a system of numbers and letters.

- The letters in the *first two positions* of the code identify the **Subject Area** (e.g., MA for mathematics).
- The number in the *third position* represents the **Grade Level** to which the benchmark belongs.
- The letter in the *fourth position* of the code represents the **Body of Knowledge** to which the benchmark belongs.
- The number in the *fifth position* represents the **Big Idea/Supporting Idea** to which the benchmark belongs.
- The number in the *last position* of the code states the specific **Benchmark** under grade-level Big Idea/Supporting Idea.
- Note that, in Grades 3–8, Number and Operations is assessed within the Algebra Body of Knowledge.



Grade 6
Big Idea 1: Develop an understanding of and fluency with multiplication and division of fractions and decimals.
MA.6.A.1.1 Explain and justify procedures for multiplying and dividing fractions and decimals.

Definitions of Benchmark Specifications

The *Specifications* identify how Florida's NGSSS benchmarks are assessed at Grades 3–8, Algebra 1 EOC, and Geometry EOC. For each benchmark assessed in mathematics, the following information is provided in each grade-level *Specifications* section.

Reporting Categories are groupings of related benchmarks from the NGSSS that are used to summarize and report achievement for FCAT 2.0 Mathematics, Algebra 1 EOC, and Geometry EOC.

Standard refers to the standard statement presented in the NGSSS.

Big Idea/ Supporting Idea are general statements of expected student achievement within each reporting category.

Benchmark refers to the benchmark statement presented in the NGSSS. The benchmarks are specific statements of expected student achievement. The benchmarks are different for the different grade levels assessed (as described at the beginning of this section). In some cases, two or more related benchmarks are grouped together because the assessment of one benchmark addresses another benchmark. Such groupings are indicated in the benchmark statement.

Item Types are used to assess the benchmark or group of benchmarks. The types of items used on the FCAT 2.0 are described in the Item Style and Format section of the *Specifications*. In the Sample Items section that follows, the item types are abbreviated as MC for multiple choice and GR for gridded response.

Benchmark Clarifications explain how the achievement of the benchmark will be demonstrated by students for each specific item type. In other words, the clarification statements explain what the student will do when responding to questions of each type.

Content Limits define the range of content knowledge and degree of difficulty that should be assessed in the items for the benchmark.

Benchmark content limits are to be used in conjunction with the General Content Limits identified for each grade level in the *Specifications*. The content limits defined in the Individual Benchmark Specifications section may be an expansion or further restriction of the General Content Limits by Grade Level specified earlier in the *Specifications*.

Stimulus Attributes	define the types of stimulus materials that should be used in the items, including the appropriate use of graphic materials and item context or content.
Response Attributes	define the characteristics of the answers that a student must choose from or provide.
Sample Items	are provided for each type of question assessed. The sample items are presented in a format like that used in the test. The correct answer for each sample item is identified in the following manner: • For MC items, the correct answer is indicated with a five-point star. • For GR items, the acceptable answers are given. • For FR items, the acceptable answers are given.
Item Context	gives a topical frame of reference to real-world applications of the test items.

General Content Limits by Grade Level

Grade 3 General Content Limits

The content limits described below are applicable to all items developed for Grade 3; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

- Items should not require the use of more than two operations.
- Place values should range from ones through hundred thousands.

Addition

- Items should not exceed three 5-digit addends or two 6-digit addends.

Subtraction

- Subtrahends cannot exceed 999,999.
- Minuends and differences should not exceed five digits.

Multiplication

- Items may include whole-number multiplication facts from 0×0 through 9×9.
- Multiples of 10 through 100, multiples of 100 through 1,000, and multiples of 50 through 500 may be used.

Division

- Items may include the related division facts for 0×0 through 9×9.

Decimals

- Decimal numbers are limited to amounts of money to the nearest cent.

Addition, Subtraction, Multiplication, and Division

- Not assessed at Grade 3.

Fractions

- Fractions should have denominators of 1–10, 12, or 16.
- Items may include fractions and mixed numbers up to and including the whole number 5.

Addition, Subtraction, Multiplication, and Division

- Not assessed at Grade 3.

Percent

- Not assessed at Grade 3.

Measurement

- Items will not assess weight/mass, capacity, or temperature in isolation.
- Time and linear measurement, including perimeter, will be assessed.
- Items may use customary and/or metric units.

Grade 4 General Content Limits

The content limits described below are applicable to all items developed for Grade 4; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

- Items should not require the use of more than two operations.
- Place values should range from ones through hundred millions.

Addition

- Items should not exceed three 7-digit addends or two 8-digit addends.

Subtraction

- Subtrahends, minuends, and differences should not exceed eight digits.

Multiplication

- Factors used may include up to two 3-digit numbers, or, when a four-digit factor is used, the other factor may not exceed two digits.
- Multiplication can be shown by use of parentheses [e.g., 5(4)], a multiplication sign (the dot or $\times$), or as a coefficient and variable (e.g., $4n$).

Division

- Divisors should not exceed one digit, unless it is a related division fact of 0×0 through 12×12.
- Dividends should not exceed three digits.
- Quotients may include remainders expressed only as whole numbers.
- Items will not require the use of long division.

Decimals

- Place values could range from tenths through thousandths with no more than five total digits.

Addition, Subtraction, Multiplication, and Division

- Not assessed at Grade 4.

Fractions

- Items may have denominators of 1–20, 25, 50, 100, or 1,000, or denominators that are derived from multiplication facts through 12×12 may also be used (e.g., 24 has the factors 6 and 4; 72 has the factors 8 and 9).

Addition, Subtraction, Multiplication, and Division

- Not assessed at Grade 4.

Percent

- Percents must be equivalent only to halves, fourths, tenths, or hundredths.
- Items dealing with percents will not involve computation using the percent.

Measurement

- Items will not assess weight/mass, time, temperature, perimeter, and/or capacity in isolation.
- Items may use customary and/or metric units.
- See Geometry and Measurement benchmarks for specifics.

Gridded-Response Items

- Answers may not exceed five digits.
- Answers may not include fractions.
- See grid types for appropriate answer formats. See Appendix H.

Grade 5 General Content Limits

The content limits described below are applicable to all items developed for Grade 5; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

- Items should not require the use of more than three operations.
- Integers may range from -500 through 999,999,999.

Addition

- Items should not exceed four addends.
- Items should not exceed four 4-digit addends, three 5-digit addends, or two 6-digit addends.

Subtraction

- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication

- Factors can have up to three digits by three digits or four digits by two digits and could include a 0 in the hundreds, tens, and/or ones places.
- Multiplication can be shown by use of parentheses [e.g., 5(4)], a multiplication sign (the dot or $\times$), or as a coefficient and variable (e.g., 4n).

Division

- Divisors should not exceed two digits.
- Dividends should not exceed four digits.
- Quotients may be expressed as mixed numbers or include remainders.

Decimals

- Place values could range from tenths through thousandths.

Addition

- Items should not require the use of more than four 4-digit addends or two 5-digit addends.

Subtraction

- Subtrahends, minuends, and differences should not exceed five digits.

Multiplication

- Multiplication is limited to the context of money.
- Factors may have up to a four-digit number multiplied by a two-digit number.

Division

- Division is limited to the context of money.
- Divisors should not exceed two digits and must be whole numbers.
- Dividends should not exceed four digits.
- Quotients should not have remainders.

Fractions

- Fractions should have denominators of 1–20, 25, 50, 75, 100, 1,000, or denominators that are derived from multiplication facts through 12×12 may also be used (e.g., 24 has the factors 6 and 4; 72 has the factors 8 and 9).

Addition

- Items should not require the use of more than three addends.
- Items may require the use of up to two mixed numbers with unlike denominators of 2 through 12 (excluding 11).
- Items should not require the use of more than two unlike denominators.

Subtraction

- Items should not require the use of more than two unlike denominators.
- Subtrahends and minuends may use up to two mixed numbers with unlike denominators of 2 through 12 (excluding 11).

Multiplication

- Not assessed at Grade 5.

Division

- Not assessed at Grade 5.

Percent

- When finding equivalent fractions and decimals, items will be limited to percents equivalent to halves, fourths, tenths, and hundredths.
- Items dealing with percents will not involve computation using the percent.

Measurement

- Items will be limited to assessment of length (to the nearest $\frac{1}{16}$ inch), weight/mass, elapsed time, temperature, perimeter, area, and volume/capacity.

Gridded-Response Items

- Answers may not exceed five digits.
- See grid types for appropriate answer formats. See Appendix H.

Grade 6 General Content Limits

The content limits described below are applicable to all items developed for Grade 6; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

- Items should not require the use of more than three operations.
- Place values should range from -500 through 999,999,999.

Addition

- Items should not exceed five addends.
- Addends should not exceed six digits.
- Addends in items with five addends should not exceed four digits.

Subtraction

- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication

- Products should not exceed seven digits.

Division

- Divisors should not exceed two digits.
- Dividends should not exceed four digits, unless a dividend is a multiple of 10 (e.g., 17,240 ÷ 60).
- Quotients should be terminating decimals.

Decimals

- Place values should range from tenths through thousandths.

Addition

- Items should not require the use of more than five addends.
- Addends should not exceed five digits.
- Items with five addends should not use five-digit numbers.

Subtraction

- Subtrahends, minuends, and differences should not exceed five digits.

Multiplication

- Products should not exceed seven digits.

Division

- Divisors should not exceed three digits.
- Dividends should not exceed four digits.
- Quotients should not exceed four digits and must terminate within three decimal places.

Fractions

- Items should use denominators of 1 through 20; any multiple of 2, 3, or 5 through 100; or 1,000; or denominators that are derived from multiplication facts through 12×12.
- Items may include fractions and mixed numbers.

Addition

- Items should not require the use of more than three unlike denominators.

Subtraction

- Items should not require the use of more than three unlike denominators.

Multiplication

- Items may include up to three factors.

Division

- Denominators of fractions must be less than or equal to 12.
- In fractions that must be simplified, the numerator and denominator must have at least one common prime factor of 2, 3, 5, or 7.

Percent

- See benchmark for specific content limits.

Measurement

- Items will not assess conversion of units in isolation.

Grade 7 General Content Limits

The content limits described below are applicable to all items developed for Grade 7; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

Addition
- Items should not require the use of more than five addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- Products should not exceed eight digits.

Division
- Dividends should not exceed five digits.

Decimals

- Place values should range from tenths through ten-thousandths.

Addition
- Items should not exceed five addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- Products should not exceed eight digits.

Division
- Divisors should not exceed three digits.
- Dividends should not exceed five digits.
- Quotients should not exceed seven digits.

Fractions

- Items should use denominators through 1,000.
- Items may include fractions and mixed numbers.

Addition

- Items should not require the use of more than three addends.

Subtraction

- See benchmark for specific content limits.

Multiplication

- See benchmark for specific content limits.

Division

- Divisors cannot be mixed numbers.

Percent

- See benchmark for specific content limits.

Measurement

- See benchmark for specific content limits.

Grade 8 General Content Limits

The content limits described below are applicable to all items developed for Grade 8; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

Addition
- Items should not require the use of more than six addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- See benchmark for specific content limits.

Division
- See benchmark for specific content limits.

Decimals

Addition
- Items should not require the use of more than six addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- See benchmark for specific content limits.

Division
- Quotients should have terminating decimals.

Fractions
- Items should not require the use of more than three addends or factors.

Percent
- See benchmark for specific content limits.

Measurement
- See benchmark for specific content limits.

Algebra 1 and Geometry End-of-Course General Content Limits

The content limits described below are applicable to all items developed for the Algebra 1 and Geometry End-of-Course assessments; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

Whole numbers

Addition
- Items should not require the use of more than six addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- Products should not exceed eight digits.

Division
- Divisors should not exceed three digits.
- Dividends should not exceed five digits.

Decimals

Addition
- Items should not require the use of more than six addends.
- Addends should not exceed six digits.

Subtraction
- Subtrahends, minuends, and differences should not exceed six digits.

Multiplication
- Products should not exceed eight digits.

Division
- Divisors should not exceed three digits, unless dealing with currency.
- Dividends should not exceed five digits, unless dealing with currency.
- Quotients should not exceed seven digits.

Fractions

- Items should not require the use of more than three addends or factors.

Percent

- See benchmark for specific content limits.

Measurement

- See benchmark for specific content limits.

Item Contexts

The situation in which a test question is presented is called the item context. FCAT 2.0 Mathematics questions may be presented in either a real-world or mathematical context; however, other variables must also be considered. Several of these considerations are listed below, and others are described in the Individual Benchmark Specifications. For more information about item contexts, refer to the DOE website at: http://fcat.fldoe.org/fcat2/pdf/MathematicsAppendixA.pdf.

1. The item content should be designed to interest students at the tested levels.
2. The item context should be designed to incorporate subject areas other than mathematics. Specifically, topics from the NGSSS should be used where appropriate. For example, items may require students to work with topics related to The Arts, Language Arts, Social Studies/Consumerism, Science, Foreign Language, or Health/Physical Education.
3. As often as possible, items should be presented in real-world contexts or should be related to real-world situations.
4. Items including specific information or data should be accurate and documented against reliable sources. It may be necessary to obtain copyright permissions.
5. The item content should be timely but not likely to become dated too quickly.
6. Information should be presented through written text and/or through visual material, such as graphs, tables, diagrams, maps, models, and/or other illustrations.
7. All graphs provided to the students should be complete with title, scale, and labeled axes, except when these components are to be completed by the student.
8. All graphics in items should be uncluttered and should clearly depict the necessary information. Graphics should contain relevant details that contribute to the student's understanding of the item or support the context of the item. Graphics should not introduce bias to the item.
9. Extraneous information may be included in items.

Benchmarks Assessed at Grades 3–5

Grade 3	Grade 4	Grade 5
Big Idea 1: Develop understandings of multiplication and division and strategies for basic multiplication facts and related division facts.	**Big Idea 1:** Develop quick recall of multiplication facts and related division facts and fluency with whole number multiplication.	**Big Idea 1:** Develop an understanding of and fluency with division of whole numbers.
MA.3.A.1.1 Model multiplication and division, including problems presented in context: repeated addition, multiplicative comparison, array, how many combinations, measurement, and partitioning.	**MA.4.A.1.1** Use and describe various models for multiplication in problem-solving situations, and demonstrate recall of basic multiplication and related division facts with ease. (Assessed with MA.4.A.1.2.)	**MA.5.A.1.1** Describe the process of finding quotients involving multi-digit dividends using models, place value, properties, and the relationship of division to multiplication.
MA.3.A.1.2 Solve multiplication and division fact problems by using strategies that result from applying number properties.	**MA.4.A.1.2** Multiply multi-digit whole numbers through four digits fluently, demonstrating understanding of the standard algorithm and checking for reasonableness of results, including solving real-world problems. (Also assesses MA.4.A.1.1.)	**MA.5.A.1.2** Estimate quotients or calculate them mentally depending on the context and numbers involved. (Assessed with MA.5.A.1.4.)
MA.3.A.1.3 Identify, describe, and apply division and multiplication as inverse operations.		**MA.5.A.1.3** Interpret solutions to division situations, including those with remainders, depending on the context of the problem. (Assessed with MA.5.A.1.4.)
		MA.5.A.1.4 Divide multi-digit whole numbers fluently, including solving real-world problems, demonstrating understanding of the standard algorithm, and checking the reasonableness of results. (Also assesses MA.5.A.1.2 and MA.5.A.1.3.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 3–5

Grade 3	Grade 4	Grade 5
Big Idea 2: Develop an understanding of fractions and fraction equivalence.	**Big Idea 2:** Develop an understanding of decimals, including the connection between fractions and decimals.	**Big Idea 2:** Develop an understanding of and fluency with addition and subtraction of fractions and decimals.
MA.3.A.2.1 Represent fractions, including fractions greater than 1, using area, set, and linear models.	**MA.4.A.2.1** Use decimals through the thousandths place to name numbers between whole numbers. (Assessed with MA.4.A.2.3 and MA.4.A.2.4.)	**MA.5.A.2.1** Represent addition and subtraction of decimals and fractions with like and unlike denominators using models, place value, or properties. (Also assesses MA.5.A.6.1.)
MA.3.A.2.2 Describe how the size of the fractional part is related to the number of equal-sized pieces in the whole. (Assessed with MA.3.A.2.3.)	**MA.4.A.2.2** Describe decimals as an extension of the base-ten number system. (Assessed with MA.4.A.2.3 and MA.4.A.2.4.)	**MA.5.A.2.2** Add and subtract fractions and decimals fluently, and verify the reasonableness of results, including in problem situations. (Also assesses MA.5.A.2.3 and MA.5.A.6.1.)
MA.3.A.2.3 Compare and order fractions, including fractions greater than 1, using models and strategies. (Also assesses MA.3.A.2.2.)	**MA.4.A.2.3** Relate equivalent fractions and decimals with and without models, including locations on a number line. (Also assesses MA.4.A.2.1 and MA.4.A.2.2.)	**MA.5.A.2.3** Make reasonable estimates of fraction and decimal sums and differences, and use techniques for rounding. (Assessed with MA.5.A.2.2.)
MA.3.A.2.4 Use models to represent equivalent fractions, including fractions greater than 1, and identify representations of equivalence.	**MA.4.A.2.4** Compare and order decimals, and estimate fraction and decimal amounts in real-world problems. (Also assesses MA.4.A.2.1 and MA.4.A.2.2.)	**MA.5.A.2.4** Determine the prime factorization of numbers. (Also assesses MA.5.A.6.1.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 3–5

Grade 3	Grade 4	Grade 5
Big Idea 3: Describe and analyze properties of two-dimensional shapes.	**Big Idea 3:** Develop an understanding of area and determine the area of two-dimensional shapes.	**Big Idea 3:** Describe three-dimensional shapes and analyze their properties, including volume and surface area.
MA.3.G.3.1 Describe, analyze, compare, and classify two-dimensional shapes using sides and angles–including acute, obtuse, and right angles–and connect these ideas to the definition of shapes.	**MA.4.G.3.1** Describe and determine area as the number of same-sized units that cover a region in the plane, recognizing that a unit square is the standard unit for measuring area.	**MA.5.G.3.1** Analyze and compare the properties of two-dimensional figures and three-dimensional solids (polyhedra), including the number of edges, faces, vertices, and types of faces.
MA.3.G.3.2 Compose, decompose, and transform polygons to make other polygons, including concave and convex polygons with three, four, five, six, eight, or ten sides.	**MA.4.G.3.2** Justify the formula for the area of the rectangle "area = base × height."	**MA.5.G.3.2** Describe, define, and determine surface area and volume of prisms by using appropriate units and selecting strategies and tools.
MA.3.G.3.3 Build, draw, and analyze two-dimensional shapes from several orientations in order to examine and apply congruence and symmetry.	**MA.4.G.3.3** Select and use appropriate units, both customary and metric, strategies, and measuring tools to estimate and solve real-world area problems.	
Supporting Idea: Algebra		
MA.3.A.4.1 Create, analyze, and represent patterns and relationships using words, variables, tables, and graphs.	**MA.4.A.4.1** Generate algebraic rules and use all four operations to describe patterns, including nonnumeric growing or repeating patterns.	**MA.5.A.4.1** Use the properties of equality to solve numerical and real-world situations.
	MA.4.A.4.2 Describe mathematics relationships using expressions, equations, and visual representations.	**MA.5.A.4.2** Construct and describe a graph showing continuous data, such as a graph of a quantity that changes over time. (Assessed with MA.5.S.7.1 and MA.5.S.7.2.)
	MA.4.A.4.3 Recognize and write algebraic expressions for functions with two operations.	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 3–5

Grade 3	Grade 4	Grade 5
Supporting Idea: Geometry and Measurement		
MA.3.G.5.1 Select appropriate units, strategies, and tools to solve problems involving perimeter.	**MA.4.G.5.1** Classify angles of two-dimensional shapes using benchmark angles (45˚, 90˚, 180˚, and 360˚).	**MA.5.G.5.1** Identify and plot ordered pairs on the first quadrant of the coordinate plane.
MA.3.G.5.2 Measure objects using fractional parts of linear units such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{10}$.	**MA.4.G.5.2** Identify and describe the results of translations, reflections, and rotations of 45, 90, 180, 270, and 360 degrees, including figures with line and rotational symmetry.	**MA.5.G.5.2** Compare, contrast, and convert units of measure within the same dimension (length, mass, or time) to solve problems.
MA.3.G.5.3 Tell time to the nearest minute and to the nearest quarter hour, and determine the amount of time elapsed.	**MA.4.G.5.3** Identify and build a three-dimensional object from a two-dimensional representation of that object and vice versa.	**MA.5.G.5.3** Solve problems requiring attention to approximation, selection of appropriate measuring tools, and precision of measurement.
		MA.5.G.5.4 Derive and apply formulas for areas of parallelograms, triangles, and trapezoids from the area of a rectangle.
Supporting Idea: Number and Operations		
MA.3.A.6.1 Represent, compute, estimate, and solve problems using numbers through hundred thousands.	**MA.4.A.6.1** Use and represent numbers through millions in various contexts, including estimation of relative sizes of amounts or distances.	**MA.5.A.6.1** Identify and relate prime and composite numbers, factors, and multiples within the context of fractions. (Assessed with MA.5.A.2.1, MA.5.A.2.2 and MA.5.A.2.4.)
MA.3.A.6.2 Solve non-routine problems by making a table, chart, or list and searching for patterns.	**MA.4.A.6.2** Use models to represent division as: • the inverse of multiplication • as partitioning • as successive subtraction	**MA.5.A.6.2** Use the order of operations to simplify expressions, which include exponents and parentheses.
	MA.4.A.6.3 Generate equivalent fractions and simplify fractions.	**MA.5.A.6.3** Describe real-world situations using positive and negative numbers.
	MA.4.A.6.4 Determine factors and multiples for specified whole numbers.	**MA.5.A.6.4** Compare, order, and graph integers, including integers shown on a number line.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 3–5

Grade 3	Grade 4	Grade 5
Supporting Idea: Number and Operations (Continued)		
	MA.4.A.6.5 Relate halves, fourths, tenths, and hundredths to decimals and percents.	**MA.5.A.6.5** Solve non-routine problems using various strategies including "solving a simpler problem" and "guess, check, and revise."
	MA.4.A.6.6 Estimate and describe reasonableness of estimates; determine the appropriateness of an estimate versus an exact answer.	
Supporting Idea: Data Analysis		
MA.3.S.7.1 Construct and analyze frequency tables, bar graphs, pictographs, and line plots from data, including data collected through observations, surveys, and experiments.		**MA.5.S.7.1** Construct and analyze line graphs and double bar graphs. (Also assesses MA.5.A.4.2.)
		MA.5.S.7.2 Differentiate between continuous and discrete data, and determine ways to represent those using graphs and diagrams. (Also assesses MA.5.A.4.2.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 6–8

Grade 6	Grade 7	Grade 8
Big Idea 1: Develop an understanding of and fluency with multiplication and division of fractions and decimals.	**Big Idea 1:** Develop an understanding of and apply proportionality, including similarity.	**Big Idea 1:** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
MA.6.A.1.1 Explain and justify procedures for multiplying and dividing fractions and decimals.	**MA.7.A.1.1** Distinguish between situations that are proportional or not proportional, and use proportions to solve problems.	**MA.8.A.1.1** Create and interpret tables, graphs, and models to represent, analyze, and solve problems related to linear equations, including analysis of domain, range, and the difference between discrete and continuous data.
MA.6.A.1.2 Multiply and divide fractions and decimals efficiently. (Assessed with MA.6.A.1.3.)	**MA.7.A.1.2** Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease.	**MA.8.A.1.2** Interpret the slope and the x- and y-intercepts when graphing a linear equation for a real-world problem.
MA.6.A.1.3 Solve real-world problems involving multiplication and division of fractions and decimals. (Also assesses MA.6.A.1.2.)	**MA.7.A.1.3** Solve problems involving similar figures.	**MA.8.A.1.3** Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations. (Also assesses MA.8.A.1.4.)
	MA.7.A.1.4 Graph proportional relationships and identify the unit rate as the slope of the related linear function.	**MA.8.A.1.4** Identify the solution to a system of linear equations using graphs. (Assessed with MA.8.A.1.3.)
	MA.7.A.1.5 Distinguish direct variation from other relationships, including inverse variation.	**MA.8.A.1.5** Translate among verbal, tabular, graphical, and algebraic representations of linear functions.
	MA.7.A.1.6 Apply proportionality to measurement in multiple contexts, including scale drawings and constant speed.	**MA.8.A.1.6** Compare the graphs of linear and nonlinear functions for real-world situations.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 6–8

Grade 6	Grade 7	Grade 8
Big Idea 2: Connect ratio and rates to multiplication and division.	**Big Idea 2:** Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.	**Big Idea 2:** Analyze two- and three-dimensional figures by using distance and angle.
MA.6.A.2.1 Use reasoning about multiplication and division to solve ratio and rate problems.	**MA.7.G.2.1** Justify and apply formulas for surface area and volume of pyramids, prisms, cylinders, and cones.	**MA.8.G.2.1** Use similar triangles to solve problems that include height and distances.
MA.6.A.2.2 Interpret and compare ratios and rates.	**MA.7.G.2.2** Use formulas to find surface areas and volume of three-dimensional composite shapes.	**MA.8.G.2.2** Classify and determine the measure of angles, including angles created when parallel lines are cut by transversals.
		MA.8.G.2.3 Demonstrate that the sum of the angles in a triangle is 180-degrees and apply this fact to find unknown measure of angles and the sum of angles in polygons.
		MA.8.G.2.4 Validate and apply Pythagorean Theorem to find distances in real world situations or between points in the coordinate plane.
Big Idea 3: Write, interpret, and use mathematical expressions and equations.	**Big Idea 3:** Develop an understanding of operations on all rational numbers and solving linear equations.	**Big Idea 3:** Analyze and summarize data sets.
MA.6.A.3.1 Write and evaluate mathematical expressions that correspond to given situations. (Also assesses MA.6.A.3.3.)	**MA.7.A.3.1** Use and justify the rules for adding, subtracting, multiplying, dividing, and finding the absolute value of integers.	**MA.8.S.3.1** Select, organize and construct appropriate data displays, including box-and-whisker-plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 6–8

Grade 6	Grade 7	Grade 8
MA.6.A.3.2 Write, solve, and graph one- and two- step linear equations and inequalities. (Also assesses MA.6.A.3.4.)	**MA.7.A.3.2** Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts.	**MA.8.S.3.2** Determine and describe how changes in data values impact measures of central tendency.
MA.6.A.3.3 Work backward with two-step function rules to undo expressions. (Assessed with MA.6.A.3.1.)		
MA.6.A.3.4 Solve problems given a formula. (Assessed with MA.6.A.3.2, MA.6.G.4.1, MA.6.G.4.2, and MA.6.G.4.3.)	**MA.7.A.3.3** Formulate and use different strategies to solve one-step and two-step linear equations, including equations with rational coefficients. (Also assesses MA.7.A.5.2.)	
MA.6.A.3.5 Apply the Commutative, Associative, and Distributive Properties to show that two expressions are equivalent.	**MA.7.A.3.4** Use the properties of equality to represent an equation in a different way and to show that two equations are equivalent in a given context.	
MA.6.A.3.6 Construct and analyze tables, graphs, and equations to describe linear functions and other simple relations using both common language and algebraic notation.		
Supporting Idea: Algebra		
		MA.8.A.4.1 Solve literal equations for a specified variable.
		MA.8.A.4.2 Solve and graph one- and two-step inequalities in one variable.
Supporting Idea: Geometry and Measurement		
MA.6.G.4.1 Understand the concept of Pi, know common estimates of Pi (3.14; $\frac{22}{7}$) and use these values to estimate and calculate the circumference and the area of circles. (Also assesses MA.6.A.3.4.)	**MA.7.G.4.1** Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures, and apply these relationships to solve problems.	**MA.8.G.5.1** Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)) and dimensions including temperature, area, volume, and derived units to solve problems.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 6–8

