Florida EOC Assessments 2012

Geometry
End-of-Course Assessment
Test Item Specifications
Version 2

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 (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, which further emphasized 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 subdivided into benchmarks that identify what a student should know and be able to do. This document, *Geometry End-of-Course Assessment Test Item Specifications* (*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, Civics, Geometry, and U.S. History. The Geometry EOC Assessment measures achievement of Florida students enrolled in Geometry, or an equivalent course, by assessing student progress on benchmarks from the NGSSS that are assigned to Geometry course descriptions.

Origin and Purpose of the *Specifications*

The Florida Department of Education and committees of experienced Florida educators developed and approved the *Specifications*. 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 the Geometry EOC Assessment provides general guidelines for the development of all test items used in the Geometry EOC Assessment. Three additional *Specifications* documents provide the same information for FCAT 2.0 Mathematics grades 3–5 and grades 6–8 and for the Algebra 1 EOC assessment.

The Overall Considerations section in this Introduction provides an explanation of the mathematics elements assessed by the test. The Criteria for Geometry End-of-Course Assessment Items section addresses the quality of the stimuli and test items and selection and development of multiple-choice and fill-in response items. The Item Difficulty and Cognitive Complexity section addresses cognitive-complexity levels as well as item difficulty and universal design. The Individual Benchmark Specifications section contains specific information about each benchmark. This section provides benchmark clarification statements, content limits, stimulus attributes, response attributes, and a sample item for each benchmark grouping.

Overall Considerations

This section of the *Specifications* describes the guidelines that apply to all test items developed for the Geometry EOC Assessment.

Overall considerations are broad item-development issues that should be addressed during the development of test items. Other sections relate more specifically to one aspect of the development (e.g., item types or content limits).

1. Each test 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. Test items should be course appropriate for students in terms of difficulty, cognitive development, and reading level.
4. Test items will exhibit a varied range of difficulty.
5. Test items should not disadvantage or exhibit disrespect to anyone in regard to age, gender, race, ethnicity, language, religion, socioeconomic status, disability, or geographic region.
6. For the Algebra 1 End-of-Course Assessment, a four-function calculator will be allowed. For the Geometry End-of-Course Assessment, a scientific calculator will be allowed.
7. Test 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.
8. Test items should provide clear and complete instructions to students.
9. Each test item should be written to clearly elicit the desired response.
10. A reference sheet containing appropriate formulas and conversions is provided to students taking the Algebra 1 EOC Assessment and the Geometry EOC Assessment for use during testing. Copies of the reference sheets are included in Appendix G of this document.
11. Test items on the 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 test 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.

Criteria for Geometry End-of-Course Assessment Items

The Geometry EOC Assessment includes two types of test items: multiple-choice items (MC) and fill-in response items (FR). The general specifications on pages 3 through 14 cover the following criteria:

- Use of Graphics
- Item Style and Format
- Scope of Test Items
- Guidelines for Item Writers
- Item Difficulty and Cognitive Complexity of Geometry End-of-Course Assessment Items
- Universal Design

Use of Graphics

Graphics are used extensively in the Geometry EOC Assessment 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. All artwork must be high quality.

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, although 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 FR 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 FR 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 the test item question (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).
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 when the number is given in the context of the problem. If a number greater than or equal to 1,000 is presented in an equation or an algebraic expression, no comma should be used. 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). 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 test item stem, any numbers needed to compute answers should be presented as numerals.
17. In MC items where π is used in the stem, the question or answer options should address which form of π should be used or if the answer will be kept in π form. In FR items, the question should address which form of π should be used or the key answer should account for using 22/7 or 3.14.
18. All angle measurements will be in degrees.