Grade 6	Grade 7	Grade 8
Supporting Idea: Geometry and Measurement (Continued)		
MA.6.G.4.2 Find the perimeters and areas of composite two-dimensional figures, including non-rectangular figures (such as semicircles) using various strategies. (Also assesses MA.6.A.3.4.)	**MA.7.G.4.2** Predict the results of transformations, and draw transformed figures with and without the coordinate plane.	
	MA.7.G.4.3 Identify and plot ordered pairs in all four quadrants of the coordinate plane.	
MA.6.G.4.3 Determine a missing dimension of a plane figure or prism given its area or volume and some of the dimensions, or determine the area or volume given the dimensions. (Also assesses MA.6.A.3.4.)	**MA.7.G.4.4** Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)), dimensions, and derived units to solve problems.	
Supporting Idea: Number and Operations		
MA.6.A.5.1 Use equivalent forms of fractions, decimals, and percents to solve problems.	**MA.7.A.5.1** Express rational numbers as terminating or repeating decimals.	**MA.8.A.6.1** Use exponents and scientific notation to write large and small numbers and vice versa and to solve problems.
MA.6.A.5.2 Compare and order fractions, decimals, and percents, including finding their approximate location on a number line.	**MA.7.A.5.2** Solve non-routine problems by working backwards. (Assessed with MA.7.A.3.3.)	**MA.8.A.6.2** Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions.
MA.6.A.5.3 Estimate the results of computations with fractions, decimals, and percents, and judge the reasonableness of the results.		
		MA.8.A.6.3 Simplify real number expressions using the laws of exponents. (Assessed with MA.8.A.6.4.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed at Grades 6–8

Grade 6	Grade 7	Grade 8
Supporting Idea: Number and Operations (Continued)		
		MA.8.A.6.4 Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems. (Also assesses MA.8.A.6.3.)
Supporting Idea: Data Analysis		
MA.6.S.6.1 Determine the measures of central tendency (mean, median, mode) and variability (range) for a given set of data.	**MA.7.S.6.1** Evaluate the reasonableness of a sample to determine the appropriateness of generalizations made about the population.	
MA.6.S.6.2 Select and analyze the measures of central tendency or variability to represent, describe, analyze, and/or summarize a data set for the purpose of answering questions appropriately.	**MA.7.S.6.2** Construct and analyze histograms, stem-and-leaf plots, and circle graphs.	
Supporting Idea: Probability		
	MA.7.P.7.1 Determine the outcome of an experiment and predict which events are likely or unlikely, and if the experiment is fair or unfair.	
	MA.7.P.7.2 Determine, compare, and make predictions based on experimental or theoretical probability of independent or dependent events.	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Algebra	
MA.912.A.1.8 Use the zero product property of real numbers in a variety of contexts to identify solutions to equations. (Assessed with MA.912.A.7.2.)	
MA.912.A.2.3 Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions. (Also assesses MA.912.A.2.13.)	
MA.912.A.2.4 Determine the domain and range of a relation. (Also assesses MA.912.A.2.13.)	
MA.912.A.2.13 Solve real-world problems involving relations and functions. (Assessed with MA.912.A.2.3, MA.912.A.2.4.)	
MA.912.A.3.1 Solve linear equations in one variable that include simplifying algebraic expressions. (Also assesses MA.912.A.3.2.)	
MA.912.A.3.2 Identify and apply the distributive, associative, and commutative properties of real numbers and the properties of equality. (Assessed with MA.912.A.3.1.)	
MA.912.A.3.3 Solve literal equations for a specified variable.	
MA.912.A.3.4 Solve and graph simple and compound inequalities in one variable and be able to justify each step in a solution.	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Algebra (Continued)	
MA.912.A.3.5 Symbolically represent and solve multi-step and real-world applications that involve linear equations and inequalities.	
MA.912.A.3.7 Rewrite equations of a line into slope-intercept form and standard form. (Assessed with MA.912.A.3.10.)	
MA.912.A.3.8 Graph a line given any of the following information: a table of values, the x- and y-intercepts, two points, the slope and a point, the equation of the line in slope-intercept form, standard form, or point-slope form. (Also assesses MA.912.A.3.12.)	
MA.912.A.3.9 Determine the slope, x-intercept, and y-intercept of a line given its graph, its equation, or two points on the line. (Also assesses MA.912.A.3.12.)	
MA.912.A.3.10 Write an equation of a line given any of the following information: two points on the line, its slope and one point on the line, or its graph. Also, find an equation of a new line parallel to a given line, or perpendicular to a given line, through a given point on the new line. (Also assesses MA.912.A.3.7, MA.912.A.3.12, and MA.912.G.1.4.)	
MA.912.A.3.11 Write an equation of a line that models a data set, and use the equation or the graph to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change. (Also assesses MA.912.A.3.12.)	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Algebra (Continued)	
MA.912.A.3.12 Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph. (Assessed with MA.912.A.3.8, MA.912.A.3.9, MA.912.A.3.10, and MA.912.A.3.11.)	
MA.912.A.3.13 Use a graph to approximate the solution of a system of linear equations or inequalities in two variables with and without technology. (Assessed with MA.912.A.3.14.)	
MA.912.A.3.14 Solve systems of linear equations and inequalities in two and three variables using graphical, substitution, and elimination methods. (Also assesses MA.912.A.3.13 and MA.912.A.3.15.)	
MA.912.A.3.15 Solve real-world problems involving systems of linear equations and inequalities in two and three variables. (Assessed with MA.912.A.3.14.)	
MA.912.A.4.1 Simplify monomials and monomial expressions using the laws of integral exponents.	
MA.912.A.4.2 Add, subtract, and multiply polynomials.	
MA.912.A.4.3 Factor polynomial expressions. (Also assesses MA.912.A.5.1.)	
MA.912.A.4.4 Divide polynomials by monomials and polynomials with various techniques, including synthetic division.	
MA.912.A.5.1 Simplify algebraic ratios. (Assessed with MA.912.A.4.3.)	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Algebra (Continued)	
MA.912.A.5.4 Solve algebraic proportions.	
MA.912.A.6.1 Simplify radical expressions. (Assessed with MA.912.A.6.2.)	
MA.912.A.6.2 Add, subtract, multiply, and divide radical expressions (square roots and higher). (Also assesses MA.912.A.6.1.)	
MA.912.A.7.1 Graph quadratic equations with and without graphing technology. (Also assesses MA.912.A.7.8.)	
MA.912.A.7.2 Solve quadratic equations over the real numbers by factoring and by using the quadratic formula. (Also assesses MA.912.A.1.8 and MA.912.A.7.8.)	
MA.912.A.7.8 Use quadratic equations to solve real-world problems. (Assessed with MA.912.A.7.1 and MA.912.A.7.2.)	
MA.912.A.10.1 Use a variety of problem-solving strategies, such as drawing a diagram, making a chart, guessing-and-checking, solving a simpler problem, writing an equation, working backwards, and creating a table. (Assessed throughout.)	
MA.912.A.10.2 Decide whether a solution is reasonable in the context of the original situation. (Assessed throughout.)	

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Discrete Mathematics	
MA.912.D.7.1 Perform set operations such as union and intersection, complement, and cross product.	**MA.912.D.6.2** Find the converse, inverse, and contrapositive of a statement. (Also assesses MA.912.D.6.3.)
MA.912.D.7.2 Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets.	**MA.912.D.6.3** Determine whether two propositions are logically equivalent. (Assessed with MA.912.D.6.2.)
	MA.912.D.6.4 Use methods of direct and indirect proof and determine whether a short proof is logically valid. (Assessed with MA.912.G.3.4 and MA.912.G.4.6.)
Body of Knowledge: Geometry	
MA.912.G.1.4 Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. (Assessed with MA.912.A.3.10.)	**MA.912.G.1.1** Find the lengths and midpoints of line segments in two-dimensional coordinate systems.
	MA.912.G.1.2 Construct congruent segments and angles, angle bisectors, and parallel and perpendicular lines using a straightedge and compass or a drawing program, explaining and justifying the process used. (Not assessed.)
	MA.912.G.1.3 Identify and use the relationships between special pairs of angles formed by parallel lines and transversals.
	MA.912.G.2.1 Identify and describe convex, concave, regular, and irregular polygons. (Assessed with MA.912.G.2.3.)
	MA.912.G.2.2 Determine the measures of interior and exterior angles of polygons, justifying the method used.
	MA.912.G.2.3 Use properties of congruent and similar polygons to solve mathematical or real-world problems. (Also assesses MA.912.G.2.1, MA.912.G.4.1, MA.912.G.4.2, MA.912.G.4.4, MA.912.G.4.5.)
	MA.912.G.2.4 Apply transformations (translations, reflections, rotations, dilations, and scale factors) to polygons to determine congruence, similarity, and symmetry. Know that images formed by translations, reflections, and rotations are congruent to the original shape. Create and verify tessellations of the plane using polygons.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Geometry (Continued)	
	MA.912.G.2.5 Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.). (Also assesses MA.912.G.2.7.)
	MA.912.G.2.7 Determine how changes in dimensions affect the perimeter and area of common geometric figures. (Assessed with MA.912.G.2.5 and MA.912.G.7.7.)
	MA.912.G.3.1 Describe, classify, and compare relationships among quadrilaterals including the square, rectangle, rhombus, parallelogram, trapezoid, and kite. (Assessed with MA.912.G.3.4.)
	MA.912.G.3.2 Compare and contrast special quadrilaterals on the basis of their properties. (Assessed with MA.912.G.3.4.)
	MA.912.G.3.3 Use coordinate geometry to prove properties of congruent, regular, and similar quadrilaterals.
	MA.912.G.3.4 Prove theorems involving quadrilaterals. (Also assesses MA.912.D.6.4, MA.912.G.3.1, MA.912.G.3.2, and MA.912.G.8.5.)
	MA.912.G.4.1 Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular. (Assessed with MA.912.G.2.3.)
	MA.912.G.4.2 Define, identify, and construct altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter. (Assessed with MA.912.G.2.3.)
	MA.912.G.4.3 Construct triangles congruent to given triangles. (Not assessed.)
	MA.912.G.4.4 Use properties of congruent and similar triangles to solve problems involving lengths and areas. (Assessed with MA.912.G.2.3.)
	MA.912.G.4.5 Apply theorems involving segments divided proportionally. (Assessed with MA.912.G.2.3.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Geometry (Continued)	
	MA.912.G.4.6 Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles. (Also assesses MA.912.D.6.4 and MA.912.G.8.5.)
	MA.912.G.4.7 Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem.
	MA.912.G.5.1 Prove and apply the Pythagorean Theorem and its converse. (Assessed with MA.912.G.5.4.)
	MA.912.G.5.2 State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. (Assessed with MA.912.G.5.4.)
	MA.912.G.5.3 Use special right triangles (30° - 60° - 90° and 45° - 45° - 90°) to solve problems. (Assessed with MA.912.G.5.4.)
	MA.912.G.5.4 Solve real-world problems involving right triangles. (Also assesses MA.912.G.5.1, MA.912.G.5.2, MA.912.G.5.3.)
	MA.912.G.6.2 Define and identify: circumference, radius, diameter, arc, arc length, chord, secant, tangent and concentric circles. (Assessed with MA.912.G.6.5.)
	MA.912.G.6.4 Determine and use measures of arcs and related angles (central, inscribed, and intersections of secants and tangents). (Assessed with MA.912.G.6.5.)
	MA.912.G.6.5 Solve real-world problems using measures of circumference, arc length, and areas of circles and sectors. (Also assesses MA.912.G.6.2 and MA.912.G.6.4.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Geometry (Continued)	
	MA.912.G.6.6 Given the center and the radius, find the equation of a circle in the coordinate plane or given the equation of a circle in center-radius form, state the center and the radius of the circle. (Also assesses MA.912.G.6.7.)
	MA.912.G.6.7 Given the equation of a circle in center-radius form or given the center and the radius of a circle, sketch the graph of the circle. (Assessed with MA.912.G.6.6.)
	MA.912.G.7.1 Describe and make regular, non-regular, and oblique polyhedra, and sketch the net for a given polyhedron and vice versa. (Also assesses MA.912.G.7.2.)
	MA.912.G.7.2 Describe the relationships between the faces, edges, and vertices of polyhedra. (Assessed with MA.912.G.7.1.)
	MA.912.G.7.4 Identify chords, tangents, radii, and great circles of spheres. (Assessed with MA.912.G.7.5.)
	MA.912.G.7.5 Explain and use formulas for lateral area, surface area, and volume of solids. (Also assesses MA.912.G.7.4, MA.912.G.7.6.)
	MA.912.G.7.6 Identify and use properties of congruent and similar solids. (Assessed with MA.912.G.7.5.)
	MA.912.G.7.7 Determine how changes in dimensions affect the surface area and volume of common geometric solids. (Also assesses MA.912.G.2.7.)
	MA.912.G.8.1 Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems. (Embedded throughout.)
	MA.912.G.8.2 Use a variety of problem-solving strategies, such as drawing a diagram, making a chart, guess-and-check, solving a simpler problem, writing an equation, and working backwards. (Embedded throughout.)

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

Algebra 1 EOC	Geometry EOC
Body of Knowledge: Geometry (Continued)	
	MA.912.G.8.3 Determine whether a solution is reasonable in the context of the original situation. (Embedded throughout.)
	MA.912.G.8.4 Make conjectures with justifications about geometric ideas. Distinguish between information that supports a conjecture and the proof of a conjecture.
	MA.912.G.8.5 Write geometric proofs, including proofs by contradiction and proofs involving coordinate geometry. Use and compare a variety of ways to present deductive proofs, such as flow charts, paragraphs, two-column, and indirect proofs. (Assessed with MA.912.G.3.4 and MA.912.G.4.6.)
	MA.912.G.8.6 Perform basic constructions using straightedge and compass, and/or drawing programs describing and justifying the procedures used. Distinguish between sketching, constructing, and drawing geometric figures. (Not assessed.)
Body of Knowledge: Trigonometry	
	MA.912.T.2.1 Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, cosecant) in terms of angles of right triangles.

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

Benchmark Specifications for Grades 6–8

This section of the *Specifications* describes how Florida's NGSSS benchmarks are assessed. The benchmarks are defined in the NGSSS from Kindergarten through Grade 8 using a Big Idea/Supporting Idea format. High school assessments are constructed using the Bodies of Knowledge (BOK). FCAT 2.0 Mathematics is administered at Grades 3–8. Algebra 1 and Geometry are assessed separately in end-of-course (EOC) formats.

The set of sample items that is included throughout the *Specifications* document represents a wide range of difficulty and cognitive complexity. Although most of the items are of average difficulty and moderate complexity and can be answered correctly by students who reach Achievement Level 3, some of the items presented will be challenging for some students and are specifically included to prompt item writers to submit items that will measure the abilities of students in higher achievement levels. As the assessment is constructed to measure various achievement levels, this document was constructed to help item writers see the range of difficulties and complexities of items that may appear on a test.

Specifications for Grade 6

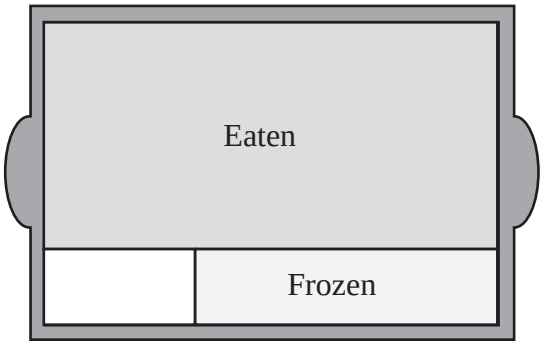
Benchmark MA.6.A.1.1

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Big Idea 1** Develop an understanding of and fluency with multiplication and division of fractions and decimals.
Benchmark	**MA.6.A.1.1 Explain and justify procedures for multiplying and dividing fractions and decimals.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students may identify procedures for multiplying or dividing fractions and/or decimals in the context of expressions, equations, or real-world situations. Students will choose the correct graphic representation of multiplication or division problems involving fractions or decimals.
Content Limits	Items may include mixed numbers, fractions, and/or decimals. Items may include decimals through the hundredths place. Denominators of fractions used must be less than or equal to 16. Items will not require the student to simplify fractions. Items may not include a combination of fractions and decimals.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphical representations of fractions, mixed numbers, and/or decimals may be used, as appropriate.

Sample Item 1 **MC**

Merrill baked a cake in the shape of a rectangular prism for a party. After the party, $\frac{1}{4}$ of the cake had not been eaten. Merrill froze $\frac{2}{3}$ of the remaining cake. A diagram of the portion eaten and the portion frozen is shown below.

Top View of Cake



Which expression can be used to find the fraction of the original whole cake Merrill froze?

★ **A.** $\frac{2}{3} \times \frac{1}{4}$

B. $\frac{2}{3} \div \frac{1}{4}$

C. $\frac{2}{3} - \frac{1}{4}$

D. $\frac{2}{3} + \frac{1}{4}$

Item Context Mathematics

Benchmark MA.6.A.1.3

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Big Idea 1** Develop an understanding of and fluency with multiplication and division of fractions and decimals.
Benchmark	**MA.6.A.1.3 Solve real-world problems involving multiplication and division of fractions and decimals.** Also assesses MA.6.A.1.2 Multiply and divide fractions and decimals efficiently.
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will solve real-world problems involving multiplication and/or division of fractions and decimals.
Content Limits	Items may include fractions and mixed numbers. Items may include decimals through the hundredths place. Fractions and decimals may not be used in the same item. In fractions that must be simplified, the numerator and denominator must be simplified to lowest terms with no more than two common prime factors, e.g., 2, 3, 5, or 7. Items may include up to three procedural steps. Items may involve checking for reasonableness of answers, especially when dealing with remainders.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics may be used, as appropriate.
Response Attribute	For multiple-choice items, options that are fractions should be in simplest form.

Sample Item 2 **MC**

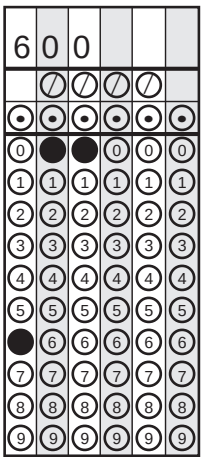
Mr. Nichols wants to store $25\frac{1}{2}$ cups of stew in containers. Each container holds a maximum of $1\frac{1}{2}$ cups of stew. What is the minimum number of containers Mr. Nichols needs to hold all the stew?

A. 9
★ **B.** 17
C. 25
D. 51

Item Context Mathematics

Sample Item 3 **GR**

The Rolanda family drove 1,600 miles in 3 days. On the first day, they traveled $\frac{1}{2}$ of the total distance. On the second day, they traveled $\frac{1}{4}$ of the remaining distance.
What was the total distance, **in miles**, the Rolanda family traveled on the third day?



Sample Response 600

Item Context Mathematics

Benchmark MA.6.A.2.1

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Big Idea 2** Connect ratio and rates to multiplication and division.
Benchmark	**MA.6.A.2.1 Use reasoning about multiplication and division to solve ratio and rate problems.**
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will find solutions to real-world and mathematical ratio and/or rate problems.
Content Limits	Rates involving money should be limited to the nearest cent. Ratios may be presented in words or symbols (e.g., 2 to 3, 2:3, 2 out of 3, or $\frac{2}{3}$).
Stimulus Attributes	Items should be set in a real-world or mathematical context. Stimuli in GR items must indicate the place value to which answers should be rounded. Graphics can be used in some items, as appropriate.
Response Attribute	Answers in items involving real-world situations may require students to round answers depending on the context of the item.

Sample Item 4 **MC**

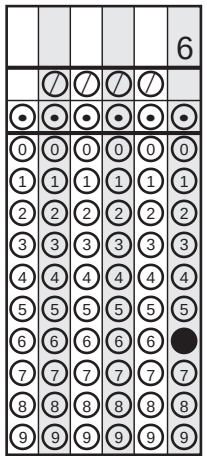
Karla and Becky were practicing free throws. Karla attempted 24 free throws and was successful 8 times. Becky attempted 20 free throws and was successful 5 times. At these rates, how many more successful free throws would Karla make than Becky if they each attempted 180 free throws?

★ **A.** 15
B. 23
C. 27
D. 51

Item Context Health/Physical Education

Sample Item 5 **GR**

Marissa drove 770 miles in two days to visit her friend. On the first day, she drove 8 hours at an average speed of 55 miles per hour. She continued to drive at the same rate on the second day. How many hours did Marissa drive the second day?



Sample Response 6

Item Context Mathematics

Benchmark MA.6.A.2.2

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Big Idea 2** Connect ratio and rates to multiplication and division.
Benchmark	**MA.6.A.2.2 Interpret and compare ratios and rates.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will translate situations involving ratio and rate from real-world contexts to mathematical equations or expressions. Students will compare rates and ratios to solve real-world problems.
Content Limits	Items will not include defining rate and ratio. Items will not include inequality symbols. Ratios may be presented in words or symbols (e.g., 2 to 3, 2:3, 2 out of 3, or $\frac{2}{3}$).
Stimulus Attributes	Items should be set in a real-world context. Ratios may be represented in various forms, such as simple drawings and multiplication tables.

Sample Item 6 **MC**

Mr. Gerard purchased different types of halogen light bulbs for the apartment building where he works. The information about the bulbs he purchased is shown in the table below.

HALOGEN LIGHT BULBS PURCHASED

Type of Light Bulb	Number Purchased	Total Cost
10-Watt Clear	9	$ 14.85
13-Watt Warm White	60	$119.40
20-Watt Capsule Bulb	6	$ 10.74
34-Watt Cool White	90	$147.60

Which type of light bulb costs the **least amount** per light bulb?

A. 10-Watt Clear
B. 13-Watt Warm White
C. 20-Watt Capsule Bulb
★ **D.** 34-Watt Cool White

Item Context Social Studies/Consumerism

Benchmark MA.6.A.3.1

Reporting Category	Expressions and Equations
Standard	**Big Idea 3** Write, interpret, and use mathematical expressions and equations.
Benchmark	**MA.6.A.3.1 Write and evaluate mathematical expressions that correspond to given situations.** Also assesses MA.6.A.3.3 Work backward with two-step function rules to undo expressions.
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will translate a real-world situation to a mathematical expression. Students will identify the real-world situation that can be represented by a given mathematical expression. Students will evaluate expressions involving one or two variables when given the value(s) of the variable(s), using strategies such as working backwards.
Content Limits	Expressions may have up to two variables and up to two different operations, with no more than three procedural steps needed to evaluate the expression (e.g., $2x + 3y$ requires two multiplication steps and one addition step). Items will not require students to evaluate expressions having both decimals and fractions. Items will not include identifying equivalent expressions using the associative, commutative, or distributive properties.
Stimulus Attribute	Items should be set in a real-world context.
Response Attribute	Multiple-choice responses may be positive rational numbers or expressions. Gridded responses may be positive rational numbers.

Sample Item 7 **MC**

Camera World rents video recorders by the day. The store charges $6.00 per day and a one-time cleaning fee of $2.50. If x represents a number of days, which expression can be used to determine the total charge, in dollars, to rent a video recorder for x days?

A. $6(x + 2.50)$
B. $2.50x + 6$
★ **C.** $6x + 2.50$
D. $8.50x$

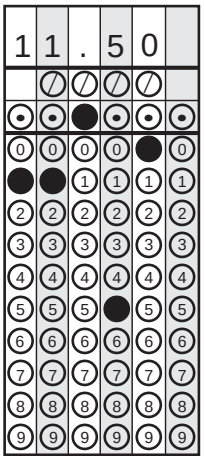
Item Context Social Studies/Consumerism

Sample Item 8 **GR**

A bag of popcorn sells for $1.75 and a drink sells for $1.25 at a snack bar. The expression below can be used to determine the total cost, in dollars, for p bags of popcorn and d drinks.

$$1.75p + 1.25d$$

What would be the total cost, **in dollars**, to purchase 3 bags of popcorn and 5 drinks?



Sample Response 11.50

Item Context Social Studies/Consumerism

Benchmark MA.6.A.3.2

Reporting Category	Expressions and Equations
Standard	**Big Idea 3** Write, interpret, and use mathematical expressions and equations.
Benchmark	**MA.6.A.3.2 Write, solve, and graph one- and two- step linear equations and inequalities.** Also assesses MA.6.A.3.4 Solve problems given a formula.
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will solve a one- or two-step linear equation, inequality (e.g., $<$, $\leq$, $>$, or $\geq$), or formula. Students will translate a real-world situation to a mathematical equation or inequality. Students will choose a representative graph for a given equation or inequality.
Content Limits	Items may include patterns, graphic models, situations, number lines, graphs, and relationships. Items may include up to three variables, if the third variable is isolated on one side, as when using a formula (e.g., $d = rt$). Items may have up to two operations, with no more than three procedural steps needed to evaluate the equation, expression, and/or inequality. Items involving the graphing of inequalities will be limited to one procedural step. Graphs must be limited to the first quadrant. In items involving inequalities, the inequality must include only one variable and may be on a number line. Items that involve solving inequalities may only use positive coefficients.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Formulas used in items need not be limited to those found on the reference sheet or to commonly used mathematical formulas.

Sample Item 9 **MC**

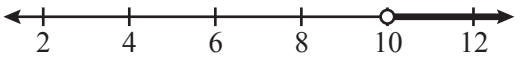
Which graph represents the solutions to the inequality $2x < 12$?

★ **A.**

B.

C.

D.



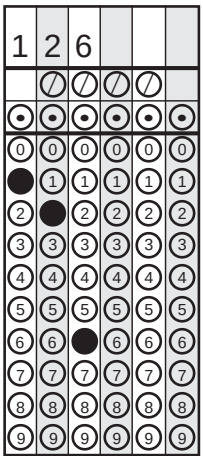
Item Context Mathematics

Sample Item 10 **GR**

Mr. Schmidt is purchasing film for his camera. With the roll of film that is in his camera now, he can take 18 pictures. Mr. Schmidt wants to purchase several rolls of film that can each produce up to 36 pictures. The equation below can be used to determine p, the total number of pictures Mr. Schmidt can take based on r, the number of rolls of film he purchases.

$$p = 36r + 18$$

If Mr. Schmidt purchases 3 rolls of film, what is the total number of pictures he can take?



Sample Response 126

Item Context Social Studies/Consumerism

Benchmark MA.6.A.3.5

Reporting Category	Expressions and Equations
Standard	**Big Idea 3** Write, interpret, and use mathematical expressions and equations.
Benchmark	**MA.6.A.3.5 Apply the Commutative, Associative, and Distributive Properties to show that two expressions are equivalent.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will recognize equivalent expressions based on the application of the commutative, associative, identity, inverse, and/or distributive properties. Students will identify and name the following properties: commutative, associative, identity, inverse, and distributive.
Content Limits	Items may include expressions or real-world situations. No more than two properties should be needed to convert from one expression to an equivalent expression in an item. Items may include a maximum of two variables.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 11 **MC**

Which expression is equivalent to $3(b + c)$ using only the distributive property?

A. $3bc$
B. $3(c + b)$
★ **C.** $3b + 3c$
D. $(b + c) \cdot 3$

Item Context Mathematics

Benchmark MA.6.A.3.6

Reporting Category	Expressions and Equations
Standard	**Big Idea 3** Write, interpret, and use mathematical expressions and equations.
Benchmark	**MA.6.A.3.6 Construct and analyze tables, graphs, and equations to describe linear functions and other simple relations using both common language and algebraic notation.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will identify a table, graph, or equation that represents a linear function or other simple relationship. Students will analyze a table or graph to identify or describe the rate of change. Students will identify different representations of the same relationship, including translating among graphs, equations, tables, and words.
Content Limits	Items may include tables, graphs, equations, or real-world situations. Simple relationships may include discrete data that lends itself to a linear relationship. Graphs should be limited to the first quadrant, and indicated points on the graphs must have whole-number coordinates. Items will not include the use of the slope formula.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 12 **MC**

A cellular phone company charges a fixed monthly fee, plus \$0.25 for each minute the phone is in use. The table below shows that T, the total charge for one month, depends on m, the number of minutes the phone is in use.

CELLULAR CHARGES FOR ONE MONTH

Minutes (m)	Total Charges (T)
20	\$17.50
30	\$20.00
40	\$22.50
50	\$25.00
60	\$27.50

Which equation correctly shows the relationship between T and m?