Multiple-Choice (MC) Items

1. MC items should take an average of two minutes per item to solve.
2. MC items are worth one point each.
3. MC items should have four answer choices (A, B, C, and D).
4. The correct response should be indicated.
5. During item development and review, the rationale for distractors (incorrect answer options) should be indicated and set off in brackets.
6. In most cases, answer options 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 3
Figure 2 Figure 4
8. If the answer options 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, options should be arranged as they are presented in the item stem.
9. If the answer options for an item are neither strictly numerical nor denominate numbers, the options 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.

Fill-In Response (FR) Items

1. The Algebra 1 EOC and Geometry EOC Assessments use FR items.
2. FR items should take an average of 2.5 minutes per item to complete.
3. FR items are worth one point each.
4. 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.
5. FR items may have a negative answer.
6. 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.
7. FR items are written with consideration for the number of columns in the response box.
8. The Algebra 1 EOC and Geometry EOC Assessments are computer based and will use a seven-column fill-in response box for items not assessed by multiple choice.

Scope of Test Items

The scope of Geometry EOC Assessment test items is presented in Appendix B, which gives the benchmarks for Geometry. The benchmarks serve as the objectives to which the test items are written. There may be additional specifications or restrictions by grade level or course; these are given in the General Content Limits section of the *Specifications*.

Some of the benchmarks are assessed across grades 3–8, Algebra 1, and Geometry. 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

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 Geometry EOC 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 test 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 test 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 distractor is incorrect.
- 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 test items of varying difficulty;
- include test 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 Geometry End-of-Course Assessment Items

Educational standards and assessments can be aligned based on the category of content covered and also on the complexity of knowledge required. The Geometry EOC Assessment 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 and EOC items is currently categorized in two ways: **item difficulty** and **cognitive complexity**.

Item Difficulty

The difficulty of FCAT 2.0 and EOC 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 a test 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. Test items are chosen for the FCAT 2.0 and EOC assessments based on the NGSSS and their grade-level or course 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 (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 Geometry. 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. Test items should be written to the highest level of complexity as appropriate to the assessed benchmark.

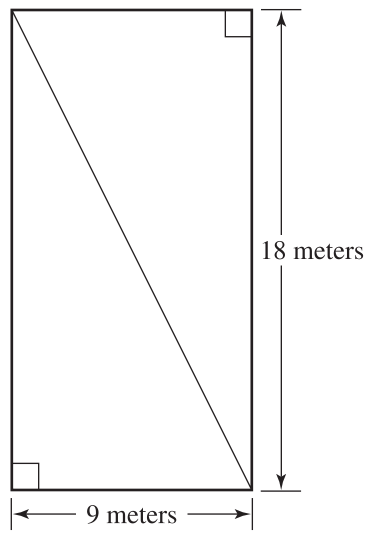
[1] Bloom, B.S. et al. *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain.* New York: McKay, 1956.
[2] Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center for Education Research. University of Wisconsin-Madison. 2 Feb. 2006. http://www.wcer.wisc.edu/WAT/index.aspx.

Low Complexity

Geometry low-complexity items rely on recall or recognition of a course-related fact, property, or concept. Items may rely on previously learned concepts and principles.

Below is an example of a low-complexity test item that is based on Benchmark MA.912.G.5.4. For more information about this benchmark, see page 58.

The dimensions and shape of a rectangular volleyball court are shown in this picture.



What is the approximate distance of a serve that is hit diagonally from one corner of the court to the other?

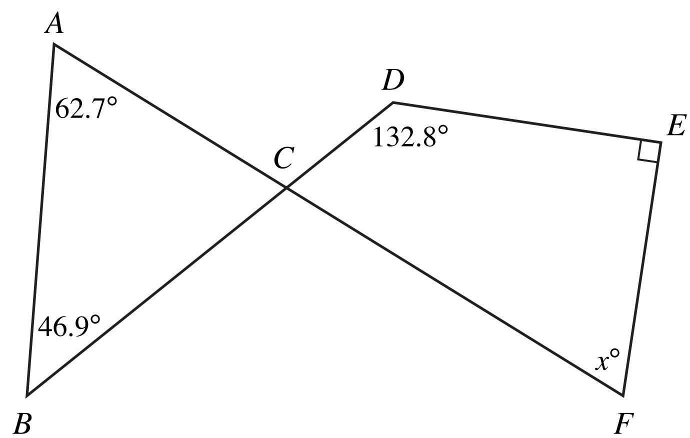
A. 27.0 meters
★ **B.** 20.1 meters
C. 15.6 meters
D. 12.7 meters