A. $T = 0.25m + 17.50$
B. $T = m + 17.30$
★ **C.** $T = 0.25m + 12.50$
D. $T = m - 2.50$

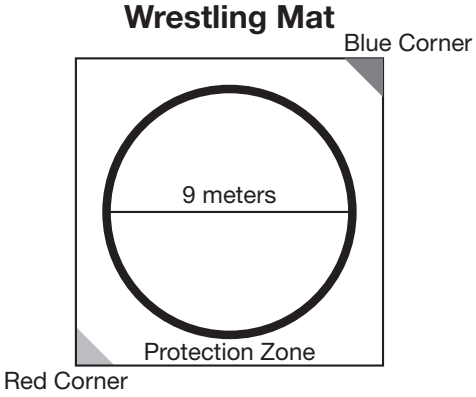
Item Context Social Studies/Consumerism

Benchmark MA.6.G.4.1

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.6.G.4.1 Understand the concept of Pi, know common estimates of Pi (3.14; $\frac{22}{7}$) and use these values to estimate and calculate the circumference and the area of circles.** Also assesses MA.6.A.3.4 Solve problems given a formula.
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will use $\frac{22}{7}$ or 3.14 as an approximation for π to determine the approximate circumference and area of circles. Students will find the diameter or radius, given the circumference or area of a circle.
Content Limits	Items may include using vocabulary such as *radius*, *diameter*, and *center*. Item graphics or options may include the use of visual representations or vocabulary associated with a circle, such as *chord*, *arc*, *sector*, and *central angle*. These terms will not be directly assessed.
Stimulus Attributes	Items may be set in a real-world or mathematical context. Graphics should be used in most of these items, as appropriate.
Response Attribute	Multiple-choice responses should include only correct units (e.g., answers for area questions should all have square units).

Sample Item 13 **MC**

In a regulation wrestling match, wrestlers compete within a circular zone 9 meters in diameter.



Which of the following is closest to the area of the circular zone?

A. 28.3 square meters
B. 56.5 square meters
★ **C.** 63.6 square meters
D. 254.3 square meters

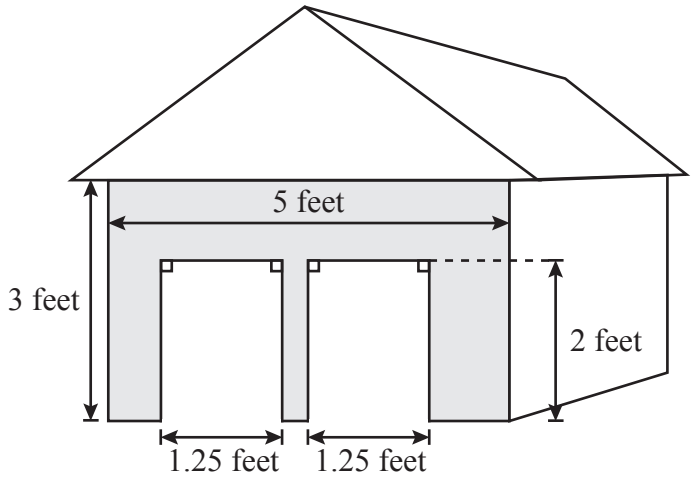
Item Context Health/Physical Education

Benchmark MA.6.G.4.2

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.6.G.4.2 Find the perimeters and areas of composite two-dimensional figures, including non-rectangular figures (such as semicircles) using various strategies.** Also assesses MA.6.A.3.4 Solve problems given a formula.
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will find the perimeters and areas of composite two-dimensional figures made from convex and concave polygons, circles, and semicircles.
Content Limits	Students may find missing dimensions in order to find the perimeter or area of composite or decomposed two-dimensional figures, given some of the dimensions of a figure. Students will work with composite two-dimensional figures, which may be composed of shapes within other shapes. Polygons used in composite two-dimensional figures may be convex or concave. The figures used within another figure are limited to triangles, quadrilaterals, circles, and semicircles. Composite two-dimensional figures may be created from up to three different simple polygons. Dimensions of polygons may be whole numbers; fractions with denominators of 2, 4, or 10; or decimal values, which may include 0.25, 0.75, or tenths. Composite shapes should not be represented on grids. Items will not include the vocabulary of *inscribed* or *circumscribed*, but these concepts may be represented graphically.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Items that are set in real-world context may use length and width as dimensions as well as base and height as dimensions. Graphics should be used in all of these items.

Sample Item 14 **MC**

Dana plans to paint the front face of her doghouse, as shown by the shaded region below. The face is rectangular in shape, with 2 congruent rectangular doorways cut out.



Front Face of Doghouse

Dana needs to calculate the area of the shaded region to be painted so she can purchase the correct amount of paint. What is the area of the shaded region of her doghouse that needs to be painted?

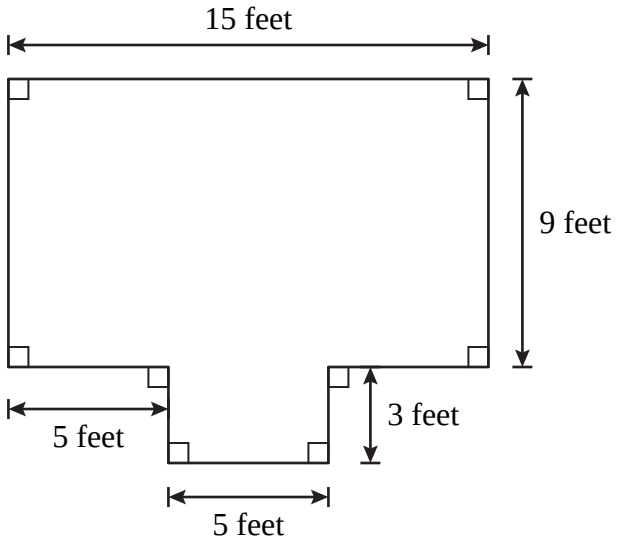
A. 5 square feet
★ **B.** 10 square feet
C. 10.5 square feet
D. 12.5 square feet

Item Context Mathematics

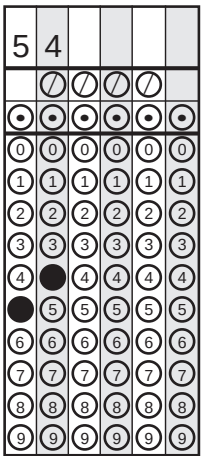
Sample Item 15 **GR**

Mr. Lindbrook wants to purchase molding to place around the edges of the ceiling in his family room. The shape and dimensions of his family room are shown below.

Dimensions of Mr. Lindbrook's Family Room



Mr. Lindbrook needs to know the perimeter of the family room in order to know how much molding to purchase. What is the perimeter, **in feet**, of Mr. Lindbrook's family room?



Sample Response 54

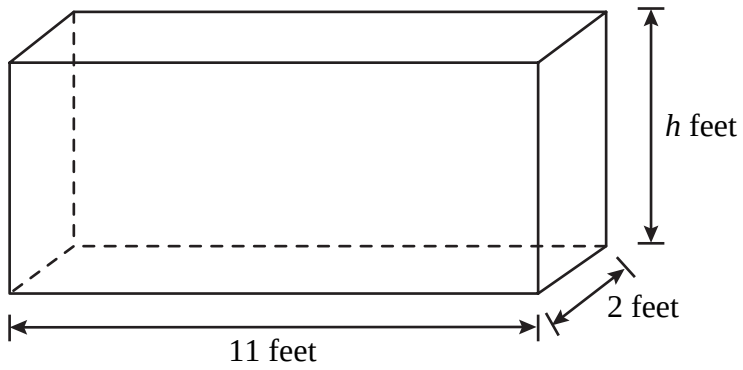
Item Context Social Studies/Consumerism

Benchmark MA.6.G.4.3

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.6.G.4.3 Determine a missing dimension of a plane figure or prism given its area or volume and some of the dimensions, or determine the area or volume given the dimensions.** Also assesses MA.6.A.3.4 Solve problems given a formula.
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will use formulas to determine a dimension of a plane figure or right prism, given its area or volume and the remaining dimensions. Students will determine the area of a plane figure or the volume of a right prism given the dimensions.
Content Limits	Items may include three-dimensional figures, which are limited to cubes and rectangular prisms. Items may include two-dimensional figures, which are limited to triangles, parallelograms, trapezoids, rectangles, squares, rhombi, and circles. Dimensions of figures may be whole numbers; fractions with denominators of 2, 4, or 10; or decimal values, which may include 0.25, 0.75, or tenths. Items will not include composite two-dimensional or composite three-dimensional figures. Items will not include two-dimensional figures represented on grids.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Items that are set in real-world context may use length and width as dimensions as well as base and height as dimensions. Graphic representations of two- and three-dimensional figures may be included but are not required.

Sample Item 16 **MC**

Lamar is building a glass case for a reptile display. The interior of the case is in the shape of a rectangular prism with the dimensions shown in the diagram.



The total volume of the interior of the case is 154 cubic feet. What is the value of h?

★ **A.** 7
B. 9
C. 13
D. 14

Item Context Science

Benchmark MA.6.A.5.1

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.6.A.5.1 Use equivalent forms of fractions, decimals, and percents to solve problems.**
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will solve real-world problems involving fractions, decimals, and percents. Students will convert between fractions, decimals, and percents to solve real-world problems.
Content Limits	Items may include different forms of numbers within the same problem (fractions, decimals, and/or percents). Percents used in items must be whole numbers less than or equal to 100. Items will not include decimals beyond the thousandths place. Items will not include solving percent problems involving multiplying by a percent (e.g., finding discounts, simple interest, taxes, tips, and percents of increase or decrease). Items involving finding percents of numbers must use percents that are easily converted to fractions, such as fourths, fifths, tenths, or fractions that can be easily simplified (e.g., $\frac{9}{12}$).
Stimulus Attribute	Items should be set in a real-world context.

Sample Item 17 **MC**

Mrs. Nelson has 20 students in her classroom. She noticed that $\frac{3}{10}$ of the students have blue eyes and $\frac{1}{2}$ of the students have brown eyes. The rest of the students have green eyes. What percent of the students in Mrs. Nelson's class have green eyes?

★ **A.** 20%
B. 33%
C. 67%
D. 80%

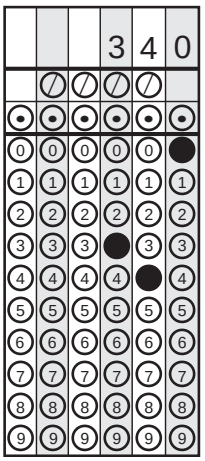
Item Context Social Studies/Consumerism

Sample Item 18 **GR**

A school held an election for student body president. When the election was over, the principal announced some facts about the election, as shown below.

- A total of 800 votes were cast for president
- 20% of the votes for president were for Brian
- $\frac{3}{8}$ of the votes for president were for Paulette

The remaining votes for president were for Shirley. What was the total number of votes for Shirley?



Sample Response 340

Item Context Social Studies/Consumerism

Benchmark MA.6.A.5.2

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.6.A.5.2 Compare and order fractions, decimals, and percents, including finding their approximate location on a number line.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will compare and order fractions, decimals, and percents. Students will plot or identify approximate locations of fractions, decimals, and percents on number lines.
Content Limits	Items may include multiple forms of numbers expressed as fractions, mixed numbers, decimals, or percents. Items may include inequality symbols and graphs of inequalities on a number line. Items may include mixed numbers or fractions following the general content limits. Percents used in items must be whole numbers less than or equal to 100. Items will not include decimals beyond the thousandths place. No more than five numbers may be compared or ordered in each item.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 19 **MC**

If the following numbers were plotted on a number line, which number would be nearest to zero?

A. 0.29

★ **B.** 0.065

C. $\frac{5}{3}$

D. $\frac{81}{100}$

Item Context Mathematics

Benchmark MA.6.A.5.3

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.6.A.5.3 Estimate the results of computations with fractions, decimals, and percents, and judge the reasonableness of the results.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will judge the reasonableness of the result(s) of computations with fractions, decimals, and percents. Students will estimate the result(s) of computations with fractions, decimals, and percents.
Content Limits	Fractions must not exceed those indicated in the general content limits. Percents used in items must be whole numbers less than or equal to 100. Items will not involve multiplying a number by a percent. Items will not include decimals beyond the thousandths place. Computations may have up to two different operations, with no more than three procedural steps (e.g., $2(4) + 3(9)$ requires two multiplication steps and one addition step).
Stimulus Attribute	Items should be set in a real-world context.
Response Attribute	Options should not include answers students could obtain by making rounding decisions during the computation (e.g., if the item asks the student to add $49.27 + 39.16$, 88.5 would not be an appropriate distractor because a student might estimate the sum as $49.3 + 39.2 = 88.5$).

Sample Item 20 **MC**

Mr. Madsen worked 49 hours last week at his job. He spent $\frac{1}{5}$ of this time in meetings and $\frac{1}{3}$ of this time talking to customers on the phone. Which method would provide the most reasonable estimate of the total number of hours Mr. Madsen spent in meetings and talking to customers on the phone at his job last week?

A. multiply $\frac{1}{4}$ by 50

★ **B.** multiply $\frac{1}{2}$ by 50

C. multiply $\frac{1}{5}$ by 50 and add $\frac{1}{3}$ to the product

D. multiply $\frac{1}{5}$ by $\frac{1}{3}$ and multiply the product by 50

Item Context Social Studies/Consumerism

Benchmark MA.6.S.6.1

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Supporting Idea** Data Analysis
Benchmark	**MA.6.S.6.1 Determine the measures of central tendency (mean, median, mode) and variability (range) for a given set of data.**
Item Types	At Grade 6, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will determine the mean, median, mode, or range for a given set of data.
Content Limits	Items may include data presented in a table, line plot, bar graph, double bar graph, or line graph. The number of data points may not exceed ten when the median or mode is being determined. The number of data points may not exceed six when the mean is being calculated. Items may include the use of frequency tables for numerical or categorical data. Items may include the use of whole numbers; fractions with denominators of 2, 4, or 10; or decimal values, which may include 0.25, 0.75, or tenths.
Stimulus Attribute	Items should be set in a real-world context.

Sample Item 21 **MC**

The table below shows information about the 10 most-collected special edition stamps in the United States as of 1998.

MOST-COLLECTED SPECIAL EDITION STAMPS

Name of Stamp	Number Collected (in millions)
Bugs Bunny 1997	45.3
Centennial Olympic Games 1996	38.1
Civil War 1995	46.6
Marilyn Monroe 1995	46.3
Legends of the West 1994	46.5
Elvis 1993	124.0
Rock and Roll 1993	75.8
Summer Olympics 1992	39.6
Wildflowers 1992	76.2
The World of Dinosaurs 1997	38.5

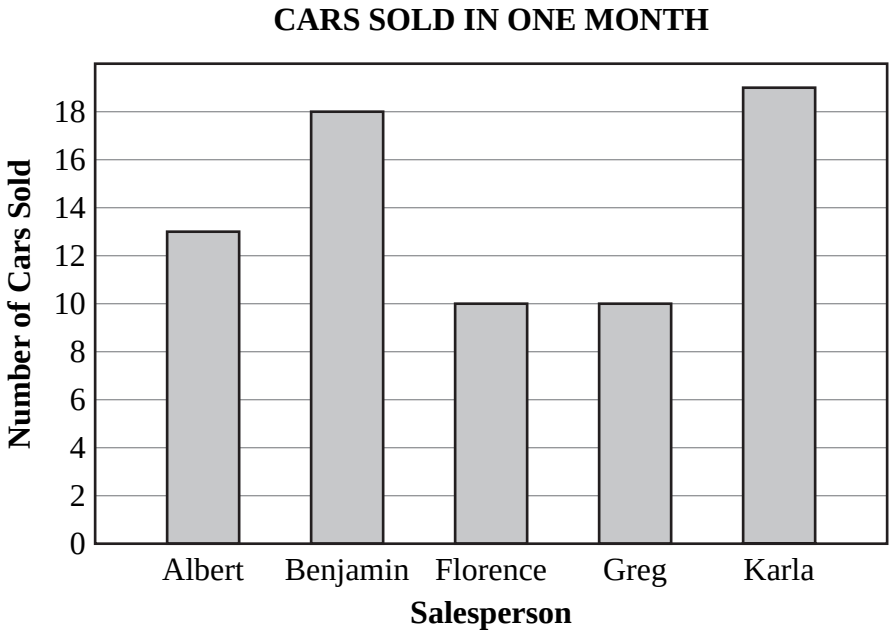
For the stamps listed in the table, what is the median number collected, in millions?

★ **A.** 46.4
B. 57.69
C. 85.90
D. 576.9

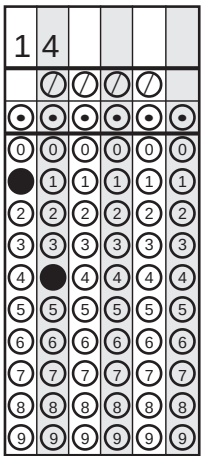
Item Context The Arts

Sample Item 22 **GR**

The bar graph below shows the number of cars sold by each of 5 car salespeople during the same month.



What is the mean number of cars sold during this month for these 5 salespeople?



Sample Response 14

Item Context Social Studies/Consumerism

Benchmark MA.6.S.6.2

Reporting Category	Fractions, Ratios/Proportional Relationships, and Statistics
Standard	**Supporting Idea** Data Analysis
Benchmark	**MA.6.S.6.2 Select and analyze the measures of central tendency or variability to represent, describe, analyze, and/or summarize a data set for the purposes of answering questions appropriately.**
Item Type	At Grade 6, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine which measures of central tendency or variability should be used to best describe the given data. Students will identify one missing data point in a data set given the mean, median, and/or mode of the data set and all other data points. Students will identify which question can be answered from a given measure of central tendency or variability.
Content Limits	Items may include data sets that are presented as lists, frequency tables, and charts. The number of data points may not exceed six when the mean is being calculated. The number of data points may not exceed ten when the median or mode is being determined. Graphical displays are limited to line graphs, double bar graphs, bar graphs, pictographs, and line plots. Items will not assess the vocabulary *measures of central tendency* or *variability*. Items may include, in both stem or answer options, the vocabulary word *outlier*.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in most of these items, as appropriate.

Sample Item 23 **MC**

Noreen took 5 tests in her science class. Her test scores are shown in the table below.

NOREEN'S TEST SCORES

Chapter in Science Book	Test Score
1	70
2	90
3	80
4	50
5	70

Noreen's teacher calculated the mean, median, mode, and range of Noreen's set of test scores. Which of these measures has the highest value?

★ **A.** mean
B. median
C. mode
D. range

Item Context Mathematics

Specifications for Grade 7

Benchmark MA.7.A.1.1

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.1 Distinguish between situations that are proportional or not proportional, and use proportions to solve problems.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will distinguish between proportional and nonproportional relationships. Students will identify possible scenarios that may or may not be proportional. Students will use proportions to solve problems.
Content Limits	Items will not include discounts, simple interest, taxes, tips, percents of increase or decrease, inverse variation, scale drawing, or constant speed. Items will not include negative numbers.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 24 **MC**

If x and y are related, which of the following is true for x and y to be proportional?

A. If x is squared, then y is squared.
B. If 2 is added to x, then 2 is added to y.
★ **C.** If x is multiplied by 2, then y is also multiplied by 2.
D. If 2 is subtracted from x, then 2 is also subtracted from y.

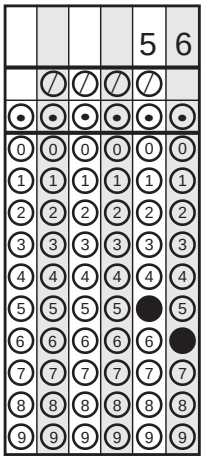
Item Context Mathematics

Sample Item 25 **GR**

Larry's recipe for his chocolate fudge is shown below.

- 3 cups semi-sweet chocolate chips
- 14 ounces sweetened condensed milk
- Dash of salt
- $\frac{3}{4}$ cup chopped nuts (optional)
- $1\frac{1}{2}$ teaspoons vanilla extract

Larry is making a large batch of his fudge and will use 12 cups of semi-sweet chocolate chips. Based on this information, what is the total number of ounces of sweetened condensed milk he will need to use?



Sample Response 56

Item Context The Arts

Benchmark MA.7.A.1.2

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.2 Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will solve single- or multistep percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease, using appropriate computations and rounding strategies where appropriate.
Content Limits	Items may include solving for the whole, the part, or the percent. Percents greater than 100 should be in multiples of 10 or 25, up to 300. Percents less than 100 should be whole numbers or mixed numbers that can be written in decimal form (e.g., $3\frac{1}{2}\%$ as 3.5%). Items may require the student to round answers to the nearest whole number, dollar, cent, percent, or other amount, as appropriate.
Stimulus Attribute	All items should be set in a real-world context.

Sample Item 26 **MC**

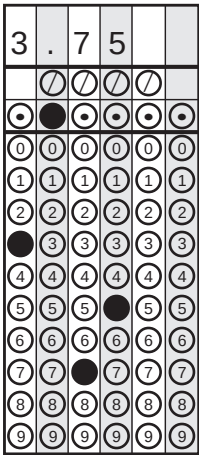
Last year, Nicholas paid $7.25 for the price of a movie ticket at his favorite theater. This year, the price of a movie ticket at the same theater is $9.50. Which is closest to the **percent of increase** in the price of a movie ticket?

A. 16%
B. 24%
★ **C.** 31%
D. 76%

Item Context Science

Sample Item 27 **GR**

In August, Music Maze priced all the compact discs (CDs) at $10. In October, these same CDs were discounted 50%, and in December they were reduced an additional 25%. What was the price of one CD after both discounts?



Sample Response 3.75

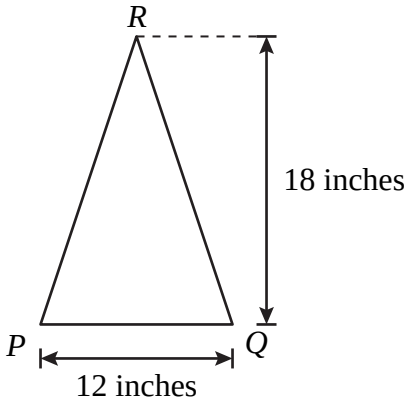
Item Context Social Studies/Consumerism

Benchmark MA.7.A.1.3

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.3 Solve problems involving similar figures.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will use proportional reasoning to solve problems involving similar figures. Students will identify conditions necessary to show two figures are similar.
Content Limits	Items may include graphic representations of three-dimensional objects, but the similar figures being assessed must be two-dimensional figures. Items may include diagonals of two-dimensional figures. Items will not require the use of the Pythagorean theorem. Items will not include circles. Items will not include how changes in dimensions affect perimeter, circumference, area, or volume.
Stimulus Attributes	Graphics may be used in these items. Items should be set in a real-world or mathematical context. Items that are set in real-world context may use length and width as dimensions as well as base and height as dimensions.

Sample Item 28 **MC**

The height and base of isosceles triangle *PRQ* are shown below.



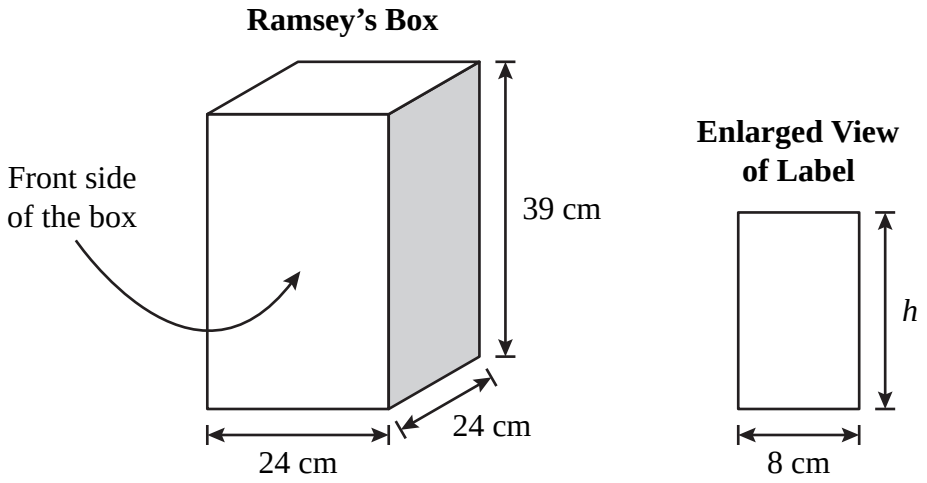
Evelyn drew another isosceles triangle that was similar to triangle *PRQ*. Which of the following could be the dimensions of the triangle Evelyn drew?

A. height = 54 inches; base = 24 inches
B. height = 24 inches; base = 18 inches
C. height = 12 inches; base = 9 inches
★ **D.** height = 9 inches; base = 6 inches

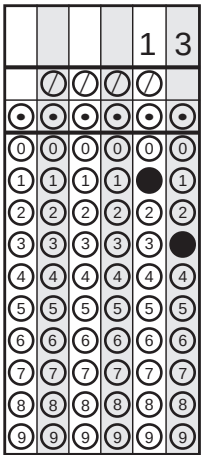
Item Context Mathematics

Sample Item 29 **GR**

Ramsey is making a label to fit on the front side of the rectangular prism box with a height of 39 centimeters (cm).



Ramsey wants the label to be similar to the front side of the box. If the width of the label is 8 cm, what must be the height, **in centimeters**, of the label?



Sample Response 13

Item Context Mathematics

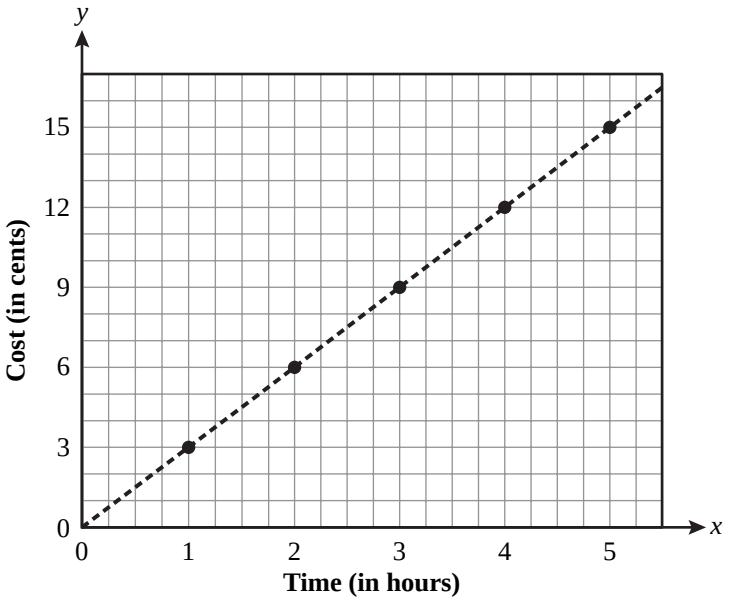
Benchmark MA.7.A.1.4

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.4 Graph proportional relationships and identify the unit rate as the slope of the related linear function.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will use proportionality to demonstrate understanding of the concept of slope as a rate of change. Students will analyze the graph of a line and find the rate of change. Students will identify a graphic representation of a proportional relationship. Students will explain how a change in one variable affects the other variable or how a change in the slope of the line affects one of the variables.
Content Limits	Students should NOT be expected to use $y = mx + b$ or the slope formula in order to solve items in this benchmark. Items will NOT include determining the slope using formulas. For graphs showing a line of a proportional relationship, the line must pass through the origin. Graphs should use dashed lines for discrete values. Items may include up to two variables, with no more than five procedural steps needed to evaluate the expression, equation, or inequality. Items may include the use of whole numbers, fractions, and terminating decimals as indicated in the general content limits. Items may include all four quadrants on a coordinate grid. Items may include the concept of positive slope, negative slope, no slope, or zero slope.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in some of these items, as appropriate.

Sample Item 30 **MC**

Electronic bicycle lockers are public storage lockers designed specifically for the storage of bicycles in a transit station. These lockers can be rented for an annual fee. The graph below shows the cost of renting an electronic bicycle locker with the annual fee changed to an hourly rate.

ELECTRONIC BICYCLE LOCKER RENTAL



Which of the following shows the rate for renting an electronic bicycle locker?