Moderate Complexity

Geometry moderate-complexity items involve flexible thinking while applying basic skills and concepts of geometry. Items may require more than one step, and the student may be expected to decide which geometric concepts to apply.

Below is an example of a moderate-complexity test item that is based on Benchmark MA.912.G.2.2. For more information about this benchmark, see page 37.

In the figure below, $\overline{BD}$ and $\overline{AF}$ intersect at point C.



What is the value of x?

			6	6	.	8

Correct Answer: 66.8

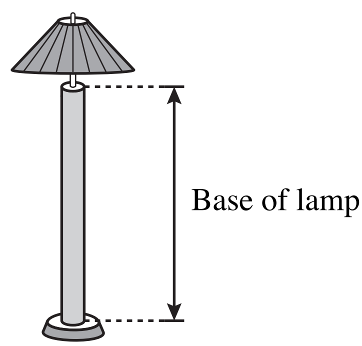
High Complexity

Geometry high-complexity items may require the student to reason, justify, or explain their thinking. Students may develop a plan to solve the problem. Items often require several decision points, abstract reasoning, or analysis.

Below is an example of a high-complexity test item that is based on Benchmark MA.912.G.7.5. For more information about this benchmark, see page 68.

Tobias is restoring an antique lamp like the one pictured below. The base of the lamp is cylindrical with a height of $19\frac{1}{2}$ inches and a diameter of $1\frac{1}{4}$ inches. He will use gold leaf to cover the lateral surface area of the base of the lamp.

TOBIAS'S LAMP



The gold-leaf material Tobias will use comes in square pieces that measure $3\frac{3}{8}$ inches by $3\frac{3}{8}$ inches. What is **the least number** of these pieces of gold-leaf material Tobias will need to completely cover the lateral area of the lamp's base?

						7

Correct Answer: 7

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 and EOC Mathematics Activities across Cognitive-Complexity Levels

Low Complexity	Moderate Complexity	High Complexity
• Recall or recognize a fact, term, or property.	• Solve a problem requiring multiple operations.	• Solve real-world problems using multiple steps and multiple decision points.
• Identify appropriate units or tools for common measurements.	• Solve a problem involving multiple transformations of a figure or spatial visualization or reasoning.	• Describe how different representations can be used for different purposes.
• Compute a sum, difference, product, or quotient.	• Retrieve information from a graph, table, or figure and use it to solve a problem.	• Solve a nonroutine problem (as determined by grade-level appropriateness).
• Recognize or determine an equivalent representation.	• Compare figures or statements.	• Analyze similarities and differences between procedures and concepts.
• Calculate the value of an expression, given specific values for the variables.	• Determine a reasonable estimate.	• Generalize an algebraic or geometric pattern.
• Solve a one-step problem.	• Extend an algebraic or geometric pattern.	• Formulate an original problem, given a situation.
• Retrieve information from a graph, table, or figure.	• Explain steps of a solution process.	• Solve a problem in more than one way.
• Perform a single-unit conversion (e.g., feet to inches).	• Translate and solve a routine problem, given data and conditions.	• Provide a mathematical explanation and/or justification to a problem.
	• Represent a situation mathematically in more than one way.	• 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 items, not on assumptions about the student's approach to the items. 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 mathematics assessment.

Percentage of Points by Cognitive-Complexity Level for FCAT 2.0 and EOC Mathematics

Grades/Courses	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	10–20	60–80	10–20
Geometry	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 Geometry End-of-Course Assessment Test Items

Prior to appearing on any assessment, all Geometry 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 for 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 alike 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 Geometry EOC 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 test 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 course specifications for test items. Separate reviews for bias and sensitivity issues are also conducted as noted above.

Geometry 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.

Guide to the Individual Benchmark Specifications

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 numbers in the *third, fourth, and fifth positions* represent the **Grade Levels** to which the benchmark belongs.
- The letter in the *sixth position* of the code represents the **Body of Knowledge** to which the benchmark belongs.
- The number in the *seventh position* represents the **Standard** to which the benchmark belongs.
- The number in the *last position* of the code states the specific **Benchmark** under the grade-level Standard.

MA. 912. G. 1. 1

Subject Area
Mathematics

Grade Levels
Grades 9–12

Body of Knowledge
Geometry

Standard
Understand geometric concepts, applications, and their representations with coordinate systems. Find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, construct lines and angles, explaining and justifying the processes used.

Benchmark
Find the lengths and midpoints of line segments in two-dimensional coordinate systems.

Grades 9–12 Body of Knowledge Geometry
Standard 1: Points, Lines, Angles, and Planes Understand geometric concepts, applications, and their representations with coordinate systems. Find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, construct lines and angles, explaining and justifying the processes used.
MA.912.G.1.1 Find the lengths and midpoints of line segments in two-dimensional coordinate systems.

Definitions of Benchmark Specifications

The *Specifications* identifies how Florida's NGSSS benchmarks are assessed by FCAT 2.0 Mathematics 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.

Body of Knowledge refers to eight general categories of mathematics standards at the high school level: Algebra, Calculus, Discrete Mathematics, Financial Literacy, Geometry, Probability, Statistics, and Trigonometry. These Bodies of Knowledge do not comprise courses. Standards and benchmarks were pulled from the various Bodies of Knowledge to write specific high-school level courses (such as Geometry) in mathematics.

Reporting Category is a grouping of related benchmarks from the NGSSS that is used to summarize and report achievement for FCAT 2.0 Mathematics, the Algebra 1 EOC Assessment, and the Geometry EOC Assessment.

Standard refers to the standard statement presented in the NGSSS.

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 or courses 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 statement.

Item Types are used to assess the benchmark or group of benchmarks. The types of items used on the assessment 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 FR for fill-in response.

Benchmark Clarification explains how the achievement of the benchmark will be demonstrated by students for each specific item type. The clarification statements explain what students are expected to do when responding to the question.

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

Benchmark content limits are to be used in conjunction with the General Content Limits identified 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 specified earlier in the *Specifications*.

Stimulus Attributes define the types of stimulus materials that should be used in the test 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 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 for EOC Assessments

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

The content limits described below are applicable to all test 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 item is presented is called the item context. Geometry EOC items may be presented in either real-world or mathematical contexts; 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, Literature, 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 on Algebra 1 End-of-Course Assessment and Geometry End-of-Course Assessment

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 and 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 END-OF-COURSE ASSESSMENT AND GEOMETRY END-OF-COURSE ASSESSMENT

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.	
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.	

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 End-of-Course Assessment and Geometry End-of-Course Assessment

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 and MA.912.A.3.10.)	
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 End-of-Course Assessment and Geometry End-of-Course Assessment

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 End-of-Course Assessment and Geometry End-of-Course Assessment

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.1.3 Identify and use the relationships between special pairs of angles formed by parallel lines and transversals. (Also assesses MA.912.G.8.5.)
	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, and 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 End-of-Course Assessment and Geometry End-of-Course Assessment

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.)
	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. (Also assesses MA.912.G.8.5.)
	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.4.4 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 End-of-Course Assessment and Geometry End-of-Course Assessment

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, and 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, MA.912.G.6.4, and MA.912.G.8.5.)

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.