A. 1 cent per 3 hours
★ **B.** 3 cents per 1 hour
C. 5 cents per 16 hours
D. 16 cents per 5 hours

Item Context Social Studies/Consumerism

Benchmark MA.7.A.1.5

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.5 Distinguish direct variation from other relationships, including inverse variation.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will identify a representation of a direct or inverse variation given in a graph, table of values, or real-world situation. Students will determine whether or not a situation, graph, or table of values represents a direct or inverse variation. Items will not require students to use formulas to solve problems. The intent of this benchmark is for students to distinguish between direct and inverse variations and determine how they differ.
Content Limits	Items may include graphs, using four quadrants, function tables, and situations. Representations (graphs, tables, situations) used in the item may be nonlinear; however, items will not assess the vocabulary related to nonlinear relationships (i.e., *parabolas*, *quadratic*). Graphs in items with real-world context are limited to the first quadrant only. Graphs in items with mathematical context may use all four quadrants.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in some of these items, as appropriate.

Sample Item 31 **MC**

Which of the following tables does NOT represent a direct variation between x and y?

A.

x	3	6	12	24
y	4	8	16	32

★ B.

x	5	8	11	14
y	6	9	12	15

C.

x	2	6	8	10
y	5	15	20	25

D.

x	1	3	9	27
y	3	9	27	81

Item Context Mathematics

Benchmark MA.7.A.1.6

Reporting Category	Ratios/Proportional Relationships
Standard	**Big Idea 1** Develop an understanding of and apply proportionality, including similarity.
Benchmark	**MA.7.A.1.6 Apply proportionality to measurement in multiple contexts, including scale drawings and constant speed.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will solve problems by applying proportionality to measurement contexts. Students will determine the scale factor for a given situation or use a scale to determine a measurement.
Content Limits	Measurements may be in either metric or customary units, but measurements from both systems may not be used in the same item. Items may include the concepts of average speed or constant speed. Items may include fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 24, 25, 32, or 50. Items may include decimals through the hundredths place. Items will NOT include circumference, perimeter, area, or volume. Items will NOT include percents of increase or decrease. Items will NOT include converting units between two derived units (e.g., converting miles per hour to feet per second).
Stimulus Attributes	Items should be set in a real-world context or a mathematical context. Graphics should be used in some of these items, as appropriate.

Sample Item 32 **MC**

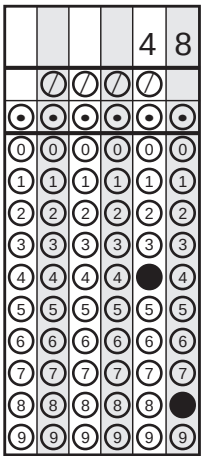
Dale and his family are planning a trip from Seattle to Miami. The distance between the cities is 5322 kilometers. Dale drew a line segment on a U.S. map from Seattle to Miami to show his younger sister the distance between the two cities. If the scale on the map shows that 2 centimeters represents 600 kilometers, what is the length of the line segment Dale drew on the map between the two cities?

A. 4.44 cm
B. 8.87 cm
C. 10.87 cm
★ **D.** 17.74 cm

Item Context Social Studies/Consumerism

Sample Item 33 **GR**

Dominic drove 324 miles from Salt Lake City, Utah, to Bryce Canyon National Park in 6 hours and 45 minutes. What was his average speed, **in miles per hour**?



Sample Response 48

Item Context Social Studies/Consumerism

Benchmark MA.7.G.2.1

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.
Benchmark	**MA.7.G.2.1 Justify and apply formulas for surface area and volume of pyramids, prisms, cylinders, and cones.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will analyze a situation to justify a strategy for calculating surface area and/or volume. Students will apply formulas to solve problems related to surface area of right-rectangular prisms, nonoblique triangular prisms, right-square pyramids, and right circular cylinders. Students will apply formulas to solve problems related to volume of right-rectangular prisms, right triangular prisms, right-square pyramids, right-circular cylinders, and cones. Students will determine one or two dimension(s) of a three-dimensional figure, given its volume or surface area and the other dimensions.
Content Limits	Dimensions of given figures will be whole numbers. Problems related to surface area will not include cones, but problems related to volume can include cones. In calculating surface area and volume of simple shapes, dimensions of given figures will be whole numbers.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in most of these items, as appropriate.

Sample Item 34 **MC**

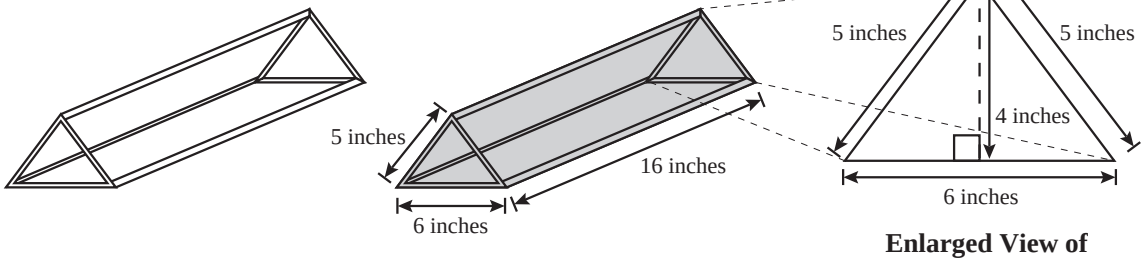
Jonah is calculating the volume of a right circular cylinder. Which of the following is a correct method for calculating the volume of a cylinder?

★ **A.** Calculate the area of the base and multiply by the height.
B. Calculate the circumference of the base and multiply by the height.
C. Calculate the area of the base, multiply by 2, and multiply by the height.
D. Calculate the circumference of the base, multiply by 2, and multiply by the height.

Item Context Mathematics

Sample Item 35 **GR**

Maura made a wood frame and covered it with transparent red plastic wrap to create a triangular prism, as shown below.



Wood Frame **Triangular Prism** **Enlarged View of Triangular Face**

What is the total surface area, **in square inches**, of the prism?

			2	8	0
	⊘	⊘	⊘	⊘	
⊙	⊙	⊙	⊙	⊙	⊙
0	0	0	0	0	●
1	1	1	1	1	1
2	2	2	●	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	●	8
9	9	9	9	9	9

Sample Response 280

Item Context The Arts

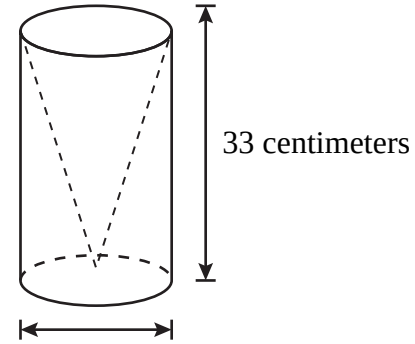
Benchmark MA.7.G.2.2

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.
Benchmark	**MA.7.G.2.2 Use formulas to find surface areas and volume of three-dimensional composite shapes.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will solve problems involving surface area or volume of three-dimensional composite figures.
Content Limits	Students will solve problems involving surface area or volume using the decomposition of three-dimensional figures. Three-dimensional figures used in composite figures are limited to three and may include right-rectangular prisms, right triangular prisms, right-square pyramids, right circular cylinders, and cones. Problems related to surface area will not include cones, but problems related to volume can include cones. Items that include cones and cylinders used in the composition or decomposition may include only whole figures, half-figures, or quarter-figures. Right-square pyramids used in the composition or decomposition must be whole pyramids only. Items will not include truncated cones and pyramids. Dimensions of composite figures used in calculations will be whole numbers.
Stimulus Attributes	Graphics should be used in all of these items, as appropriate. Items should be set in a real-world or mathematical context.

Sample Item 36 **MC**

Rebecca used a right circular cylinder piece of ice to cut out a cone. The dimensions of the ice piece she used are shown below.

Piece of Ice Used



Which is closest to the volume of the remaining ice after Rebecca removes the largest cone possible from the right circular cylinder?

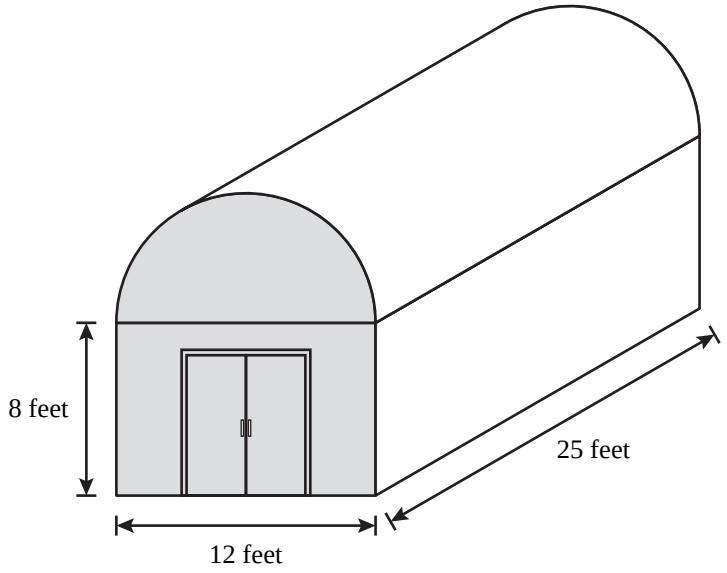
A. 1351 cm^3
B. 3456 cm^3
★ **C.** 6911 cm^3
D. 10 367 cm^3

Item Context Mathematics

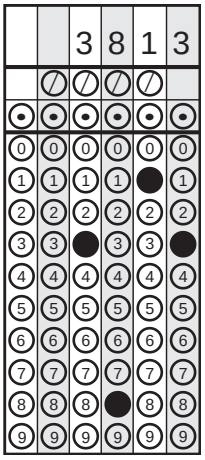
Sample Item 37 **GR**

The greenhouse shown below has the shape of half a cylinder and a rectangular prism.

Greenhouse



In order to air-condition the building, the owner needs to know the volume of air space in the empty greenhouse. What is the volume, **in cubic feet**?



Sample Responses 3813, 3814.3

Item Context The Arts

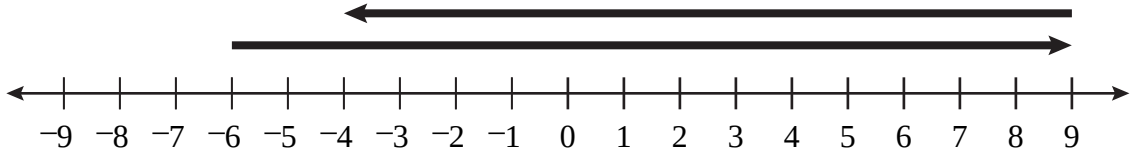
Benchmark MA.7.A.3.1

Reporting Category	Number: Base Ten
Standard	**Big Idea 3** Develop an understanding of operations on all rational numbers and solving linear equations.
Benchmark	**MA.7.A.3.1 Use and justify the rules for adding, subtracting, multiplying, dividing, and finding the absolute value of integers.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will analyze a set of circumstances, pictorial representation, or pattern to identify the correct operation to use for finding an appropriate solution. Students will recognize the appropriate operation for a stated effect, the effects of operations, and/or the relationships between operations. Problems should be solved using concrete or pictorial representations of models, tables, and graphs, instead of using algebraic symbolism. Students will use the rules for adding, subtracting, multiplying, and dividing integers, including absolute value, and the order of operations to solve real-world problems.
Content Limits	Items may include the effects of the four basic operations on integers, and the use of properties of real numbers to solve problems (commutative, associative, distributive, identity, equality, inverse, and the inverse relationship of positive and negative numbers). Items should include at least one integer in the computation. Items may use fractions less than 1 with numerators and denominators less than 100. Items may use decimals to the ten-thousandths place. Items may include up to three operations, with no more than five procedural steps needed to evaluate the expression.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Items may include representations of manipulatives, such as two-sided chips and algebra tiles.

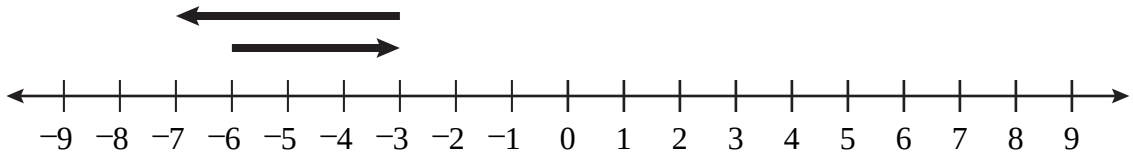
Sample Item 38 **MC**

Which of the following best represents the method for finding the value of $^{-}6 + 9 - 4$?

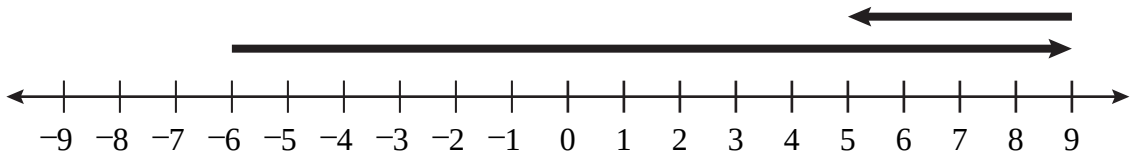
A.



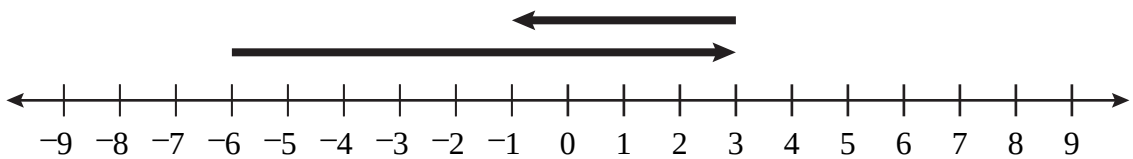
B.



C.



★ **D.**



Item Context Mathematics

Benchmark MA.7.A.3.2

Reporting Category	Number: Base Ten
Standard	**Big Idea 3** Develop an understanding of operations on all rational numbers and solving linear equations.
Benchmark	**MA.7.A.3.2 Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will solve real-world problems or mathematical constructs, including equations, expressions, or inequalities.
Content Limits	Items may include up to three operations and up to five procedural steps. Items may include at least one negative integer, a fraction, or a terminating decimal. Items using exponents are limited to whole-number exponents less than or equal to 4. Items will not include raising an exponential expression to a power (e.g., $(2^3)^2$). Items will not include scientific notation.
Stimulus Attribute	Items should be set in a real-world or mathematical context.
Response Attributes	Gridded-response items should not include the use of fractions that convert to nonterminating decimals (e.g, $\frac{1}{3}$ or $\frac{1}{7}$). Negative grids will be used in this benchmark.

Sample Item 39 **MC**

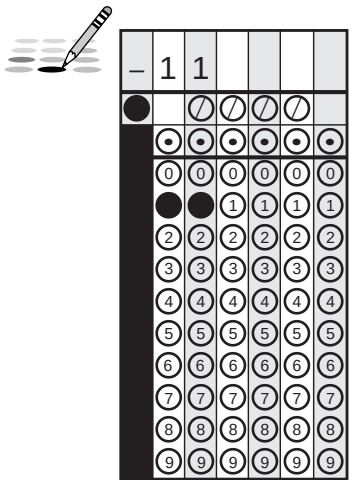
On a cold day, Rupert measured the outside temperature and discovered it was 13ºF. Each hour after that, Rupert measured the outside temperature and discovered it was 3ºF colder than the previous hour's temperature. At this rate, how many hours would it take for the temperature to reach $^{-}17$ºF?

A. 4 hours
B. 9 hours
★ **C.** 10 hours
D. 30 hours

Item Context Science

Sample Item 40 **GR**

What is the value of the expression $14 - 5^2$?



Sample Response $^{-}11$

Item Context Mathematics

Benchmark MA.7.A.3.3

Reporting Category	Number: Base Ten
Standard	**Big Idea 3** Develop an understanding of operations on all rational numbers and solving linear equations.
Benchmark	**MA.7.A.3.3 Formulate and use different strategies to solve one-step and two-step linear equations, including equations with rational coefficients.** Also assesses MA.7.A.5.2 Solve non-routine problems by working backwards.
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will identify the next step needed to solve a linear equation. Students will use different strategies, including working backwards, to solve problems that can be represented as a one- or two-step linear equation.
Content Limits	Items involving finding a solution should be limited to a variable on one side of the equation. Items identifying formulating an equation for a situation may involve two variables. Items may not exceed two (of the four) operations in one linear equation. Items may not include irrational coefficients.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Items may include equations, graphs, tables, or real-world situations.
Response Attribute	Negative grids will be used in this benchmark.

Sample Item 41 **MC**

Which of the following steps would solve $\frac{2}{3}x - 4 = 10$?

A. Add 4 to both sides of the equation, then multiply both sides by $\frac{2}{3}$.

★ **B.** Add 4 to both sides of the equation, then multiply both sides by $\frac{3}{2}$.

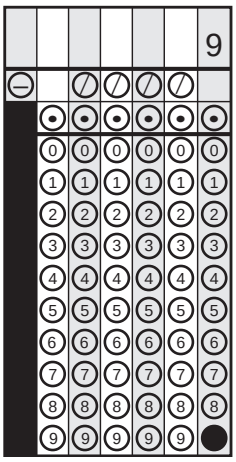
C. Subtract 4 from both sides of the equation, then multiply both sides by $\frac{2}{3}$.

D. Subtract 4 from both sides of the equation, then multiply both sides by $\frac{3}{2}$.

Item Context Mathematics

Sample Item 42 **GR**

When Eric became a member of an exercise gym, he paid a one-time fee of $250. He then had to pay $79.95 per month. So far, Eric has paid a total of $969.55, not including tax. What is the number of months for which Eric paid?



Sample Response 9

Item Context Health/Physical Education

Benchmark MA.7.A.3.4

Reporting Category	Number: Base Ten
Standard	**Big Idea 3** Develop an understanding of operations on all rational numbers and solving linear equations.
Benchmark	**MA.7.A.3.4 Use the properties of equality to represent an equation in a different way and to show that two equations are equivalent in a given context.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine if two equations have equivalent solutions. Students will recognize if two equations are equivalent based on the application of the commutative, associative, and/or distributive properties.
Content Limits	Items may include up to three operations. Equations (or expressions) used in items may include up to three operations. Coefficients and constants used in multistep equations (or expressions) must be integers. Items that contain one-step equations may use fractions less than 1.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 43 **MC**

Which is equivalent to $^{-}3(4x - 6) = 20$?

A. $^{-}12x - 6 = 20$
★ **B.** $^{-}12x + 18 = 20$
C. $^{-}12x - 6 = {}^{-}60$
D. $^{-}12x + 18 = {}^{-}60$

Item Context Mathematics

Benchmark MA.7.G.4.1

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.7.G.4.1 Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures, and apply these relationships to solve problems.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will determine the effects of changing dimensions on perimeter, circumference, area, and volume. Students will solve problems involving the effects of changing dimensions on perimeter, circumference, area, and volume.
Content Limits	Items that increase the dimensions of a figure should use scale factors that are whole numbers less than or equal to 25. Items that decrease the dimensions of a figure should use scale factors of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, 10%, 20%, 25%, or 50%. Distractors in MC items may exceed this limit. Items assessing change in volume should only include right-rectangular prisms and right-circular cylinders. Items will not assess changes in surface area.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Items that are set in real-world context may use length and width as dimensions as well as base and height as dimensions. Graphics should be used in most of these items, as appropriate.

Sample Item 44 **MC**

Toni has a rectangular vegetable garden that measures 12 feet by 18 feet. She wants to reduce the area of her garden. If Toni reduces the dimensions of her garden to 12 feet by 9 feet, how will the area of the new garden compare to the area of the old garden?

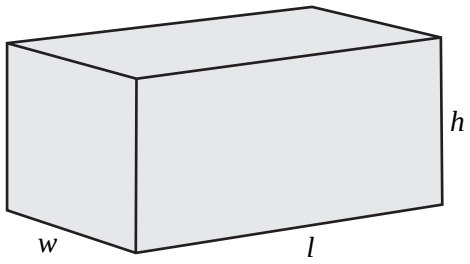
★ **A.** The area will be one-half as large.
B. The area will be two-thirds as large.
C. The area will be one-fourth as large.
D. The area will be three-fourths as large.

Item Context The Arts

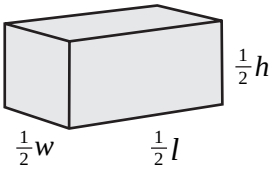
Sample Item 45 **GR**

Jeff is building walls using the building blocks shown below. The dimensions of the small blocks are $\frac{1}{2}$ the size of the dimensions of the large blocks. Jeff's wall has a length (l) of 5 large blocks and a height (h) of 2 large blocks.

Building Blocks

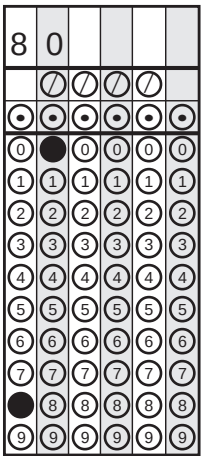


Large Block



Small Block

How many small blocks does Jeff need to build a wall with the **same volume** as the wall he made with large blocks?



Sample Response 80

Item Context Social Studies/Consumerism

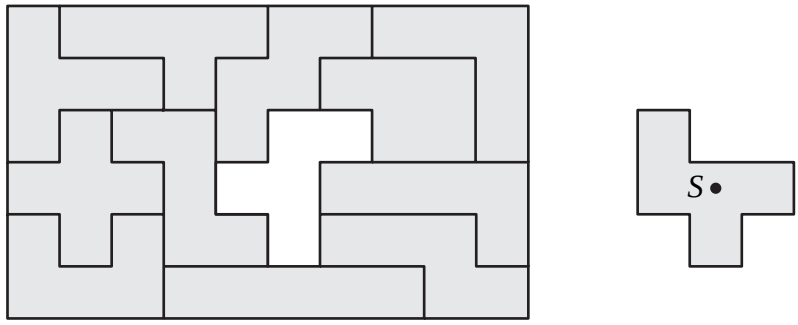
Benchmark MA.7.G.4.2

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.7.G.4.2 Predict the results of transformations, and draw transformed figures with and without the coordinate plane.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will identify the result of transformations on a two-dimensional figure. Students will identify the transformations performed on a two-dimensional figure, given the original figure and the resulting figure after the transformation. Students will determine the distance between two points located on the same vertical or horizontal line. Students will determine the vertical and horizontal translations needed to get from one point to another on the coordinate plane.
Content Limits	Items may include dilations, translations, reflections, and rotations of two-dimensional figures. Items that include translations will be limited to horizontal or vertical moves. Items may include lines of reflection, which may or may not pass through the object being reflected. Items may include centers of rotation, which may or may not be on the object being rotated. Items may include clockwise and counterclockwise rotations, which are limited to 45°, 90°, 180°, 270°, and 360°. Items may present figures on coordinate grids, which may include all four quadrants. Items may include the concepts of symmetry, congruency, or scale factors. Items may include up to three transformations.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in most of these items, as appropriate.

Sample Item 46 **MC**

Tracy is playing a puzzle game on the computer. She has placed all the pieces in the puzzle except for one, as shown below.

Tracy's Puzzle



Tracy can complete the puzzle by performing two transformations on the remaining puzzle piece. Which two transformations should Tracy perform?

★ **A.** a 90° clockwise rotation about point *S*, followed by a translation to the left
B. a 90° counterclockwise rotation about point *S*, followed by a translation to the left
C. a reflection across a vertical line, followed by a 90° clockwise rotation about point *S*
D. a reflection across a vertical line, followed by a 90° counterclockwise rotation about point *S*

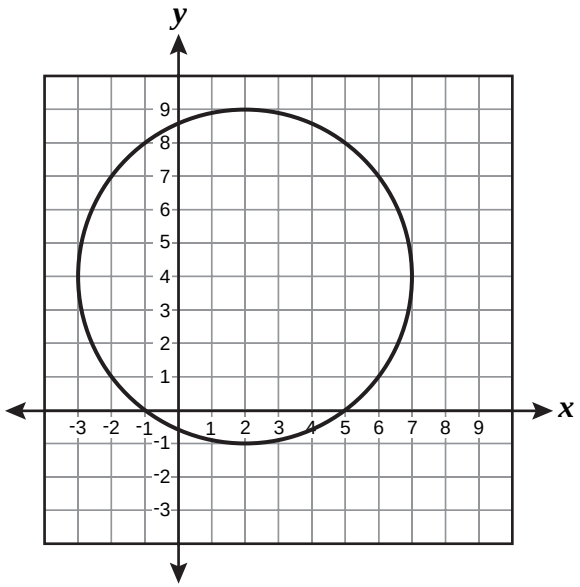
Item Context The Arts

Benchmark MA.7.G.4.3

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.7.G.4.3 Identify and plot ordered pairs in all four quadrants of the coordinate plane.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will identify ordered pairs or the location of a point on a coordinate grid (e.g., performing movement on the grid). Students will identify characteristics of points located in each of the four quadrants, or on the *x*- and *y*-axes (i.e., all points in quadrant III have negative *x*- and negative *y*-coordinates).
Content Limits	Scales on graphs used in items must be in increments of 1 for both the *x*- and *y*-axes. Both coordinates of all points used in items must be between $^{-}10$ and 10, inclusive. Items will not include finding the midpoint of a segment, the slope of a line, or use of the distance formula. Items will not include determining the *x*- or *y*-intercepts of a line.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics must be used within all of these items. Items should present a coordinate plane and should require the use of coordinate geometry to locate and/or describe points.

Sample Item 47 **MC**

Daniel drew a circle on a grid, as shown below.



Which coordinates best represent the location of a point that is NOT on the circle?

A. (⁻3, 4)
B. (⁻1, 8)
C. (7, 4)
★ **D.** (8, 5)

Item Context Mathematics

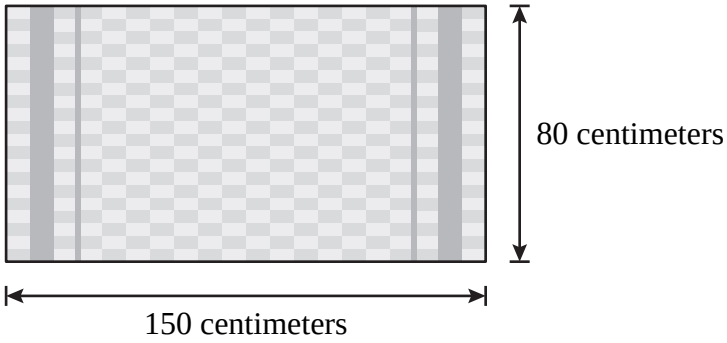
Benchmark MA.7.G.4.4

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.7.G.4.4 Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)), dimensions, and derived units to solve problems.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will compare, contrast, and convert: • linear units of measure between different measurement systems (US customary or metric [SI]); • derived units of measure within the same system; and • units of measure within the same system to solve real-world problems.
Content Limits	Items may include conversions from customary to metric or vice versa, using only one of the conversions found on the reference sheet. Items may include up to three conversions within the same system of measurement (e.g., millimeters to centimeters, centimeters to meters, and meters to kilometers). Items may include conversions within the same unit of measure when converting derived units (e.g., miles per hour to feet per second). Items may include converting a denominate number (e.g., 5 ft 3 in.) to a single unit within the same system of measurement, or vice versa. Gridded-response items may only involve conversions within the same system of measurement. Items will not include a combination of multiple conversions within the same system and across different measurement systems (e.g., convert meters to inches).
Stimulus Attribute	All items should be set in a real-world context.

Sample Item 48 **MC**

Rebecca bought a rectangular throw blanket like the one shown below.

Rebecca's Throw Blanket



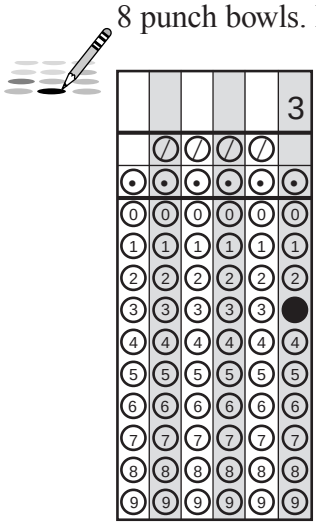
Which is closest to the dimensions, in inches, of Rebecca's throw blanket?

★ **A.** 59 inches by 32 inches
B. 59 inches by 80 inches
C. 75 inches by 40 inches
D. 80 inches by 150 inches

Item Context Social Studies/Consumerism

Sample Item 49 **GR**

Melanie is making punch for the school dance. The recipe calls for 6 cups of juice for each of the 8 punch bowls. How many **gallons** of juice does she need?



Sample Response 3

Item Context Mathematics

Benchmark MA.7.A.5.1

Reporting Category	Number: Base Ten
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.7.A.5.1 Express rational numbers as terminating or repeating decimals.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will change fractions and/or mixed numbers to decimal equivalents.
Content Limits	Items may include mixed numbers, fractions, and decimals that are terminating or repeating. Items will not include irrational numbers. Items will not include converting a repeating decimal to a fraction or mixed number. Decimals that must be converted to fractions must terminate by the thousandths place.
Stimulus Attributes	Items should be set in a mathematical context. Items should not use 7 as the denominator when converting a fraction to a decimal.
Response Attribute	Repeating decimals will be indicated by a bar over the numerals that are repeating behind the decimal.

Sample Item 50 **MC**

Which of the following is equivalent to $\frac{13}{36}$?

A. $0.36\overline{1}$
★ **B.** $0.3\overline{61}$
C. $0.\overline{361}$
D. 0.361

Item Context Mathematics

Benchmark MA.7.S.6.1

Reporting Category	Statistics and Probability
Standard	**Supporting Idea** Data Analysis
Benchmark	**MA.7.S.6.1 Evaluate the reasonableness of a sample to determine the appropriateness of generalizations made about the population.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will analyze appropriateness of a sample population and sample size used to make generalizations about the population. Students will identify an appropriate sample for a population. Students will evaluate hypotheses and conclusions based on a statistical sample.
Content Limits	Items may include common misuses of statistics based on an inadequate or nonrepresentative sample, or an over-generalized result. Items may provide measures of central tendency or range. Items will not include calculating measures of central tendency or range. No more than 25 sets of data are to be displayed. The sample size should not exceed the general content limits.
Stimulus Attributes	Items should be set in a real-world context. Graphics should be used in some of these items, as appropriate.

Sample Item 51 **MC**

A cable television company will add new channels to its service. The company president wants to have 100 customers surveyed by telephone in a single weekend to find out what kind of channels customers want. Which method would increase the bias in the survey?

A. performing the survey over a period of one week
B. increasing the number of customers surveyed to 300
★ **C.** surveying the 100 customers who have had cable service with this company for the longest period of time
D. mailing the survey questions to all the customers and offering a 25% discount on cable service to the first 100 customers who return the survey

Item Context Social Studies/Consumerism

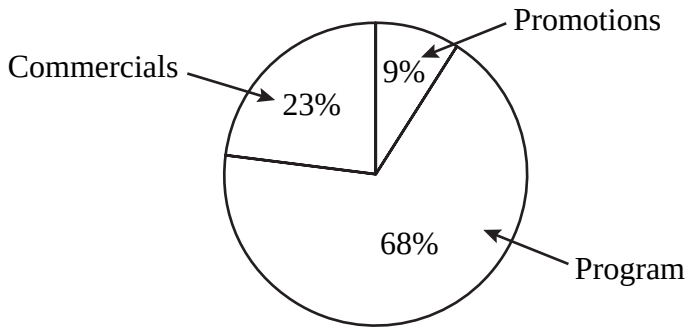
Benchmark MA.7.S.6.2

Reporting Category	Statistics and Probability
Standard	**Supporting Idea** Data Analysis
Benchmark	**MA.7.S.6.2 Construct and analyze histograms, stem-and-leaf plots, and circle graphs.**
Item Types	At Grade 7, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will read and interpret data displayed in histograms, stem-and-leaf plots, and circle graphs. Students will determine the correct type of graph to use to display a set of data.
Content Limits	Items may provide or include calculating measures of central tendency and range of the data displayed in histograms, stem-and-leaf plots, and circle graphs only. The number of data pieces displayed should not exceed ten when a measure of central tendency is being calculated. The number of data pieces displayed should not exceed 25 when a measure of central tendency is not being calculated. Percents used in items assessing circle graphs will be limited to whole-number percents.
Stimulus Attributes	Items should be set in a real-world context. Graphics should be used in all items. Gridded-response items will not include estimation of information from a histogram, stem-and-leaf plot, or circle graph.

Sample Item 52 **MC**

Television programs are separated into parts by commercials and network promotions. The circle graph below shows the percent of a 60-minute television show that is used for commercials, promotions, and the program itself.

60-MINUTE TELEVISION SHOW



Which is closest to the number of minutes used for commercials and promotions during that 60-minute television show?

A. 5
B. 14
★ **C.** 19
D. 32

Item Context The Arts

Sample Item 53 **GR**

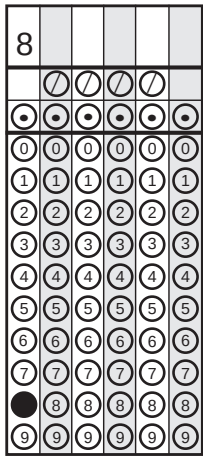
Dr. Neal is a veterinarian. In one day, he examined 12 cats. He recorded the weight, in pounds, of each of the cats in the stem-and-leaf plot below.

WEIGHT OF CATS EXAMINED

Stem	Leaf
7	4 9
8	
9	7 8
10	2 4 5 6
11	0 2 8
12	3

KEY
7 | 4 = 7.4 pounds

Based on the information in the stem-and-leaf plot, how many cats did Dr. Neal examine that weighed **more than** 10 pounds?



Sample Response 8

Item Context Science

Benchmark MA.7.P.7.1

Reporting Category	Statistics and Probability
Standard	**Supporting Idea** Probability
Benchmark	**MA.7.P.7.1 Determine the outcome of an experiment and predict which events are likely or unlikely, and if the experiment is fair or unfair.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine the likelihood or probability of an outcome occurring. Students will verify that probabilities are reasonable. Students will determine the outcomes of an experiment or test.
Content Limits	Items may include concepts such as *certain*, *impossible*, *likelihood*, *fair*, *unfair*, *most likely*, *equally likely*, and *least likely*. Items will include only simple events. Items may include representing probabilities as fractions, ratios, decimals between 0 and 1 (inclusive), and/or percentages between 0 and 100 (inclusive). Items will not include combinations or permutations In items involving the determination of all possible outcomes, the number of outcomes should not exceed 36.
Stimulus Attributes	Items should be set in a real-world or mathematical context. Graphics should be used in some of these items, as appropriate.

Sample Item 54 **MC**

Mrs. Davis is teaching her class about probability. She prepared the set of golf balls listed below.

- 6 red golf balls, each labeled with a different number from 1 to 6
- 7 green golf balls, each labeled with a different number from 1 to 7
- 8 blue golf balls, each labeled with a different number from 1 to 8
- 9 yellow golf balls, each labeled with a different number from 1 to 9

Mrs. Davis put all the golf balls into a sack and mixed them up. Nancy will be the first student to select a golf ball from the sack without looking. Which of the following outcomes is **most likely** to occur?

A. Nancy will select a yellow golf ball.
B. Nancy will select a golf ball that is not blue.
C. Nancy will select a golf ball with the number 6 on it.
★ **D.** Nancy will select a golf ball with a number on it that is not 1.

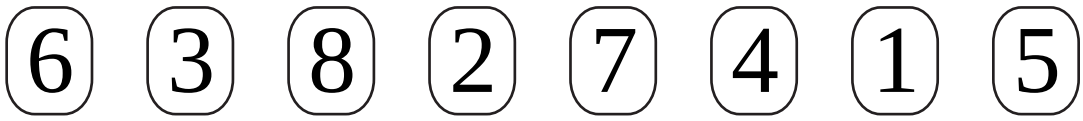
Item Context Mathematics

Benchmark MA.7.P.7.2

Reporting Category	Statistics and Probability
Standard	**Supporting Idea** Probability
Benchmark	**MA.7.P.7.2 Determine, compare, and make predictions based on experimental or theoretical probability of independent or dependent events.**
Item Type	At Grade 7, this benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine the likelihood or probability of a simple event occurring. Students will compare probabilities of events. Students will make predictions based on experimental or theoretical probability of independent or dependent events.
Content Limits	Items may include determining the probability of a compound event both with and without replacement. Items may include distinguishing between independent and dependent events. Probabilities should be expressed as whole numbers, fractions, or decimals. Items assessing compound events should not exceed sixteen outcomes in a sample space.
Stimulus Attributes	Items should be set in a real-world context. Graphics should be used in some of these items, as appropriate.

Sample Item 55 **MC**

Joaquin has the set of cards shown below.



Joaquin will shuffle the cards, select one without looking, record the number of the card, and return the card to the set. He will repeat this process 50 times. Which is closest to the number of times he should expect to select a card with a number greater than 5?

A. 6
B. 10
★ **C.** 19
D. 25

Item Context Mathematics

Specifications for Grade 8

Benchmark MA.8.A.1.1

Reporting Category	Expressions, Equations, and Functions
Standard	**Big Idea 1** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
Benchmark	**MA.8.A.1.1 Create and interpret tables, graphs, and models to represent, analyze, and solve problems related to linear equations, including analysis of domain, range, and the difference between discrete and continuous data.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will find solutions for linear problems by interpreting tables, graphs, or models. Problems should be solved using concrete or pictorial representations of models, tables, and graphs, rather than solved abstractly using algebraic symbolism. Students will determine whether the content in the problem uses discrete or continuous data and/or will determine the relevant domain and range.
Content Limits	Equations used in items should include no more than two variables and no more than two operations. Values in expressions should be rational numbers. In items that contain equations, the equation must be linear.
Stimulus Attribute	Items should be set in a real-world context.

Sample Item 56 **MC**

Sandy conducted an experiment with sound waves in dry air at 20°C. She observed that a linear relationship exists between the time and distance that sound travels under these conditions. She recorded her findings in the table below.

DISTANCE SOUND TRAVELS IN DRY AIR AT 20°C

Time (in seconds)	Distance (in kilometers)
4.0	1.372
5.0	1.715
6.0	2.058
7.0	2.401
8.0	2.744

Based on the information in the table, which of the following is a valid statement about Sandy's recorded findings?

A. Sandy's data is discrete with a range of $4 \leq x \leq 8$.
B. Sandy's data is continuous with a range of $4 \leq x \leq 8$.
C. Sandy's data is discrete with a range of $1.372 \leq x \leq 2.744$.
★ **D.** Sandy's data is continuous with a range of $1.372 \leq x \leq 2.744$.

Item Context Science

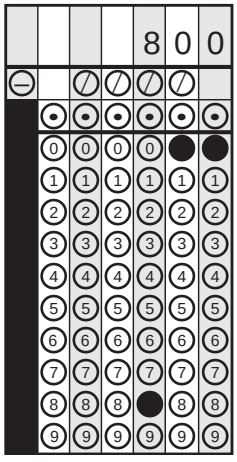
Sample Item 57 **GR**

A catering service charges a $50 setup fee, plus a set amount per guest, to provide food and beverages for a dinner party. Below is a table that lists the total cost of a dinner party for a certain number of guests.

TOTAL COST OF CATERING A DINNER PARTY

Number of Guests	Total Cost (in dollars)
10	150
20	250
30	350
40	450
50	550

What is the total cost, in dollars, if 75 guests attend a dinner party?



Sample Response 800

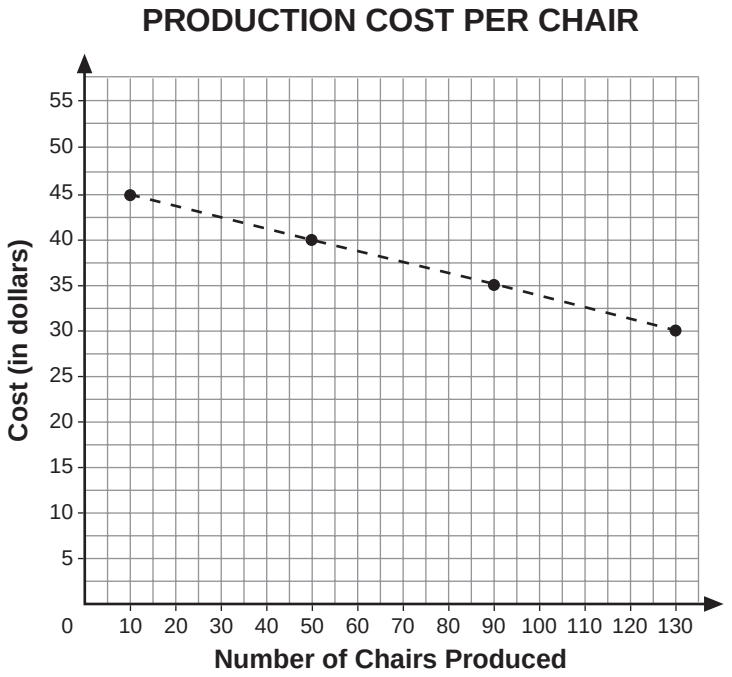
Item Context Social Studies/Consumerism

Benchmark MA.8.A.1.2

Reporting Category	Expressions, Equations, and Functions
Standard	**Big Idea 1** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
Benchmark	**MA.8.A.1.2 Interpret the slope and the x- and y-intercepts when graphing a linear equation for a real-world problem.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will describe the concepts of slope, *x*-, or *y*-intercept of a given graph in a real-world situation. Problems should be solved using concrete or pictorial representations of models, tables, and graphs, rather than solved abstractly using algebraic symbolism.
Content Limits	Functions may be from all four quadrants. Items should rely primarily on tables, graphs, and *t*-tables to present real-world relationships. Equations used in items should include no more than three operations. Items may include positive, negative, or zero slopes, but not undefined slopes. The *x*- and *y*-intercepts are limited to integers and halves.
Stimulus Attributes	Graphics should be used in most of these items, as appropriate. Items may be set in either a real-world or mathematical context.

Sample Item 58 **MC**

The production manager of a furniture manufacturing company plotted values on the graph below to show how the production cost per chair decreases as the number of chairs produced increases. The slope of the dashed line segment joining these points is $-\frac{1}{8}$.



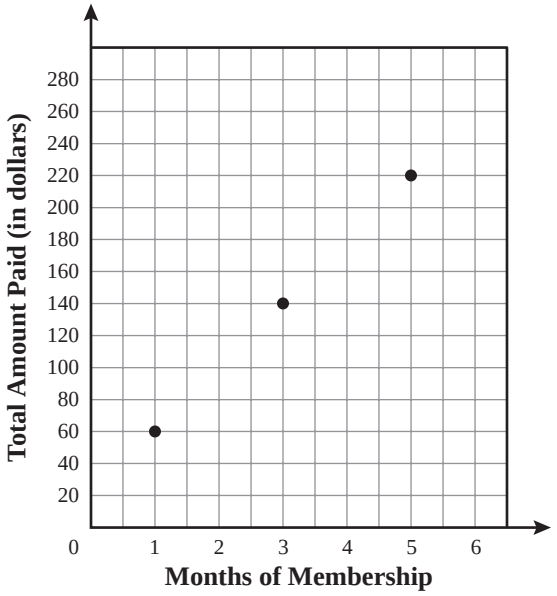
Which statement does this slope of the dashed line segment represent?

A. Each chair produced decreases the cost per chair by $5.
B. Each chair produced decreases the cost per chair by $8.
★ **C.** For every 8 chairs produced, the cost per chair decreases by $1.
D. For every 10 chairs produced, the cost per chair decreases by $5.

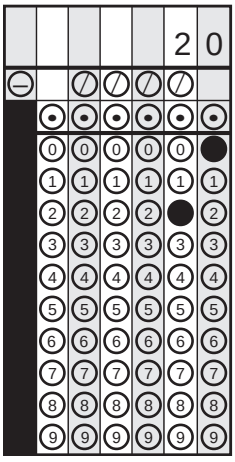
Item Context Social Studies/Consumerism

Sample Item 59 **GR**

Membership to unlimited monthly car washes at a local car wash costs $20 plus a monthly fee, as shown on the graph below.



What is the *y*-intercept of the linear relationship shown?



Sample Response 20

Item Context Social Studies/Consumerism

Benchmark MA.8.A.1.3

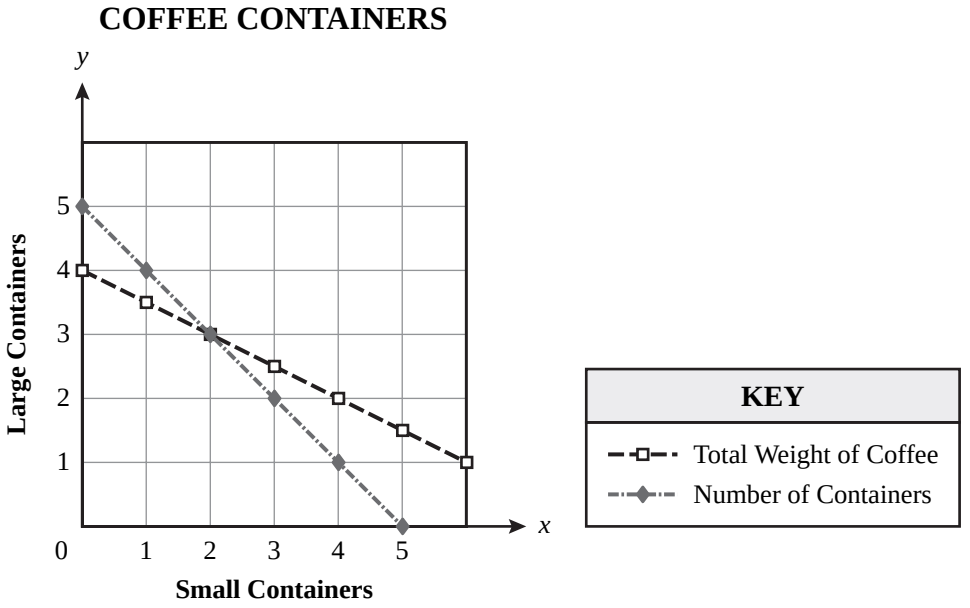
Reporting Category	Expressions, Equations, and Functions
Standard	**Big Idea 1** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
Benchmark	**MA.8.A.1.3 Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations.** Also assesses MA.8.A.1.4 Identify the solution to a system of linear equations using graphs.
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will solve problems that can be represented by a system of two linear equations. Students will identify the unique solution for a system of equations representing two intersecting lines. Students will understand that a specific system of equations representing parallel lines has no solution.
Content Limits	Graphs used in items may include all four quadrants. Items should rely primarily on tables, graphs, or models to present problems. Items may assess knowledge of the slopes of lines (including vertical and horizontal lines) and the x- and y-intercepts of lines. Items may assess properties of parallel or perpendicular lines.
Stimulus Attributes	Context or problems should enable students to solve using concrete or pictorial representations of models, tables, and graphs, rather than solve abstractly using algebraic symbolism. Graphics should be used for all of these items.

Sample Item 60 **MC**

Caleb bought small and large containers of coffee. He purchased 5 containers of coffee that weigh a total of 40 pounds. The small containers weigh 5 pounds, and the large containers weigh 10 pounds. The equations and graph below can be used to determine the number of each type of container Caleb purchased, where x represents the small container and y represents the large container.

Number of containers: $x + y = 5$

Total weight of coffee: $5x + 10y = 40$



What are the number of small containers and large containers Caleb purchased?

★ **A.** 2 small containers; 3 large containers
B. 3 small containers; 2 large containers
C. 4 small containers; 1 large container
D. 6 small containers; 1 large container

Item Context Social Studies/Consumerism

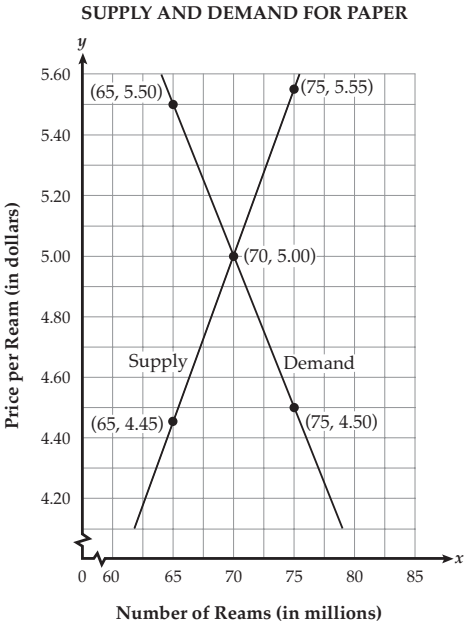
Sample Item 61 **GR**

An economist is helping a paper company evaluate the demand for reams of paper at different selling prices. The point at which the supply and demand graphs intersect is referred to as *market equilibrium*.

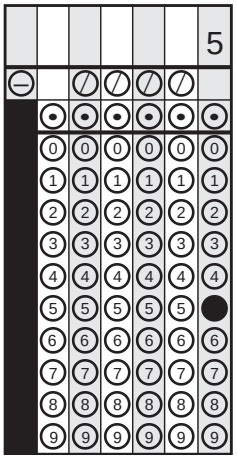
The economist graphed the supply and demand equations shown below.

Demand equation: $y = {}^{-}0.1x + 12$

Supply equation: $y = 0.11x - 2.7$



What is the price per ream, **in dollars**, of the *market equilibrium*?



Sample Response 5

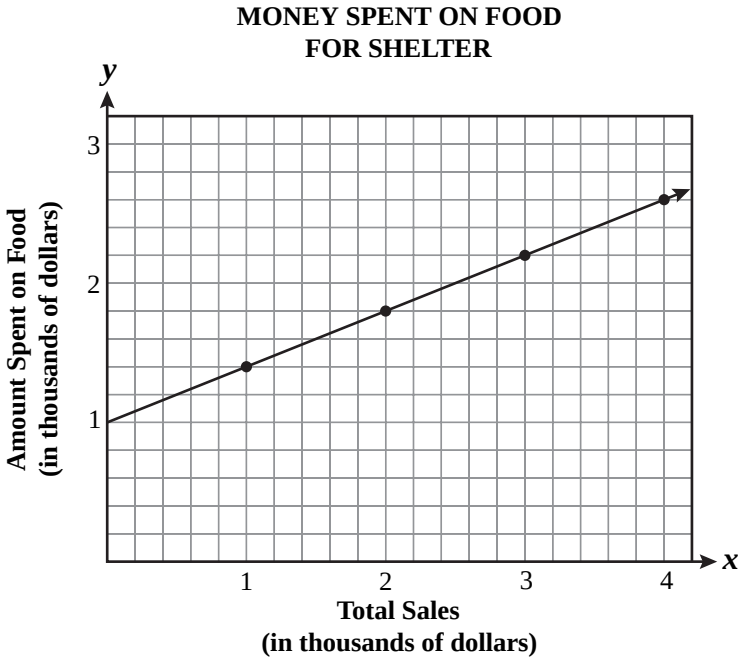
Item Context Social Studies/Consumerism

Benchmark MA.8.A.1.5

Reporting Category	Expressions, Equations, and Functions
Standard	**Big Idea 1** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
Benchmark	**MA.8.A.1.5 Translate among verbal, tabular, graphical, and algebraic representations of linear functions.**
Item Type	At Grade 8, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will identify an alternate representation of a function given in a rule, a table, a graph, or other symbolic representation.
Content Limits	Functions may include points from all four quadrants. Values in equations should be rational numbers. Items should present a table or graph and ask the student to identify another representation of the given function.
Stimulus Attributes	Items may be set in either a real-world or mathematical context. Graphics should be used for all of these items.

Sample Item 62 **MC**

The graph below shows the linear relationship between the total sales at a thrift shop and the amount the thrift shop spent on food for a homeless shelter.



Which equation best represents the relationship shown in the graph?

★ **A.** $y = \frac{2}{5}x + 1$

B. $y = \frac{5}{2}x + 1$

C. $y = 2x + 5$

D. $y = 5x + 2$

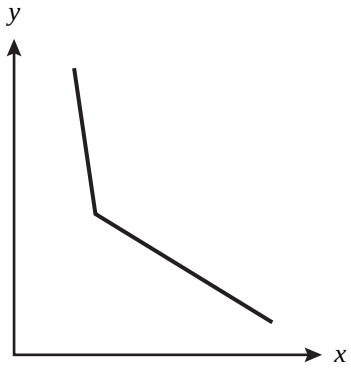
Item Context Social Studies/Consumerism

Benchmark MA.8.A.1.6

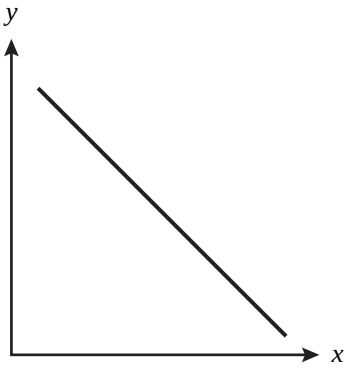
Reporting Category	Expressions, Equations, and Functions
Standard	**Big Idea 1** Analyze and represent linear functions, and solve linear equations and systems of linear equations.
Benchmark	**MA.8.A.1.6 Compare the graphs of linear and nonlinear functions for real-world situations.**
Item Type	At Grade 8, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will compare and translate between linear or nonlinear functions in real-world scenarios or graphical representations.
Content Limits	Items may include stimuli of a scenario with four different graphs for options or a graph with four different scenarios. Items will ask students to interpret graphical representations but not to solve them.
Stimulus Attributes	Items should be set in a real-world context. Graphics should be used in all of these items. Items may present a linear or nonlinear graph and ask the student to identify the representative real-world scenario.

Sample Item 63 **MC**

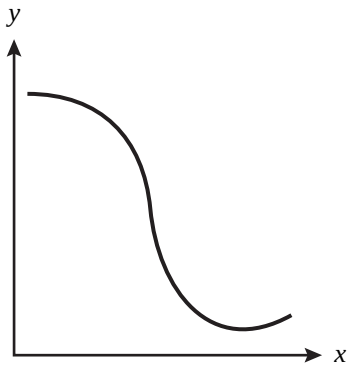
In a certain city, the number of new houses built each month during the first half of the year decreased at a constant rate. During the second half of the year, the number of new houses built each month remained the same. Which graph best illustrates the number of houses built each month in this city?



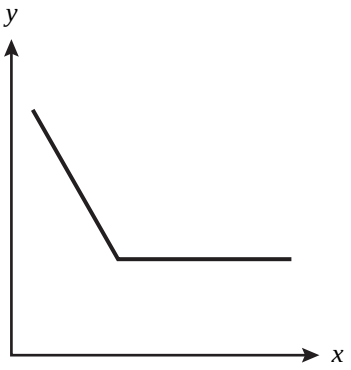
A.



C.



B.



★ D.

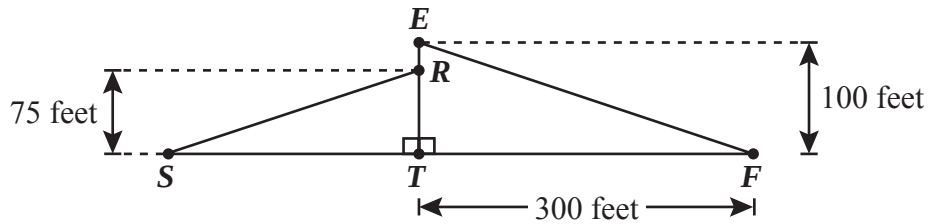
Item Context Social Studies/Consumerism

Benchmark MA.8.G.2.1

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Analyze two- and three-dimensional figures by using distance and angle.
Benchmark	**MA.8.G.2.1 Use similar triangles to solve problems that include height and distances.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will apply geometric properties related to similar triangles.
Content Limit	Items will not require applying the Pythagorean theorem.
Stimulus Attributes	Items may present similar triangles on the coordinate plane. Items should be set in either a real-world or mathematical context. Graphics should be used in most of these items, as appropriate.

Sample Item 64 **MC**

Two flying squirrels glided from two different points on the same tree, represented by $\overline{TE}$ in the diagram below. One squirrel glided from a height of 75 feet and the other from a height of 100 feet. Their gliding paths are represented by $\overline{RS}$ and $\overline{EF}$ in the triangles shown.



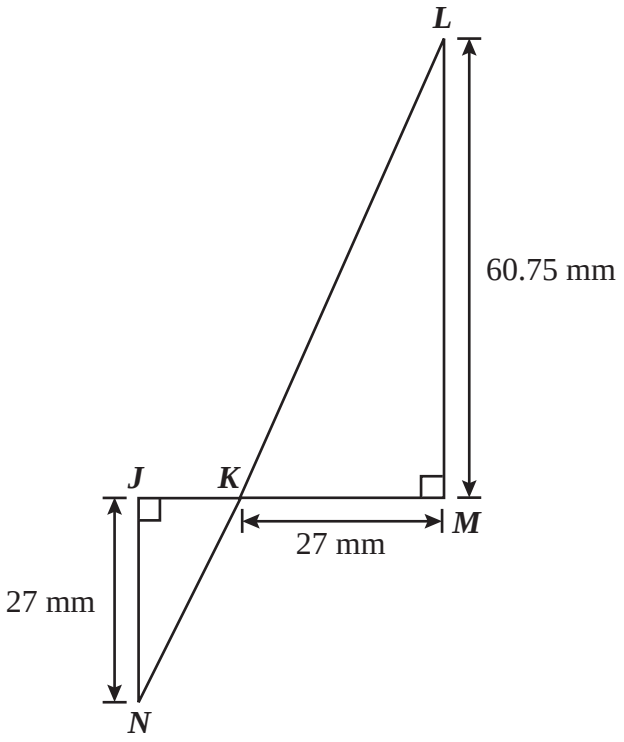
If ΔRST is similar to ΔEFT, what is the length, in feet, of ST?

A. 200
★ **B.** 225
C. 275
D. 300

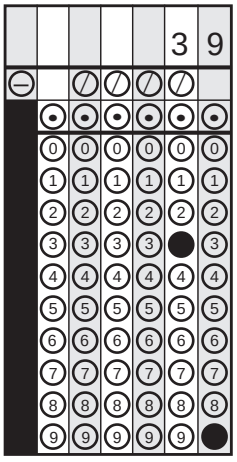
Item Context Science

Sample Item 65 **GR**

In the figure below, ΔJKN and ΔMKL are similar triangles.



What is the length of *JM*, **in millimeters**?



Sample Response 39

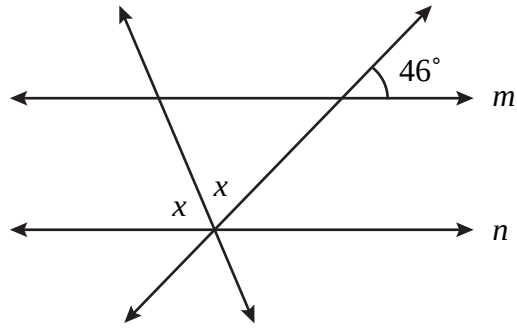
Item Context Mathematics

Benchmark MA.8.G.2.2

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Analyze two- and three-dimensional figures by using distance and angle.
Benchmark	**MA.8.G.2.2 Classify and determine the measure of angles, including angles created when parallel lines are cut by transversals.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will identify measures of angles in two-dimensional geometric figures.
Content Limits	Items may include the concepts of alternate interior angles, alternate exterior angles, same-side interior angles, same-side exterior angles, vertical angles, corresponding angles, complementary angles, and supplementary angles. Items will have no more than two transversals intersecting through two parallel lines.
Stimulus Attributes	Graphics should be used in all of these items. Items should be set in either a real-world or mathematical context.

Sample Item 66 **MC**

In the figure below, lines *m* and *n* are parallel. Two transversals intersect on *n*, forming several angles, as shown on the diagram below.



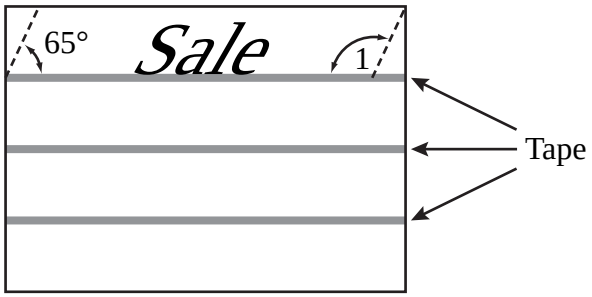
What is the measure of $\angle x$?

A. 44°
B. 46°
C. 60°
★ **D.** 67°

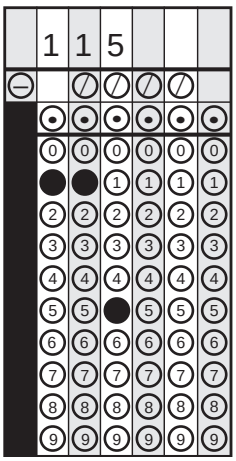
Item Context Mathematics

Sample Item 67 **GR**

Anthony used strips of tape to guide him in painting an advertisement on a rectangular-shaped store window. The strips of tape are parallel and taped on the glass window. When he writes the message, he wants the letters to be slanted at 65° angles. The first word is shown below.



What is the measure, **in degrees**, of ∠1?



Sample Response 115

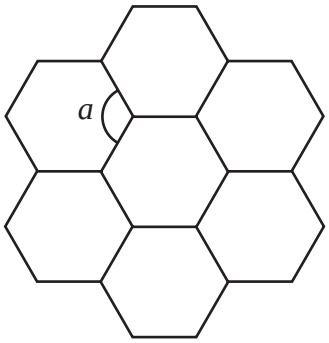
Item Context The Arts

Benchmark MA.8.G.2.3

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Analyze two- and three-dimensional figures by using distance and angle.
Benchmark	**MA.8.G.2.3 Demonstrate that the sum of the angles in a triangle is 180-degrees and apply this fact to find unknown measure of angles and the sum of angles in polygons.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will determine the measures of angles in triangles and other polygons when some of the angle measures are given.
Content Limit	Polygons will not exceed a maximum of eight sides.
Stimulus Attributes	Graphics should be used in all of these items. Items should be set in either a real-world or mathematical context.

Sample Item 68 **MC**

Lou is studying the design of a honeycomb. The honeycomb design is made up of regular hexagons, as shown below.



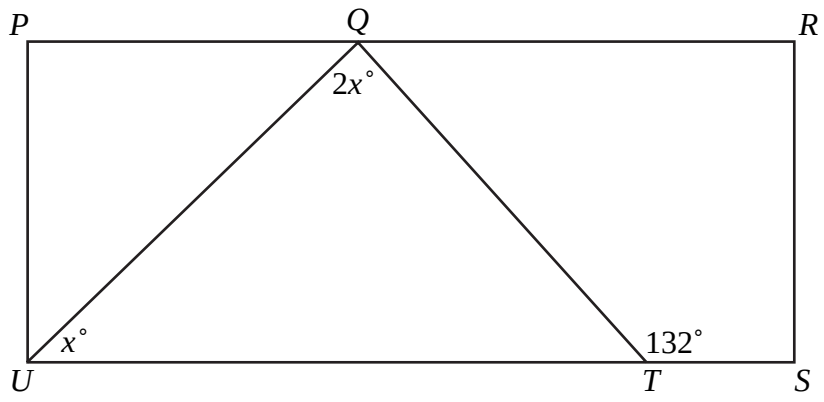
What is the measure, **in degrees**, of $\angle a$ above?

A. 60
★ **B.** 120
C. 150
D. 240

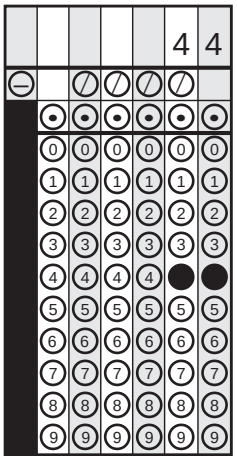
Item Context Science

Sample Item 69 **GR**

Vertices Q and T of ΔQTU are located on opposite sides of rectangle $PRSU$, as shown in the diagram below.



What is the value of x?



Sample Response 44

Item Context Mathematics

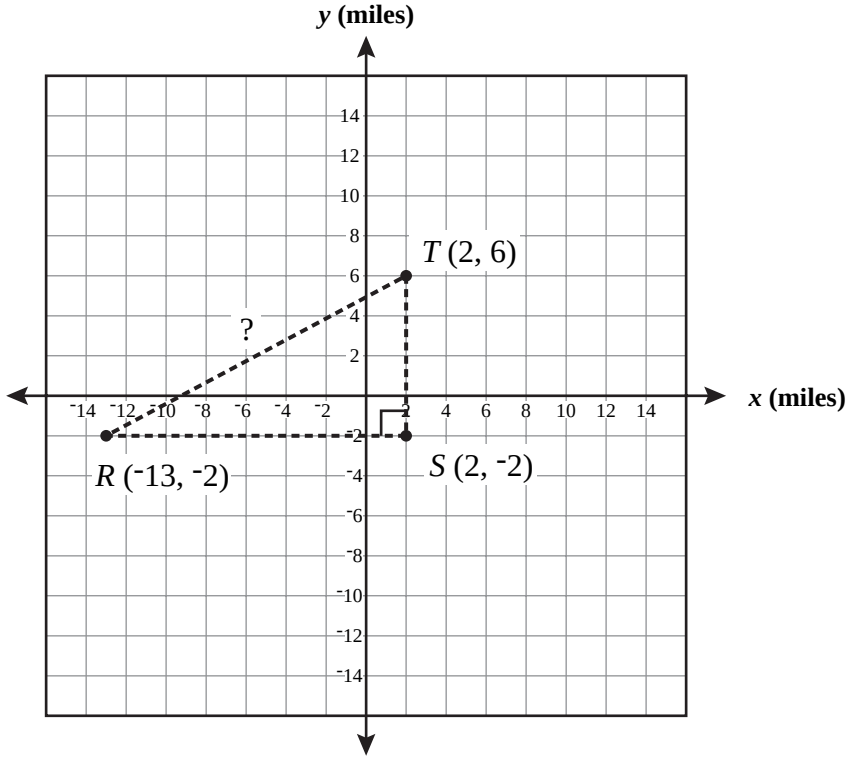
Benchmark MA.8.G.2.4

Reporting Category	Geometry and Measurement
Standard	**Big Idea 2** Analyze two- and three-dimensional figures by using distance and angle.
Benchmark	**MA.8.G.2.4 Validate and apply Pythagorean Theorem to find distances in real world situations or between points in the coordinate plane.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will identify and apply the Pythagorean theorem to find distances in real-world situations or between points on the coordinate plane.
Content Limits	Graphics of three-dimensional figures may be included in items, but only two-dimensional figures may be assessed. Items may assess vertical distance, horizontal distance, and grade-level appropriate applications of the Pythagorean theorem.
Stimulus Attributes	Items may use coordinate planes or similar figures. Graphics should be used in most of these items, as appropriate. Items should be set in either a real-world or mathematical context.
Response Attribute	When the responses are decimal approximations, they should be rounded to the nearest hundredths.

Sample Item 70 **MC**

On the coordinate plane below, Δ*RST* shows the path bicycle riders will follow on one of their weekly rides.

BICYCLE RIDING PATH



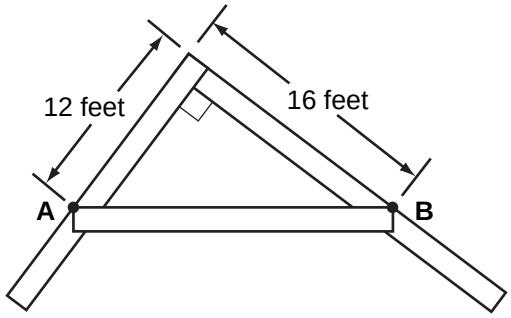
What is the total distance from point *R* to *S* to *T* and back to point *R*?

A. 17 miles
B. 23 miles
C. 32 miles
★ **D.** 40 miles

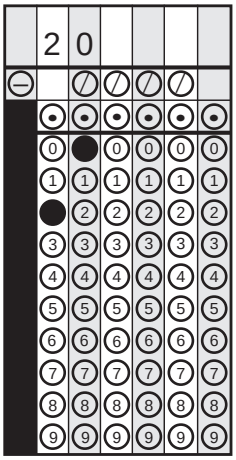
Item Context Health/Physical Education

Sample Item 71 **GR**

A *truss* is a triangular structure that helps to support the roof of a building.



The truss above has one side measuring 12 feet and another side measuring 16 feet. How long, **in feet**, is the third side of the truss, from Point A to Point B?



Sample Response 20

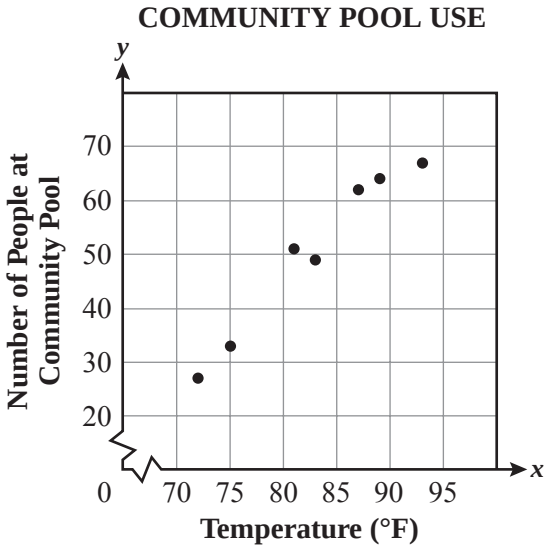
Item Context Mathematics

Benchmark MA.8.S.3.1

Reporting Category	Number: Operations, Problems, and Statistics
Standard	**Big Idea 3** Analyze and summarize data sets.
Benchmark	**MA.8.S.3.1 Select, organize and construct appropriate data displays, including box-and-whisker-plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will interpret data displayed in box-and-whisker plots, scatter plots, and lines of best fit and make conjectures. Students will select the best display for a given data set. Students will select the explanation that expresses the appropriate interpretation of the given data.
Content Limits	Data sets used in items should be limited to a maximum of 12 data points and three categories for all graphic displays except for scatter plots and lines of best fit. Graphic displays may include line graphs, line plots, pictographs, single/multiple-bar graphs, circle graphs, stem-and-leaf plots/tables, histograms, box-and-whisker plots, scatter plots, and lines of best fit. Items should have no more than two box-and-whisker plots from which to interpret data.
Stimulus Attributes	Items may ask students to use statistics to interpret and analyze real-world situations. All items should be set in a real-world context. Graphics should be used in all of these items. Items will use the terms *first quartile* and *third quartile* instead of *lower quartile* and *upper quartile*.

Sample Item 72 **MC**

At the same time each day for one week, an employee at a community pool recorded the number of people at the pool and the outside temperature, in degrees Fahrenheit (°F). The results are shown in the scatter plot below.



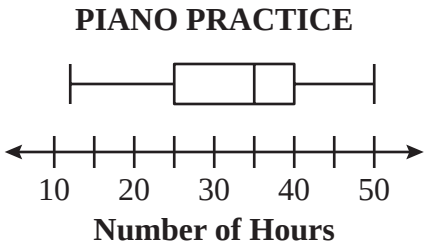
Which statement best describes the relationship in this scatter plot?

A. The higher the outside temperature, the fewer the number of people at the community pool.
B. The lower the outside temperature, the greater the number of people at the community pool.
★ **C.** The higher the outside temperature, the greater the number of people at the community pool.
D. There is no relationship between outside temperature and the number of people at the community pool.

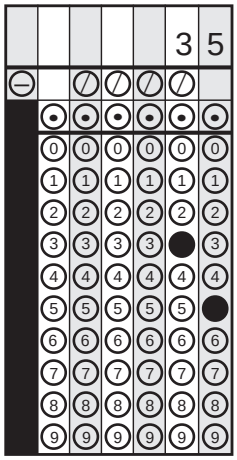
Item Context Mathematics

Sample Item 73 **GR**

Ms. Davis drew a box-and-whisker plot to display data about the number of hours her piano students practiced last month, as shown below.



What whole number best represents the median number of hours her students practiced playing the piano last month?



Sample Response 35

Item Context The Arts

Benchmark MA.8.S.3.2

Reporting Category	Number: Operations, Problems, and Statistics
Standard	**Big Idea 3** Analyze and summarize data sets.
Benchmark	**MA.8.S.3.2 Determine and describe how changes in data values impact measures of central tendency.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will determine how changes in data impact the mean, median, or mode (e.g., students will identify one missing data point in a set given the mean and median of the data set and all other data points). Students will determine the missing numbers in a data set when given the values of the measures of central tendency. Students will analyze how the measures of central tendency and variability of a data set are affected by including additional data points or excluding data points in a set, especially outliers.
Content Limits	Data sets used in items shall be limited to a maximum of 12 data points, and no more than three categories of information should be used. Items will assess finding the mean, median, or mode of a set of data presented in a chart, table, graph, or plot (e.g., scatter plot, stem-and-leaf plot, line plot, or box-and-whisker plot) when there is a change in the data set given.
Stimulus Attributes	Items should be set in a real-world context. Data contained in these items need not be ordered. Graphics should be used in most of these items, as appropriate.

Sample Item 74 **MC**

Annie runs 5 days per week to train for a race. Her running distance for each of four days this week is shown in the table below.

RUNNING DISTANCE

Day	Distance Run (in kilometers)
Tuesday	3.3
Wednesday	6.8
Friday	7.2
Saturday	8.0
Sunday	

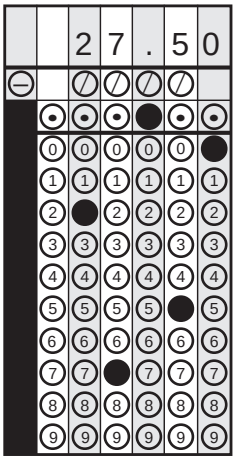
What is the number of kilometers Annie must run on Sunday to have a **mean** running distance of exactly 6.1 kilometers per day for the 5 days?

A. 4.7
★ **B.** 5.2
C. 6.3
D. 7.0

Item Context Health/Physical Education

Sample Item 75 **GR**

Every week, 3 members of a cooking club total their food costs and then determine the mean amount each person should contribute. This week, the mean contribution per member is $30. A fourth person who wants to join the cooking club buys $20 worth of food. What is the mean contribution for this week if the fourth person joins the cooking club?



Sample Response 27.50

Item Context The Arts

Benchmark MA.8.A.4.1

Reporting Category	Expressions, Equations, and Functions
Standard	**Supporting Idea** Algebra
Benchmark	**MA.8.A.4.1 Solve literal equations for a specified variable.**
Item Type	At Grade 8, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will solve literal equations.
Content Limits	Items should contain no more than three variables and no more than three operations. The stem must have a rational coefficient. In items that contain equations, the equation should be linear. Inequalities will not be assessed in this benchmark.
Stimulus Attribute	Items should be set in a real-world context.

Sample Item 76 **MC**

The equation below is used to find C, the total charge, in dollars, not including tax, for a purchase of company jackets (j) that have a specific design and color.

$$C = 20j + 100$$

Which of the following is the same equation solved for j in terms of C?

A. $j = 20C - 100$

B. $j = \frac{1}{20}C - 100$

C. $j = 20(C - 100)$

★ **D.** $j = \frac{1}{20}\left(C - 100\right)$

Item Context Social Studies/Consumerism

Benchmark MA.8.A.4.2

Reporting Category	Expressions, Equations, and Functions
Standard	**Supporting Idea** Algebra
Benchmark	**MA.8.A.4.2 Solve and graph one- and two-step inequalities in one variable.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will identify the graph of a given one- or two-step inequality and will solve and/or graph one- or two-step linear inequalities.
Content Limits	Items should contain no more than two variables and no more than two operations. Items will solve for only one variable. For compound inequalities expressed as one statement (e.g., $45 < x < 55$) or two statements, *and* or *or* may be used. Inequalities must be linear.
Stimulus Attributes	Items can be set in a real-world or mathematical context. Graphics should be used in these items, as appropriate.

Sample Item 77 **MC**

By United States law, any food labeled "reduced fat" must have at least 25% less fat per serving than the regular version of that food. The inequality below can be used to calculate the allowable fat content of a food labeled "reduced fat."

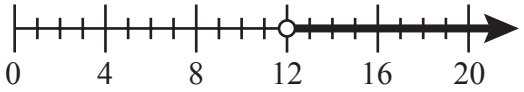
$$x \leq \frac{3}{4}y$$

where:

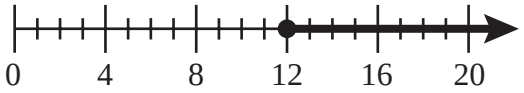
x = the number of fat grams per serving in the "reduced fat" food
y = the number of fat grams per serving in the regular-version food

One serving of regular crunchy peanut butter has 16 grams of fat. Which number line represents all possible numbers of fat grams that may be in one serving of "reduced fat" crunchy peanut butter while meeting the requirements of U.S. law?

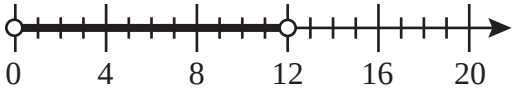
A.



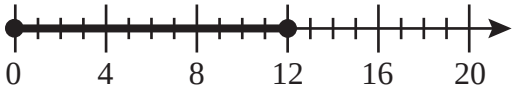
B.



C.



★ **D.**



Item Context Health/Physical Education

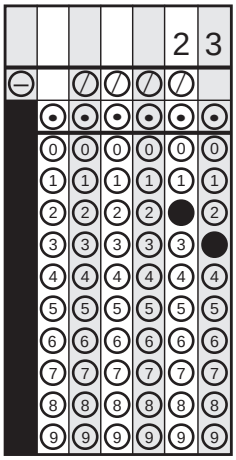
Sample Item 78 **GR**

Austin saved $455 from his pay and joined a golf club to improve his game. He paid a $100 membership fee and will pay $15 for each round of golf he plays.

Austin used the following inequality to determine the number of rounds of golf he could play.

$$100 + 15r \leq 455$$

What is the maximum number of rounds of golf Austin can play?



Sample Response 23

Item Context Health/Physical Education

Benchmark MA.8.G.5.1

Reporting Category	Geometry and Measurement
Standard	**Supporting Idea** Geometry and Measurement
Benchmark	**MA.8.G.5.1 Compare, contrast, and convert units of measure between different measurement systems (US customary or metric [SI]) and dimensions including temperature, area, volume, and derived units to solve problems.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will compare, contrast, and convert: • units of capacity, mass, weight, and temperature between different measurement systems; • dimensions, including area and volume, within the same system to solve real-world problems; and • derived units to solve problems within the same system (e.g., mi/hr to ft/sec).
Content Limits	The majority of the items addressing dimensions should focus on area, volume, and capacity. Items may involve mixed units within each system, such as converting hours and minutes to seconds. Only items assessing derived units will convert time measurements. Items may include conversion from customary to metric or vice versa, using only the conversions found on the conversion sheet. Items may include up to three conversions within the same system of measurement (e.g., converting cups to gallons). Gridded-response items may only involve conversions within the same system of measurement.
Stimulus Attribute	Items should be set in a real-world context.

Sample Item 79 **MC**

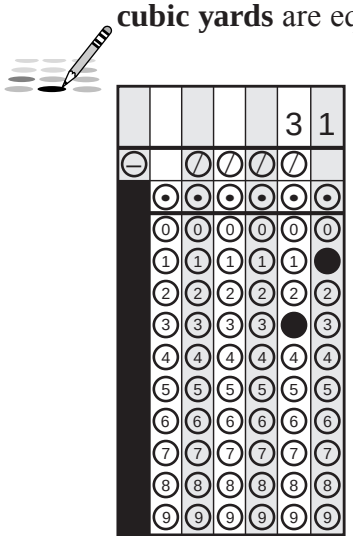
According to one source, one of the seven ancient wonders of the world, the Colossus of Rhodes, was a statue approximately 110 feet high located on the island of Rhodes, Greece. Which of the following is closest to 110 feet expressed in meters?

A. 361
B. 280
C. 43
★ **D.** 34

Item Context Social Studies/Consumerism

Sample Item 80 **GR**

A farmer needs to calculate the number of cubic yards in 837 cubic feet of soil. How many **cubic yards** are equivalent to 837 cubic feet?



Sample Response 31

Item Context Mathematics

Benchmark MA.8.A.6.1

Reporting Category	Number: Operations, Problems, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.8.A.6.1 Use exponents and scientific notation to write large and small numbers and vice versa and to solve problems.**
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will represent or solve problems using exponents and scientific notation.
Content Limits	Items may provide expressions of rational numbers in exponential notation, including negative exponents, and/or numerical or algebraic expressions that contain exponential notation. Rational numbers presented as decimals must be terminating decimals. Negative exponents may be used in standard scientific notation only. Fractions represented in standard scientific notation should be greater than one-billionth. Standard scientific notation of whole numbers and decimals is limited to hundred billions through hundred-billionths.
Stimulus Attributes	Items should be set in real-world or mathematical context. Graphics should be used in some of these items, as appropriate.

Sample Item 81 **MC**

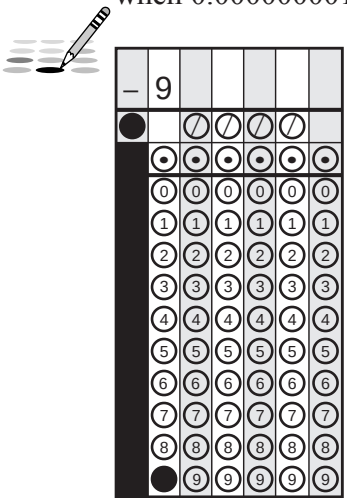
By studying lunar samples, scientists have learned the Moon is approximately 4,600,000,000 years old. What is this number expressed in scientific notation?

A. 4.6×10^8
B. 46×10^8
★ **C.** 4.6×10^9
D. 46×10^9

Item Context Science

Sample Item 82 **GR**

A **nanosecond** is one billionth of a second. What is the **exponent** associated with the base 10 when 0.000000001 is expressed in scientific notation?



Sample Response -9

Item Context Science

Benchmark MA.8.A.6.2

Reporting Category	Number: Operations, Problems, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.8.A.6.2 Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions.**
Item Type	At Grade 8, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will approximate square roots and use approximations for irrational numbers to estimate solutions to real-world problems.
Content Limits	Items may include the relationships among fractions, decimals, or numbers expressed as percents, with at least one square root included, given a real-world context. The place values of the fractional part of decimal numbers should range from tenths through ten-thousandths. Items should require students to determine the effects of operations on real numbers, including addition, subtraction, multiplication, division, exponents, and finding square roots. Items that require determining inverses may include adding, subtracting, multiplying, dividing, squaring, and extracting roots. Items may include simplified expressions using integers, exponents, radicals, and ratios; large and small numbers in standard scientific notation; or absolute values. Numbers may exceed the limits specified in the General Content Limits by Grade Level section when the numbers are represented in word form (e.g., fifty billion) or as denominate numbers (e.g., 4.3 trillion). Negative exponents should be used in standard scientific notation only. Items may contain multiple forms of a given value.
Stimulus Attribute	Items should be set in a real-world or mathematical context.

Sample Item 83 **MC**

Andre will install carpet in his bedroom. The floor in Andre's bedroom is square, with an area of 65 square feet. Which is closest to the length, in feet, of each side of Andre's bedroom floor?

★ **A.** 8
B. 9
C. 16
D. 17

Item Context Mathematics

Benchmark MA.8.A.6.4

Reporting Category	Number: Operations, Problems, and Statistics
Standard	**Supporting Idea** Number and Operations
Benchmark	**MA.8.A.6.4 Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems.** Also assesses MA.8.A.6.3 Simplify real number expressions using the laws of exponents.
Item Types	At Grade 8, this benchmark will be assessed using MC and GR items.
Benchmark Clarifications	Students will perform operations on real numbers using multistep and real-world problems. The student understands real number expressions and the law of exponents.
Content Limits	Items will include the effects of the four basic operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers), and the use of properties of real numbers to solve problems (commutative, associative, distributive, identity, equality, and the inverse relationship of rational numbers). Items may involve simplifying expressions using integers and exponents. Items may include performing operations involving fractions, decimals, irrational numbers, numbers expressed as radicals, percents, absolute values, or scientific notation. Radicals used in items must be square roots with a radicand less than or equal to 100, or cube roots of perfect cubes.
Stimulus Attributes	All items should be set in a real-world or mathematical context. Items may require answers to be rounded to the nearest percent, whole number, dollar, cent, etc., as appropriate.

Sample Item 84 **MC**

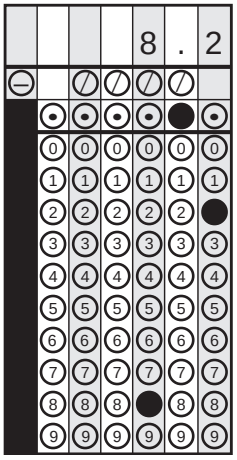
The human body produces 1.5×10^7 red blood cells every second. How many red blood cells, expressed in scientific notation, does the human body produce in a 60-second period?

A. 9.0×10^7
★ **B.** 9.0×10^8
C. 90.0×10^7
D. 90.0×10^8

Item Context Science

Sample Item 85 **GR**

The daily lunch special at Bertan's favorite restaurant costs $6.95, not including tax. The final cost of the lunch special with tax is $7.52. What is the tax rate, **to the nearest tenth of a percent**, charged for the lunch special?



Sample Response 8.2

Item Context Social Studies/Consumerism

FCAT 2.0 and EOC Topics Florida's NGSSS

Topics, or item contexts, for FCAT 2.0 assessment items can be found on the DOE website at: http://fcat.fldoe.org/fcat2/pdf/MathematicsAppendixA.pdf.

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 6					
Big Idea 1 **Develop an understanding of and fluency with multiplication and division of fractions and decimals.**					
MA.6.A.1.1 Explain and justify procedures for multiplying and dividing fractions and decimals. **MC**	**MA.6.A.1.2** Multiply and divide fractions and decimals efficiently. Assessed with MA.6.A.1.3.	**MA.6.A.1.3** Solve real-world problems involving multiplication and division of fractions and decimals. Also assesses MA.6.A.1.2. **MC, GR**			
Big Idea 2 **Connect ratio and rates to multiplication and division.**					
MA.6.A.2.1 Use reasoning about multiplication and division to solve ratio and rate problems. **MC, GR**	**MA.6.A.2.2** Interpret and compare ratios and rates. **MC**				

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark
Grades 6–8

Grade 6					
Big Idea 3	**Write, interpret, and use mathematical expressions and equations.**				
MA.6.A.3.1 Write and evaluate mathematical expressions that correspond to given situations. Also assesses MA.6.A.3.3. **MC, GR**	**MA.6.A.3.2** Write, solve, and graph one- and two-step linear equations and inequalities. Also assesses MA.6.A.3.4. **MC, GR**	**MA.6.A.3.3** Work backward with two-step function rules to undo expressions. Assessed with MA.6.A.3.1.	**MA.6.A.3.4** Solve problems given a formula. Assessed with MA.6.A.3.2, MA.6.G.4.1, MA.6.G.4.2, and MA.6.G.4.3.	**MA.6.A.3.5** Apply the Commutative, Associative, and Distributive Properties to show that two expressions are equivalent. **MC**	**MA.6.A.3.6** Construct and analyze tables, graphs, and equations to describe linear functions and other simple relations using both common language and algebraic notation. **MC**
Supporting Idea	**Geometry and Measurement**				
MA.6.G.4.1 Understand the concept of Pi, know common estimates of Pi (3.14; 22/7) and use these values to estimate and calculate the circumference and the area of circles. Also assesses MA.6.A.3.4. **MC**	**MA.6.G.4.2** Find the perimeters and areas of composite two-dimensional figures, including non-rectangular figures (such as semicircles) using various strategies. Also assesses MA.6.A.3.4. **MC, GR**	**MA.6.G.4.3** Determine a missing dimension of a plane figure or prism given its area or volume and some of the dimensions, or determine the area or volume given the dimensions. Also assesses MA.6.A.3.4. **MC**			

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 6					
Supporting Idea	**Number and Operations**				
MA.6.A.5.1 Use equivalent forms of fractions, decimals, and percents to solve problems. **MC, GR**	**MA.6.A.5.2** Compare and order fractions, decimals, and percents, including finding their approximate location on a number line. **MC**	**MA.6.A.5.3** Estimate the results of computations with fractions, decimals, and percents, and judge the reasonableness of the results. **MC**			
Supporting Idea	**Data Analysis**				
MA.6.S.6.1 Determine the measures of central tendency (mean, median, mode) and variability (range) for a given set of data. **MC, GR**	**MA.6.S.6.2** Select and analyze the measures of central tendency or variability to represent, describe, analyze, and/or summarize a data set for the purpose of answering questions appropriately. **MC**				

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark
Grades 6–8

Grade 7					
Big Idea 1 Develop an understanding of and apply proportionality, including similarity.					
MA.7.A.1.1 Distinguish between situations that are proportional or not proportional, and use proportions to solve problems. **MC, GR**	**MA.7.A.1.2** Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease. **MC, GR**	**MA.7.A.1.3** Solve problems involving similar figures. **MC, GR**	**MA.7.A.1.4** Graph proportional relationships and identify the unit rate as the slope of the related linear function. **MC**	**MA.7.A.1.5** Distinguish direct variation from other relationships, including inverse variation. **MC**	**MA.7.A.1.6** Apply proportionality to measurement in multiple contexts, including scale drawings and constant speed. **MC, GR**
Big Idea 2 Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.					
MA.7.G.2.1 Justify and apply formulas for surface area and volume of pyramids, prisms, cylinders, and cones. **MC, GR**	**MA.7.G.2.2** Use formulas to find surface areas and volume of three-dimensional composite shapes. **MC, GR**				

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 7					
Big Idea 3	**Develop an understanding of operations on all rational numbers and solving linear equations.**				
MA.7.A.3.1 Use and justify the rules for adding, subtracting, multiplying, dividing, and finding the absolute value of integers. **MC**	**MA.7.A.3.2** Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts. **MC, GR**	**MA.7.A.3.3** Formulate and use different strategies to solve one-step and two-step linear equations, including equations with rational coefficients. Also assesses MA.7.A.5.2. **MC, GR**	**MA.7.A.3.4** Use the properties of equality to represent an equation in a different way and to show that two equations are equivalent in a given context. **MC**		
Supporting Idea	**Geometry and Measurement**				
MA.7.G.4.1 Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures, and apply these relationships to solve problems. **MC, GR**	**MA.7.G.4.2** Predict the results of transformations, and draw transformed figures with and without the coordinate plane. **MC**	**MA.7.G.4.3** Identify and plot ordered pairs in all four quadrants of the coordinate plane. **MC**	**MA.7.G.4.4** Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)), dimensions, and derived units to solve problems. **MC, GR**		

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 7					
Supporting Idea	**Number and Operations**				
MA.7.A.5.1 Express rational numbers as terminating or repeating decimals. **MC**	**MA.7.A.5.2** Solve non-routine problems by working backwards. Assessed with MA.7.A.3.3.				
Supporting Idea	**Data Analysis**				
MA.7.S.6.1 Evaluate the reasonableness of a sample to determine the appropriateness of generalizations made about the population. **MC**	**MA.7.S.6.2** Construct and analyze histograms, stem-and-leaf plots, and circle graphs. **MC, GR**				
Supporting Idea	**Probability**				
MA.7.P.7.1 Determine the outcome of an experiment and predict which events are likely or unlikely, and if the experiment is fair or unfair. **MC**	**MA.7.P.7.2** Determine, compare, and make predictions based on experimental or theoretical probability of independent or dependent events. **MC**				

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark
Grades 6–8

Grade 8					
Big Idea 1 Analyze and represent linear functions, and solve linear equations and systems of linear equations.					
MA.8.A.1.1 Create and interpret tables, graphs, and models to represent, analyze, and solve problems related to linear equations, including analysis of domain, range, and the difference between discrete and continuous data. **MC, GR**	**MA.8.A.1.2** Interpret the slope and the x- and y-intercepts when graphing a linear equation for a real-world problem. **MC, GR**	**MA.8.A.1.3** Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations. Also assesses MA.8.A.1.4. **MC, GR**	**MA.8.A.1.4** Identify the solution to a system of linear equations using graphs. Assessed with MA.8.A.1.3.	**MA.8.A.1.5** Translate among verbal, tabular, graphical, and algebraic representations of linear functions. **MC**	**MA.8.A.1.6** Compare the graphs of linear and nonlinear functions for real-world situations. **MC**
Big Idea 2 Analyze two- and three-dimensional figures by using distance and angle.					
MA.8.G.2.1 Use similar triangles to solve problems that include height and distances. **MC, GR**	**MA.8.G.2.2** Classify and determine the measure of angles, including angles created when parallel lines are cut by transversals. **MC, GR**	**MA.8.G.2.3** Demonstrate that the sum of the angles in a triangle is 180-degrees and apply this fact to find unknown measure of angles and the sum of angles in polygons. **MC, GR**	**MA.8.G.2.4** Validate and apply Pythagorean Theorem to find distances in real world situations or between points in the coordinate plane. **MC, GR**		

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 8					
Big Idea 3	**Analyze and summarize data sets.**				
MA.8.S.3.1 Select, organize and construct appropriate data displays, including box-and-whisker-plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships. **MC, GR**	**MA.8.S.3.2** Determine and describe how changes in data values impact measures of central tendency. **MC, GR**				
Supporting Idea	**Algebra**				
MA.8.A.4.1 Solve literal equations for a specified variable. **MC**	**MA.8.A.4.2** Solve and graph one- and two-step inequalities in one variable. **MC, GR**				

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 8					
Supporting Idea	**Geometry and Measurement**				
MA.8.G.5.1 Compare, contrast, and convert units of measure between different measurement systems (US customary or metric [SI]) and dimensions including temperature, area, volume, and derived units to solve problems. **MC, GR**					

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Mathematics Content Assessed by the FCAT 2.0 and Item Types by Benchmark Grades 6–8

Grade 8					
Supporting Idea	**Number and Operations**				
MA.8.A.6.1 Use exponents and scientific notation to write large and small numbers and vice versa and to solve problems. **MC, GR**	**MA.8.A.6.2** Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions. **MC**	**MA.8.A.6.3** Simplify real number expressions using the laws of exponents. Assessed with MA.8.A.6.4.	**MA.8.A.6.4** Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems. Also assesses MA.8.A.6.3. **MC, GR**		

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.

MC = Multiple choice GR = Gridded response

Reporting Categories for FCAT 2.0 Mathematics and End-of-Course Assessments

Reporting Categories

The following table represents the content reporting categories for the FCAT 2.0 Mathematics Assessments along with the approximate percentage of raw-score points derived from each content category.

Grade				
3	Number: Operations, Problems, and Statistics 50%	Geometry and Measurement 30%	Number: Fractions 20%	
4	Number: Operations and Problems 45%	Geometry and Measurement 30%	Number: Base Ten and Fractions 25%	
5	Number: Base Ten and Fractions 50%	Geometry and Measurement 30%	Expressions, Equations, and Statistics 20%	
6	Fractions, Ratios/Proportional Relationships, and Statistics 40%	Expressions and Equations 40%	Geometry and Measurement 20%	
7	Geometry and Measurement 30%	Ratios/Proportional Relationships 25%	Number: Base Ten 25%	Statistics and Probability 20%
8	Expressions, Equations, and Functions 40%	Geometry and Measurement 35%	Number: Operations, Problems, and Statistics 25%	

FCAT 2.0 Mathematics Glossary Grades 6–8

The following glossary is a reference list provided for item writers and is **not** intended to comprise a comprehensive vocabulary list for students. The terms defined in this glossary pertain to the NGSSS in mathematics for Grades 6–8 and the content assessed on FCAT 2.0 Mathematics.

Absolute value—A number's distance from zero (0) on a number line. Distance is expressed as a positive value (e.g., $|3| = 3$ and $|^{-}3| = 3$).

Acute angle—An angle with a measure less than 90° and greater than 0°.

Addend—Any number being added.

Additive identity—The number zero (0). When zero (0) is added to another number, the sum is the number itself (e.g., $5 + 0 = 5$).

Additive inverse property—A number and its additive inverse have a sum of zero (0) (e.g., in the equation $3 + {}^{-}3 = 0$, 3 and $^{-}3$ are additive inverses of each other).

Algebraic equation (inequality)—A mathematical sentence containing variables in which two expressions are connected by an equality or inequality symbol. See also equation and inequality.

Algebraic expression—An expression containing numbers and variables (e.g., $7x$), and operations that involve numbers and variables (e.g., $2x + y$). Algebraic expressions do not contain equality or inequality symbols.

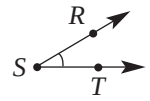
Algebraic order of operations—The order of performing computations is first parentheses, then exponents, followed by multiplication and/or division (as read from left to right), then addition and/or subtraction (as read from left to right). For example:
$5^2 + (12 - 2) \div 2 - 3 \times 2$
$5^2 + 10 \div 2 - 3 \times 2$
$25 + 10 \div 2 - 3 \times 2$
$25 + 5 - 6$
$30 - 6$
24

Algebraic rule—A mathematical expression that contains variables and describes a pattern or relationship.

Altitude—The perpendicular distance from a vertex in a polygon to its opposite side. Altitude may also be used to refer to an elevation in some real-world contexts.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Angle (∠)—A figure formed by two rays with the same endpoint (vertex). Angles are measured in degrees. In the figure, the angle can be named ∠*RST*, ∠*TSR*, or ∠*S*.



Approximate value—A number or measurement that is close to or near its exact value.

Area—The measure, in square units, of the inside region of a closed two-dimensional figure (e.g., a rectangle with sides of 4 units by 6 units has an area of 24 square units).
Area = base × height

Associative property—The way in which three or more numbers are grouped for addition or multiplication does not change their sum or product, respectively [e.g., $(5 + 6) + 9 = 5 + (6 + 9)$ or $(2 \times 3) \times 8 = 2 \times (3 \times 8)$].

Axis (of a graph) (*pl*. axes)—The horizontal and vertical number lines used in a coordinate plane system.

Bar graph—A graph that uses either vertical or horizontal bars to display countable or discrete data.

Base (algebraic)—The number used as a factor in exponential form. For example, 2^3 is the exponential form of $2 \times 2 \times 2$. The numeral two (2) is called the base, and the numeral three (3) is called the exponent.

Base (geometric)—The line segment or face of a geometric figure that is perpendicular to the height.

Benchmark—A point of reference from which other measurements or values may be made or judged.

Benchmark angles—The angles 0°, 45°, 90°, 180°, 270°, and 360°.

Benchmark fractions—The fractions 0, $\frac{1}{10}$, $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ and 1.

Biased sample—A sample that is not representative of a population.

Box-and-whisker plot—A data display that divides a set of data into four parts or quartiles that shows centering, spread, and distribution of a data set. A box is constructed from the five-number summary of the data that includes the minimum value, maximum value, median, first quartile, and third quartile.

Break—A zigzag on the *x*- or *y*-axis in a line or bar graph indicating that the data displayed do not include all of the values that exist on the number line used. Also called a squiggle.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Capacity—The amount of space that can be filled in a container. Both capacity and volume are used to measure three-dimensional spaces; however, capacity usually refers to fluid measures, whereas volume is described as cubic units.

Categorical data—Absolute; if data can be represented by one and only one category (e.g., a person's gender), it is called qualitative data. Categorical data are qualitative.

Central angle—An angle that has its vertex at the center of a circle with radii as its sides.

Chart—A data display that presents information in columns and rows.

Circle graph—A data display that divides a circle into regions representing a portion of the total set of data. The circle represents the whole set of data.

Circumference—The distance around a circle.

Circumscribed—A descriptor for a geometric figure that is drawn around and encloses (while certain **points** are touching) another geometric figure.

Closed figure—A two-dimensional figure that divides the plane into two parts—the part inside the figure and the part outside the figure (e.g., circles, squares, rectangles).

Coefficient—The number that multiplies the variable(s) in an algebraic expression (e.g., $4xy$). If no number is specified, the coefficient is 1.

Commutative property—The order in which two numbers are added or multiplied does not change their sum or product, respectively (e.g., $2 + 3 = 3 + 2$, or $4 \times 7 = 7 \times 4$).

Compatible numbers—Numbers that are easy to compute mentally.

Complementary angles—Two angles with measures that the sum of which is exactly 90°.

Compose—To form by putting together (e.g., a geometric figure or a number).

Composite figure—A figure made up of several different figures.

Composite number—A whole number that has more than two factors.

Compound inequality—Two inequalities that are combined into one statement by the words *and* or *or*.

Concave polygon—A polygon with one or more diagonals that have points outside the polygon.

FCAT 2.0 Mathematics Glossary Grades 6–8

Concentric circles—Two or more coplanar circles that share the same center.

Cone—A pyramid with a circular base.

Congruent—Having exactly the same shape and size.

Constant—A number for which the value does not change.

Continuous data—Data that can take any of an infinite number of values between whole numbers.

Continuous graph—A graph in which there are no gaps or holes (e.g., a line graph).

Convex polygon—A polygon with each interior angle measuring less than 180°. All diagonals of a convex polygon lie inside the polygon.

Coordinate grid or plane—A two-dimensional network of horizontal and vertical lines that are parallel and evenly spaced; especially designed for locating points, displaying data, or drawing maps.

Coordinates—Numbers that correspond to points on a coordinate plane in the form (x, y), or a number that corresponds to a point on a number line. Also called ordered pairs.

Corresponding angles—Angles that are in the same position on two parallel lines in relation to a transversal.

Counting principle—If a first event has n outcomes and a second event has m outcomes, then the first event followed by the second event has $n \times m$ outcomes.

Cube—A solid figure with six congruent square faces.

Customary units—The units of measure developed and used in the United States.
- Customary units for length may include inches, feet, yards, and miles.
- Customary units for weight may include ounces, pounds, and tons.
- Customary units for volume may include cubic inches, cubic feet, and cubic yards.
- Customary units for capacity may include fluid ounces, cups, pints, quarts, and gallons.

Cylinder—A three-dimensional figure with two parallel bases that are congruent circles and a lateral face that is a parallelogram.

Data displays/graphs—Different ways of displaying data in charts, tables, or graphs, including pictographs, circle graphs, single-, double-, or triple-bar and line graphs, line plots, histograms, Venn diagrams, stem-and-leaf plots, box-and-whisker plots, and scatter plots.

FCAT 2.0 Mathematics Glossary Grades 6–8

Decompose—To separate into parts or elements (e.g., geometric figures or numbers).

Degree—The unit of measure for angles or temperature (°).

Dependent events—Two events are dependent if the outcome of one event affects the probability that the other event will occur.

Depth—The distance or length from front to back of a three-dimensional object or the quality of being deep (e.g., body of water).

Derived units—Units of measurement of a derived quantity in a given system of quantities. Derived units are expressed algebraically in terms of base units by means of mathematical symbols of multiplication and division (e.g., mph).

Diagonal—A line segment that joins two nonadjacent vertices of a polygon.

Diameter—A line segment from any point on the circle passing through the center to another **point** on the circle.

Difference—A number that is the result of subtraction.

Dilation—A proportional increase or decrease in size in all dimensions.

Dimension—A measure in one direction (e.g., length, width, height, or depth).

Direct measure—Obtaining the measure of an object by using measuring devices, either standard devices of the customary or metric systems or nonstandard devices such as paper clips or pencils.

Direct variation—The relation between two quantities for which the ratio remains constant. The ratio of y to x is a constant, k, or $y/x = k$ and a graph of the relationship will always contain the origin (0, 0).

Discrete data—Distinct values that are not connected by intermediate values and are a finite set of values.

Distributive property—The product of a number and the sum or difference of two numbers is equal to the sum or difference of the two products [e.g., $x(a + b) = ax + bx$].

Dividend—A quantity that is to be divided.

Divisible—Capable of being divided by another number without a remainder.

Divisor—The number by which another number is divided.

FCAT 2.0 Mathematics Glossary Grades 6–8

Domain—The complete set of possible values of the independent variable in a function.

Dozen—A quantity made of twelve items.

Edge—A line segment where two faces of a polyhedron meet.

Elevation—The height or altitude above sea level.

Empirical probability—The likelihood of an event happening that is based on experience and observation rather than on theory.

Equal—Having the same value (=).

Equation—A mathematical sentence in which two expressions are connected by an equality symbol. See also algebraic equation (inequality).

Equidistant—Equally distant.

Equilateral triangle—A triangle with three congruent sides.

Equivalent—Having or naming the same value.

Equivalent expressions—Expressions that have the same value but are presented in a different format using the properties of numbers.

Equivalent forms of a number—The same number expressed in different forms (e.g., $\frac{3}{4}$, 0.75, 75%).

Estimation—The use of strategies to determine a reasonably accurate approximation, without calculating an exact answer (e.g., clustering, rounding, grouping, using benchmarks).

Evaluate an algebraic expression—Substitute numbers for the variables and follow the algebraic order of operations to find the numerical value of the expression.

Expanded form—A form of writing numbers that shows the value of each digit (e.g., $426 = 400 + 20 + 6$).

Exponent (exponential form)—The number of times the base occurs as a factor. For example, 2^3 is the exponential form of $2 \times 2 \times 2$. The numeral two (2) is called the base, and the numeral three (3) is called the exponent.

Expression—A mathematical phrase or part of a number sentence that combines numbers, operation signs, and sometimes variables. An expression does not contain equal or inequality signs.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Extraneous information—Information that is not necessary to solving the problem.

Extrapolate—To estimate or infer a value or quantity beyond the known range of data.

Face—One of the plane surfaces bounding a three-dimensional figure; a side.

Factor—A number or expression that divides evenly into another number [e.g., 1, 2, 4, 5, 10, and 20 are factors of 20 and $(x + 1)$ is one of the factors of $(x^2 - 1)$].

Figure—A shape in two or three dimensions.

Fraction—A rational number expressed in the form $\frac{a}{b}$, where a is called the numerator and b is called the denominator.

Frequency table—A table that shows how often each item, number, or range of numbers occurs in a set of data.

Function (of *x*)—A relation in which each value of x is paired with a unique value of y.

Function table—A table of x- and y-values (ordered pairs) that represents the function, pattern, relationship, or sequence between the two variables.

Greatest common factor (GCF)—The greatest number that is a factor of two or more numbers.

Grid—See coordinate grid or plane.

Gross—A quantity made of 144 items.

Height—A line segment extending from the apex or a vertex of a figure to its base and forming a right angle with the base or plane that contains the base.

Histogram—A bar graph with no spaces between the bars. The height of each bar shows the frequency of data within that interval.

Horizontal—Parallel to, or in the plane of the horizon.

Hypotenuse—The longest side of a right triangle; the side opposite the right angle.

Hypothesis—A proposition or supposition developed to provide a basis for further investigation or research.

Identity property of addition—The sum of a number and zero is always that number (e.g., $a + 0 = a$).

FCAT 2.0 Mathematics Glossary
Grades 6–8

Identity property of multiplication—The product of a number and one is always that number (e.g., $a \times 1 = a$).

Increment (interval)—On a graph, the distance between numbers from one grid line to another.

Independent events—Two events are independent if the outcome of one event does not affect the probability that the other will occur.

Indirect measure—The measurement of an object through the known measure of another object.

Indirect variation—See inverse variation.

Inequality—A sentence that states one expression is greater than ($>$), greater than or equal to ($\geq$), less than ($<$), less than or equal to ($\leq$), or not equal to ($\neq$), another expression (e.g., $a \neq 5$ or $x < 7$ or $2y + 3 \geq 11$). See also algebraic inequality.

Inscribed angle—An angle that has a vertex on a circle and sides that contain chords of the circle.

Integers—The numbers in the set $\{\ldots {}^{-}4, {}^{-}3, {}^{-}2, {}^{-}1, 0, 1, 2, 3, 4 \ldots\}$.

Intercept—The value of a variable when all other variables in the equation equal zero (0). On a graph, the values where a function crosses the axes.

Intersection—The point at which lines or curves meet; the line where planes meet.

Interval—See increment.

Inverse operation—An operation that is the opposite of, or "undoes" the first operation (e.g., subtraction is the inverse operation of addition, and multiplication is the inverse operation of division).

Inverse variation—The relation between two quantities for which the constant of proportionality varies inversely to each other. The product of x and y is a constant, k, or $xy = k$.

Irrational number—A real number that cannot be expressed as a ratio of two integers (e.g., $\sqrt{2}$).

Isosceles triangle—A triangle with two congruent sides and two congruent angles.

Kite—A quadrilateral with two distinct pairs of adjacent congruent sides.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Labels (for a graph)—The titles given to a graph, the axes of a graph, or the scales on the axes of a graph.

Lateral face—A face of a prism or pyramid that is not a base.

Least common multiple (LCM)—The lowest number that is a multiple of two or more numbers.

Length—A one-dimensional measure that is the measurable property of line segments.

Likelihood—The chance that something is likely to happen. See probability.

Line—A collection of an infinite number of points forming a straight pathway with unlimited length and having no width.

Line of best fit—A line drawn on a scatter plot to estimate the relationship between two sets of data.

Line graph—A graph that displays continuous data using connected line segments.

Line plot—A diagram or graph showing frequency of data on a number line.

Line segment—A portion of a line that consists of two defined endpoints and all the points in between.

Linear equation—An algebraic equation in which the variable quantity or quantities are raised to the zero or first power and the graph is a straight line [e.g., $20 = 2(w + 4) + 2w$ and $y = 3x + 4$].

Linear inequality—An algebraic inequality in which the variable quantity or quantities are raised to the zero or first power and the graph is a region for which the boundary is the straight line formed by the inequality.

Linear measure (length)—A one-dimensional measure that is the measurable property of line segments.

Literal equation—An equation that involves two or more variables.

Mass—The amount of matter in an object.

Maximum—The greatest or highest value or quantity.

Mean—The arithmetic average of a set of numbers. It is also a measure of central tendency.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Measures of central tendency—Numerical values used to describe the overall clustering of data in a set, or the overall "average" of a set of data. The three most common measures of central tendency are the mean, median, and mode.

Median—The middle point of a set of rank-ordered numbers where half of the numbers are above and half are below it. It is also a measure of central tendency.

Metric units—The units of measure developed in Europe and used in most of the world. Like the decimal system, the metric system uses the base 10.

- Metric units for length may include millimeters, centimeters, meters, and kilometers.
- Metric units for mass may include milligrams, grams, and kilograms.
- Metric units for volume may include cubic millimeters, cubic centimeters, and cubic meters.
- Metric units for capacity may include milliliters, centiliters, liters, and kiloliters.

Midpoint of a line segment—The point of a line segment equidistant from the endpoints.

Minimum—The least or lowest value or quantity.

Mode—The score or data point found most often in a set of numbers. There may be no mode, one mode, or more than one mode in a set of numbers. It is also a measure of central tendency.

Multiples—The numbers that result from multiplying a given whole number by the set of whole numbers (e.g., the multiples of 15 are 0, 15, 30, 45, 60, 75, etc.).

Multiplicative identity—The number one (1). The product of a number and the multiplicative identity is the number itself (e.g., $5 \times 1 = 5$).

Multiplicative inverse (reciprocal)—Any two numbers with a product of 1 $\left(\text{e.g., 4 and } \frac{1}{4}\right)$. Zero (0) has no multiplicative inverse.

Natural numbers (counting numbers)—The numbers in the set {1, 2, 3, 4, 5 . . .}.

Negative exponent—Used to designate the reciprocal of a number to the absolute value of the exponent. Also used in scientific notation to designate a number smaller than one (1). For example, $3.45 = 10^{-2}$ equals 0.0345.

Negative integer—Any integer that is less than 0.

Net—A two-dimensional diagram that can be folded or made into a three-dimensional figure.

FCAT 2.0 Mathematics Glossary Grades 6–8

Nonroutine problem—A problem that can be solved more than one way, rather than a set procedure; these problems may include multiple decision points and multiple steps (grade-level dependent).

Number line—A line on which ordered numbers can be written or visualized and may include negative numbers.

Oblique—A relationship between lines and/or plane figures that is not perpendicular or parallel.

Obtuse angle—An angle with a measure of greater than 90° and less than 180°.

Odds—The ratio of one event occurring (favorable outcome) to it not occurring (unfavorable outcome) if all outcomes are equally likely.

Operation—Any mathematical process, such as addition, subtraction, multiplication, division, raising to a power, or finding the square root.

Operational shortcut—A method having fewer arithmetic calculations.

Ordered pair—The location of a single point on a rectangular coordinate system where the first and second values represent the position relative to the *x*-axis and *y*-axis, respectively [e.g., (x, y) or $(3, {}^{-}4)$]. See also coordinates.

Organized data—Data arranged in a display that is meaningful and that assists in the interpretation of the data. See data displays/graphs.

Origin—The point of intersection of the *x*- and *y*-axes in a rectangular coordinate system, where the *x*-coordinate and *y*-coordinate are both zero (0).

Outcome—A possible result of an experiment.

Outlier—A value that is much higher or much lower than the other values in a set of data.

Parallel—A relationship between lines, line segments, rays or planes that are a constant distance apart.

Parallelogram—A quadrilateral in which both pairs of opposite sides are parallel.

Pattern—A predictable or prescribed sequence of numbers, objects, etc. Patterns and relationships may be described or presented using manipulatives, tables, graphics (pictures or drawings), or algebraic rules (functions).

Percent—A special-case ratio that compares numbers to 100 (the second term). For example, 25% means the ratio of 25 to 100.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Perimeter—The distance around a figure.

Perpendicular—Lines, line segments, rays, or planes that intersect to form a right angle.

***Pi* (π)**—The symbol designating the ratio of the circumference of a circle to its diameter. It is an irrational number, with common approximations of either 3.14 or $\frac{22}{7}$.

Pictograph—A data display constructed with pictures or symbols to represent and compare data.

Place value—The value of a digit in a number, based on the location of the digit.

Plane—An infinite two-dimensional geometric surface defined by three nonlinear points or two distinct parallel or intersecting lines.

Plane figure—A two-dimensional figure that lies entirely within a single plane.

Point—A specific location in space having no discernible length or width.

Polygon—A closed plane figure, having at least three sides that are line segments and are connected at their endpoints.

Polyhedron (*p*l. polyhedra)—A solid figure bounded by polygons.

Positive integer—Any integer that is greater than 0.

Precision (of measurement)—An indication of how exact, or "finely," a measurement was made.

Prime factorization—The expression of a number as the product of prime factors.

Prime number—Any positive integer with only two whole-number factors, 1 and itself (e.g., 2, 3, 5, 7, 11, etc.).

Prism—A polyhedron that has two congruent and parallel faces joined by faces that are parallelograms. Prisms are named by their bases.

Probability—A measure of the likelihood that a given event will occur; expressed as a ratio of one event occurring (favorable outcomes) to the number of equally likely possible outcomes. See also empirical probability and theoretical/expected probability.

Procedural step—An action taken to solve a problem (e.g., there are three procedural steps to evaluate the following expression: $2(7 + 5)$, which has two operations).

FCAT 2.0 Mathematics Glossary
Grades 6–8

Product—The result of multiplying numbers together.

Properties of equality—1) A balanced equation will remain balanced if you add, subtract, multiply, or divide both sides by the same number. 2) A quantity equal to another quantity can be substituted for it.

Proportion—A mathematical sentence stating that two ratios are equal.

Proportional—Having the same or a constant ratio. Two quantities that have the same ratio are considered directly proportional (e.g., if $y = kx$, then y is said to be directly proportional to x and the constant of proportionality is k). Two quantities in which products are always the same are considered inversely proportional (e.g., if $xy = k$, then y is said to be inversely proportional to x).

Pyramid—A three-dimensional figure in which the base is a polygon and the faces are triangles with a common vertex.

Pythagorean theorem—The square of the hypotenuse (c) of a right triangle is equal to the sum of the square of each of the legs (a and b), as shown in the equation $c^2 = a^2 + b^2$.

Quadrant—Any of the four regions formed by the axes in a rectangular coordinate system.

Quadrilateral—Any polygon with four sides and four angles, including parallelogram, rhombus, rectangle, square, trapezoid, and kite.

Quotient—The result of dividing two numbers.

Radical—An expression that has a root (square root, cube root, etc.) For example, $\sqrt{25}$ is a radical. Any root can be specified by an index number, b, in the form $\sqrt[b]{a}$ (e.g., $\sqrt[3]{8}$). A radical without an index number is understood to be a square root.

Radical sign—The symbol ($\sqrt{\ }$) used before a number to show that the number is a radicand. See also radical.

Radicand—The number that appears within a radical sign (e.g., in $\sqrt{25}$, 25 is the radicand).

Radius (*pl*. radii)—A line segment extending from the center of a circle or sphere to a point on the circle or sphere.

Randomly selected—Having the same probability of being chosen.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Range—1) The lowest value (L) in a set of numbers through the highest value (H) in the set. When the width of the range is expressed as a single number, the range is calculated as the difference between the highest and lowest values (H − L). Other presentations show the range calculated as (H − L + 1). Depending on the context, the result of either calculation would be considered correct. 2) The complete set of all possible resulting values of the dependent variable of a function.

Rate—A ratio that compares two quantities of different units (e.g., feet per second).

Rate of change—The ratio of change in one quantity to the corresponding change in another quantity.

Ratio—The comparison of two quantities (e.g., the ratio of a and b is $a:b$ or a/b, where $b \neq 0$).

Rational number—A real number that can be expressed as a ratio of two integers.

Ray—A portion of a line that begins at an endpoint and goes on indefinitely in one direction.

Real numbers—The set of all rational and irrational numbers.

Real-world problem—A problem that is an application of a real-life situation involving mathematics.

Reciprocal—See multiplicative inverse.

Rectangle—A parallelogram with four right angles.

Rectangular coordinate system—See coordinate grid or plane.

Rectangular prism—A three-dimensional figure (polyhedron) with congruent rectangular parallel bases and lateral faces that are parallelograms.

Reduction—A dilation in which the scale factor, or size change, is greater than 0 but less than 1. See dilation.

Reflection—A transformation that produces the mirror image of a geometric figure over a line of reflection.

Regular polygon—A polygon that is both equilateral (all sides congruent) and equiangular (all angles congruent).

Relation—A table that relates inputs to outputs or a set of ordered pairs (x, y).

Relative size—The size of one number in comparison to the size of another number or numbers.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Remainder—In a whole-number division problem, the final undivided part that is less than the divisor and left over after dividing.

Rhombus (*pl*. rhombi)—A parallelogram with four congruent sides.

Right angle—An angle that measures exactly 90°.

Right circular cylinder—A cylinder in which the bases are parallel circles perpendicular to the side of the cylinder.

Right prism—A prism in which all the lateral faces and edges are perpendicular to the bases.

Right square pyramid—A polyhedron in which one face, the base, is a square, and the other faces, the lateral faces, are triangles with a common vertex that is directly above the center of the base.

Right rectangular prism (Rectangular solid)—A polyhedron with congruent rectangular parallel bases, joined by faces that are also rectangles. The lateral edges of the faces are perpendicular to the bases.

Right triangle—A triangle having one right angle.

Right triangle geometry—Finding the measures of missing sides or angles of a right triangle when given the measures of other sides or angles.

Rise—The vertical change on the graph between two points.

Rotation—A transformation of a figure by turning it about a center point or axis. The amount of rotation is usually expressed in the number of degrees (e.g., a 90° rotation). The direction of the rotation is usually expressed as clockwise or counterclockwise.

Run—The horizontal change on a graph between two points.

Scalar drawing (or model)—A drawing (or model) that uses proportional lengths in the drawing (or model) and the actual image.

Scale—The numeric values, set at fixed intervals, assigned to the axes of a graph.

Scale factor—The constant that is multiplied by the length of each side of a figure to produce an image that is the same shape as the original figure.

Scale model—A model or drawing based on a ratio of the dimensions for the model and the actual object it represents.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Scalene triangle—A triangle having no congruent sides.

Scatter plot—A graph of data points, usually from an experiment, that is used to observe the relationship between two variables.

Scientific notation—A method of writing very large or very small numbers using exponents in which a number is expressed as the product of a power of 10 and a number that is greater than or equal to one (1) and less than 10 (e.g., $7.59 \times 10^5 = 759{,}000$).

Sequence—An ordered list of numbers with either a constant difference (arithmetic) or a constant ratio (geometric).

SI units (International System of Units)—Scientific method of expressing the magnitudes or quantities of important natural phenomena.

Side—The edge of a polygon (e.g., a triangle has three sides), the face of a polyhedron, or one of the rays that make up an angle.

Similar figures—Figures that have corresponding angles that are congruent, and have corresponding sides that are proportional in length.

Similarity—The property of having the same shape and same relative proportion but not necessarily the same size or the same position.

Simplify—The process of converting a fraction or mixed number to an equivalent fraction or mixed number, in which the greatest common factor of the numerator and the denominator of the fraction is one.

Slant height—The length of a segment from the vertex to the lateral edge of a right cone; the height of any lateral face of a regular pyramid.

Slope—The ratio of change in the vertical axis (y-axis) to change in the horizontal axis (x-axis) in the form $\frac{\text{rise}}{\text{run}}$ *or* $\frac{\Delta y}{\Delta x}$. Also, the constant, m, in the linear equation for the slope-intercept form $y = mx + b$.

Solid figure—A three-dimensional figure that completely encloses a portion of space (e.g., a rectangular prism, cube, sphere, right circular cylinder, right circular cone, pyramid).

Sphere—A three-dimensional figure in which all points on the figure are equidistant from a center point.

Square—A rectangle with four congruent sides; also, a rhombus with four right angles.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Square root—A positive real number that can be multiplied by itself to produce a given number (e.g., the square root of 144 is 12 or $\sqrt{144} = 12$).

Squiggle—See break.

Standard units of measure—Accepted measuring devices and units of the customary or metric system.

Stem-and-leaf plot—A graph that organizes data by place value to compare data frequencies.

Straight angle—An angle that measures exactly 180°.

Sum—The result of adding numbers together.

Supplementary angles—Two angles with measures the sum of which is exactly 180°.

Surface area of a geometric solid—The sum of the areas of the faces and/or any curved surfaces of the figure that create a geometric solid figure.

Symmetry—A term describing the result of a line drawn through the center of a figure such that the two halves of the figure are reflections of each other across the line (line symmetry). When a figure is rotated around a point and fits exactly on itself, the figure has rotational symmetry.

System of linear equations—Two or more related linear equations. A system of linear equations can have no common solutions, one common solution, or many common solutions. The solution to a system of linear equations is an ordered number set that makes all of the equations true.

Table—A data display that organizes information about a topic into categories.

Tally chart (or table)—A chart, or table, consisting of tallies, or slash marks, having a one-to-one correspondence between the number of objects and the number of slash marks (e.g., 6 = 𝍸 I).

Term—A number, variable, product, or quotient in an expression. A term is not a sum or difference (e.g., $5x^2 + 6$ has two terms, $5x^2$ and 6).

Theoretical probability—The likelihood of an event happening based on theory rather than on experience and observation.

Three-dimensional figure—A figure having length, height, and width (depth).

FCAT 2.0 Mathematics Glossary
Grades 6–8

Transformation—An operation on a geometric figure by which an image is created. Common transformations include reflections, translations, rotations, and dilations.

Translation—A transformation in which every point in a figure is moved in the same direction and by the same distance.

Transversal—A line that intersects two or more lines at different points.

Trapezoid—A quadrilateral with exactly one pair of parallel sides.

Tree diagram—A diagram in which all the possible outcomes of a given event are displayed.

Trend—A general pattern in a set of data (e.g., if a line graph moves generally upward from left to right, the trend is increasing).

Trend line—A line on a graph indicating a statistical trend.

Truncate—To make numbers with many digits easier to read and use by ignoring all digits to the right of the chosen place. The truncated number is an approximation, not an exact equivalence of the original number.

Two-dimensional figure—A figure having length and width.

Unorganized data—Data that are presented in a random manner.

Variable—Any symbol, usually a letter, which could represent a number.

Variability—See range.

Venn diagram—A diagram that shows relationships among sets of objects.

Vertex (*pl*. vertices)—The point common to the two rays that form an angle; the point common to any two sides of a polygon; the point common to three or more edges of a polyhedron.

Vertical—Perpendicular to the plane of the horizon.

Vertical angles—The opposite or nonadjacent angles formed when two lines intersect.

Volume—The amount of space occupied in three dimensions and expressed in cubic units. Both capacity and volume are used to measure empty spaces; however, capacity usually refers to fluid measures, whereas volume is described as cubic units.

Weight—Measures that represent the force of gravity on an object.

FCAT 2.0 Mathematics Glossary
Grades 6–8

Whole numbers—The numbers in the set {0, 1, 2, 3, 4 . . .}.

Width—One of the dimensions of a two- or three-dimensional figure.

***x*-axis**—The horizontal number line on a rectangular coordinate system.

***x*-intercept**—The value of *x* at the point where a line or graph intersects the *x-axis.* The value of *y* is zero (0) at this point.

***y*-axis**—The vertical number line on a rectangular coordinate system.

***y*-intercept**—The value of *y* at the point where a line or graph intersects the *y-axis.* The value of *x* is zero (0) at this point.

Instructions for Item Review

Directions: A series of questions numbered 1–9 are presented below. These questions are designed to assist with your evaluation of the quality of FCAT 2.0 test items you will be reviewing. The attached chart is an example of the one you will use to record your rating of each item. You will review the items independently before discussing each item with other committee members. If you identify any problem area in the item during the independent review, you should put a crossmark (✘) in the appropriate column. Crossmarks (✘) will indicate problem areas, and blank spaces or checks (✓) will indicate no problems.

Questions 1–9

1. Does the test item measure the benchmark?
2. Does the content measured by the item meet the content limits of the *FCAT 2.0 Mathematics Test Item Specifications*?
3. Is the wording/context of the item (stem and stimulus) appropriate for the grade level?
4. In your professional judgment, what is the cognitive complexity of the item for students who have attained the benchmark at the grade level being assessed? In other words, is the item best categorized as low complexity (L), moderate complexity (M), or high complexity (H)? Use the cognitive complexity handouts in making this judgment.
5. In your professional judgment, what is the level of difficulty of the item for students who have attained the benchmark at the grade level being assessed?
   Use: E = easy (more than 70% of the students should get the item correct)
   A = average (between 40% and 70% of the students should get this item correct)
   C = challenging (less than 40% of the students should get this item correct)
6. Is the NGSSS topic appropriate for the item?
7. Is the assigned content focus appropriate for the item? Is there a better content focus available for the assigned benchmark (using DOE's content focus spreadsheet)?
8. Is the keyed response the correct, best, and only answer? For gridded-response items: Does the problem result in an answer that will fit in the grid? Do other acceptable answers need to be identified in the answer key?
9. Are the multiple-choice options appropriate, parallel (both grammatically and conceptually to the keyed response), and plausible?

Overall Quality: Rate the overall quality of each test item using the following rating definitions and codes.

Overall Quality

A (Accept) **AM** (Accept with Metadata changes) **AR** (Accept as Revised)
RR (Revise and Re-present, including art) **D** (Delete)

Please provide a brief explanation of ratings of AR, RR, and D in the comment section.

After the group discussion and possible revision of an item, you may wish to change your overall rating. If so, place a slash (/) through your original rating and give the item a new rating.

FCAT 2.0 Mathematics Item Rating Form

Page # of Item	Item ID Number	Measures Benchmark	Adheres to Content Limits	Is Appropriate for Grade	Appropriate Cognitive Complexity (L, M, H)	Estimated Item Difficulty (E, A, C)	Appropriate FCAT 2.0 Topic	Appropriate Content Focus	Only One Correct Answer	Appropriate MC Options	Overall Rating A/AM/AR/RR/D	Additional Comments
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

Students in my (classroom, school, district) [circle one] are given the opportunity to learn the material that these items test, except as noted in my comments.	**Signature** _____ **Date** _____

FCAT 2.0 Mathematics, Algebra 1 EOC, and Geometry EOC Test Design Summary

Item Types and Numbers

The data in this table give ranges for the approximate number of items by item type on the FCAT 2.0 Mathematics. These ranges include both operational and field-test items.

Assessment	Item Types
3	50–55 MC
4	35–40 MC 10–15 GR
5	35–40 MC 10–15 GR
6	35–40 MC 10–15 GR
7	35–40 MC 10–15 GR
8	35–40 MC 20–25 GR
Algebra 1 EOC	35–40 MC 20–25 FR
Geometry EOC	35–40 MC 20–25 FR

Duration of Tests

The table below displays the number of minutes allowed for regular test takers for FCAT 2.0 Mathematics. All tests are administered in two sessions with the exception of the Mathematics Retake, which must be taken in one day.

Assessment	Duration (in minutes)
3	140
4	140
5	140
6	140
7	140
8	140
Alg 1 EOC	160
Geom EOC	160

Lengths of Tests

This table provides an approximate range for the number of items on each test.

Assessment	Number of Items
3	50–55
4	50–55
5	50–55
6	50–55
7	50–55
8	60–65
Alg 1 EOC	60–65
Geom EOC	60–65

Grade 5 FCAT 2.0 Mathematics Reference Sheet

Area

Rectangle	$A = bh$
Parallelogram	$A = bh$
Triangle	$A = \frac{1}{2}bh$ or $A = (bh) \div 2$
Trapezoid	$A = \frac{1}{2}h(b_1 + b_2)$ or $A = h(b_1 + b_2) \div 2$

KEY	
b = base	A = area
h = height	B = area of base
w = width	V = volume
	$S.A.$ = surface area

Volume of Rectangular Prism

$V = bwh$ or $V = Bh$

Surface Area of Rectangular Prism

$S.A. = 2bh + 2bw + 2hw$

Customary Conversions	Customary Conversions
1 foot = 12 inches 1 yard = 3 feet 1 mile = 5,280 feet 1 mile = 1,760 yards 1 acre = 43,560 square feet	1 cup = 8 fluid ounces 1 pint = 2 cups 1 quart = 2 pints 1 gallon = 4 quarts 1 pound = 16 ounces 1 ton = 2,000 pounds
Metric Conversions	**Metric Conversions**
1 centimeter = 10 millimeters 1 meter = 100 centimeters 1 meter = 1000 millimeters 1 kilometer = 1000 meters	1 liter = 1000 milliliters 1 liter = 1000 cubic centimeters 1 gram = 1000 milligrams 1 kilogram = 1000 grams
Time Conversions	
1 minute = 60 seconds 1 hour = 60 minutes 1 day = 24 hours 1 week = 7 days 1 year = 365 days 1 year = 52 weeks	

**Note:* Metric numbers with four digits are presented without a comma (e.g., 9960 kilometers). For metric numbers greater than four digits, a space is used instead of a comma (e.g., 12 500 liters).

Grades 6–8 FCAT 2.0 Mathematics Reference Sheet

Area

Rectangle	$A = bh$
Parallelogram	$A = bh$
Triangle	$A = \frac{1}{2}bh$
Trapezoid	$A = \frac{1}{2}h(b_1 + b_2)$
Circle	$A = \pi r^2$

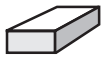
KEY

b	= base	A	= area
h	= height	B	= area of base
w	= width	C	= circumference
d	= diameter	V	= volume
r	= radius	P	= perimeter of base
ℓ	= slant height	$S.A.$	= surface area

Use 3.14 or $\frac{22}{7}$ for π.

Circumference

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

	Volume/Capacity	Total Surface Area
 Rectangular Prism	$V = bwh$ or $V = Bh$	$S.A. = 2bh + 2bw + 2hw$ or $S.A. = Ph + 2B$
 Right Circular Cylinder	$V = \pi r^2 h$ or $V = Bh$	$S.A. = 2\pi rh + 2\pi r^2$ or $S.A. = 2\pi rh + 2B$
 Right Square Pyramid	$V = \frac{1}{3}Bh$	$S.A. = \frac{1}{2}P\ell + B$
 Right Circular Cone	$V = \frac{1}{3}\pi r^2 h$ or $V = \frac{1}{3}Bh$	$S.A. = \frac{1}{2}(2\pi r)\ell + B$

Sum of the measures of the interior angles of a polygon = $180(n - 2)$

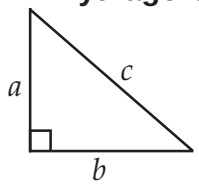
Measure of an interior angle of a regular polygon = $\frac{180(n - 2)}{n}$

where:

n represents the number of sides

Grades 6–8 FCAT 2.0 Mathematics Reference Sheet

Pythagorean theorem



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

Simple interest formula

$I = prt$

where p = principal, r = rate, t = time

Slope-intercept form of a linear equation

$y = mx + b$

where m = slope and $b = y$-intercept

Distance, rate, time formula

$d = rt$

where d = distance, r = rate, t = time

Conversions within a System of Measure

1 yard = 3 feet
1 mile = 1,760 yards = 5,280 feet
1 acre = 43,560 square feet

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 pound = 16 ounces
1 ton = 2,000 pounds

1 meter = 100 centimeters = 1000 millimeters
1 kilometer = 1000 meters

1 liter = 1000 milliliters = 1000 cubic centimeters
1 gram = 1000 milligrams
1 kilogram = 1000 grams

1 minute = 60 seconds
1 hour = 60 minutes
1 year = 52 weeks = 365 days

Conversions between Systems of Measure

When converting from Customary to Metric, use these approximations.

1 inch = 2.54 centimeters
1 foot = 0.305 meter
1 mile = 1.61 kilometers

1 cup = 0.24 liter
1 gallon = 3.785 liters
1 ounce = 28.35 grams
1 pound = 0.454 kilogram

When converting from Metric to Customary, use these approximations.

1 centimeter = 0.39 inch
1 meter = 3.28 feet
1 kilometer = 0.62 mile

1 liter = 4.23 cups
1 liter = 0.264 gallon
1 gram = 0.0352 ounce
1 kilogram = 2.204 pounds

Temperature conversions between Celsius and Fahrenheit

$°C = (°F - 32) \div 1.8$
$°F = (°C \times 1.8) + 32$

Algebra 1 End-of-Course and Geometry End-of-Course Assessments Reference Sheet

Area

Parallelogram	$A = bh$
Triangle	$A = \frac{1}{2}bh$
Trapezoid	$A = \frac{1}{2}h(b_1 + b_2)$
Circle	$A = \pi r^2$
Regular Polygon	$A = \frac{1}{2}aP$

KEY

b	= base	A	= area
h	= height	B	= area of base
w	= width	C	= circumference
d	= diameter	V	= volume
r	= radius	P	= perimeter of base
ℓ	= slant height		
a	= apothem	$S.A.$	= surface area

Use 3.14 or $\frac{22}{7}$ for π.

Circumference

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

		Volume/Capacity	Total Surface Area
	Rectangular Prism	$V = bwh$ or $V = Bh$	$S.A. = 2bh + 2bw + 2hw$ or $S.A. = Ph + 2B$
	Right Circular Cylinder	$V = \pi r^2 h$ or $V = Bh$	$S.A. = 2\pi rh + 2\pi r^2$ or $S.A. = 2\pi rh + 2B$
	Right Square Pyramid	$V = \frac{1}{3}Bh$	$S.A. = \frac{1}{2}P\ell + B$
	Right Circular Cone	$V = \frac{1}{3}\pi r^2 h$ or $V = \frac{1}{3}Bh$	$S.A. = \frac{1}{2}(2\pi r)\ell + B$
	Sphere	$V = \frac{4}{3}\pi r^3$	$S.A. = 4\pi r^2$

Sum of the measures of the interior angles of a polygon $= 180(n-2)$

Measure of an interior angle of a regular polygon $= \frac{180(n-2)}{n}$

where:

n represents the number of sides

Algebra 1 End-of-Course and Geometry End-of-Course Assessments Reference Sheet

Slope formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

where m = slope and (x_1, y_1) and (x_2, y_2) are points on the line

Slope-intercept form of a linear equation

$$y = mx + b$$

where m = slope and b = y-intercept

Point-slope form of a linear equation

$$y - y_1 = m(x - x_1)$$

where m = slope and (x_1, y_1) is a point on the line

Distance between two points

$P_1(x_1, y_1)$ and $P_2(x_2, y_2)$

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint between two points

$P_1(x_1, y_1)$ and $P_2(x_2, y_2)$

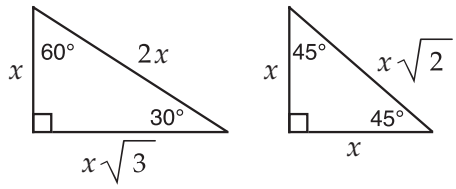
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Quadratic formula

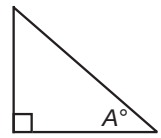
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

where a, b, and c are coefficients in an equation of the form $ax^2 + bx + c = 0$

Special Right Triangles



Trigonometric Ratios



$$\sin A° = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A° = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan A° = \frac{\text{opposite}}{\text{adjacent}}$$

Conversions

1 yard = 3 feet
1 mile = 1,760 yards = 5,280 feet
1 acre = 43,560 square feet
1 hour = 60 minutes
1 minute = 60 seconds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
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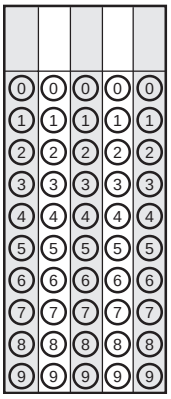
1 meter = 100 centimeters = 1000 millimeters
1 kilometer = 1000 meters
1 liter = 1000 milliliters = 1000 cubic centimeters
1 gram = 1000 milligrams
1 kilogram = 1000 grams

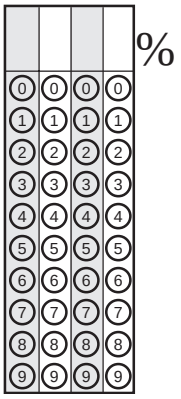
Response Grids

FCAT 2.0 Mathematics GR and FR items are written with consideration for the number of columns in the grid. Grids contain either four, five, six, or seven columns. Columns in which students may bubble a numeral contain the digits 0 through 9 enclosed in bubbles. All grids include light shading in alternate columns. At Grades 4 and 5, the grid format is designed for items that require a positive numeric solution (whole numbers, decimals, or percents). Items in Grades 7–8, Algebra 1 EOC, and Geometry EOC require either a positive or negative numeric solution. For more information about the grids, see the Item Style and Format section of this book.

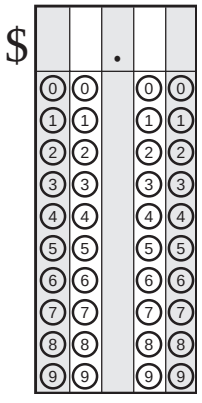
Grades 4 and 5

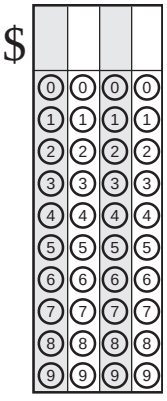
Four- or five-column grids are used for Grades 4 and 5 and may be preceded with a dollar sign ($) or followed by a percent sign (%), as appropriate.



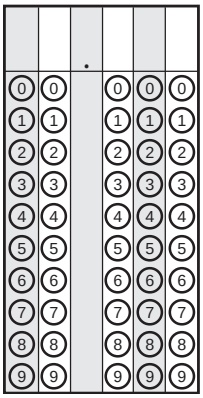


There are two types of currency grids for Grades 4 and 5. The five-column grid includes a fixed decimal point for dollars and cents. The four-column grid does not include a decimal point. Both grids have a dollar sign preceding the grid.



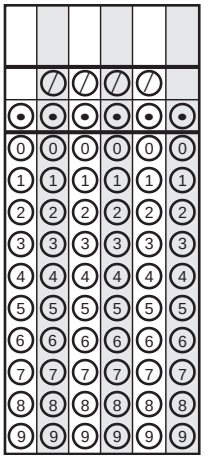


A special grid is provided at Grades 4 and 5 for gridding decimal numbers. It is six columns wide with a fixed decimal point in the third column from the left.



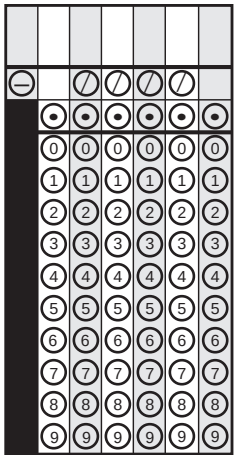
Grades 6 and 7

Grades 6 and 7 use a six-column grid that includes the digits 0 through 9 plus two symbols: a decimal point (.) and a fraction bar (/) for gridding fractions.



Grades 7–8

Grades 7 (two benchmarks) and 8 use a seven-column grid that includes the digits 0 through 9, plus two symbols: the decimal point (.) and the fraction bar (/), and a seventh column to allow for the negative sign.



Algebra 1 EOC and Geometry EOC

The Algebra 1 EOC and Geometry EOC will be computer based and use a seven-column fill-in response grid.

The Florida Department of Education and its test contractors currently employ strategies to protect the environment in the production and destruction of FCAT materials. The Department encourages schools and districts to recycle non-secure FCAT interpretive publications after use.