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 and 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.
	MA.912.G.8.1 Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems. (Assessed 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. (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 End-of-Course Assessment and Geometry End-of-Course Assessment

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. (Assessed 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.1.3, MA.912.G.3.3, MA.912.G.3.4, MA.912.G.4.6, and MA.912.G.6.5.)
Body of Knowledge: Trigonometry	
	MA.912.T.2.1 Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, and 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.

Individual Benchmark Specifications for Geometry End-of-Course Assessment

This section of the *Specifications* describes how Florida's NGSSS benchmarks are assessed. High school assessments are constructed using the Bodies of Knowledge (BOK). Algebra 1 and Geometry are assessed in end-of-course (EOC) formats.

The set of sample test 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.

BENCHMARK MA.912.D.6.2

Body of Knowledge Discrete Mathematics

Reporting Category Trigonometry and Discrete Mathematics

Standard **Standard 6** Develop an understanding of the fundamentals of propositional logic, arguments, and methods of proof.

Benchmark **MA.912.D.6.2 Find the converse, inverse, and contrapositive of a statement.**

Also assesses MA.912.D.6.3 Determine whether two propositions are logically equivalent.

Item Type This benchmark will be assessed using MC items.

Benchmark Clarifications Students will identify the converse, inverse, or contrapositive of a given statement.

Students will determine whether two propositions are logically equivalent.

Content Limits Truth tables or validity of a given statement will not be assessed.

Items must present propositions as a sentence, and not by using symbols, e.g., $p \rightarrow q$ or $3x + 1 = 7 \rightarrow x = 2$.

Sample Item 1 **MC**

Which of the following is the **converse** of the following statement?

"If today is Sunday, then tomorrow is Monday."

★ **A.** If tomorrow is Monday, then today is Sunday.
B. If tomorrow is not Monday, then today is Sunday.
C. If today is not Sunday, then tomorrow is not Monday.
D. If tomorrow is not Monday, then today is not Sunday.

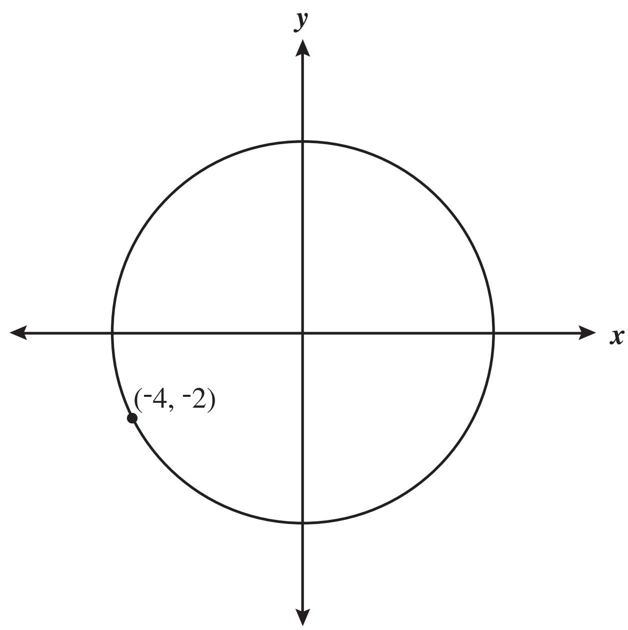
Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.1.1

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 1** Understand geometric concepts, applications, and their representations with coordinate systems. Find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, construct lines and angles, explaining and justifying the processes used.
Benchmark	**MA.912.G.1.1 Find the lengths and midpoints of line segments in two-dimensional coordinate systems.**
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarification	Students will find the length or midpoint or one of the endpoints of a segment.
Content Limits	Items may require multiple steps. Items may include both distance and midpoint.
Response Attribute	Fill-in response items may require that students provide the length of a segment or the *x*-coordinate (or *y*-coordinate) of a point of interest.

Sample Item 2 **MC**

The circle shown below is centered at the origin and contains the point (-4, -2).



Which of the following is closest to the length of the diameter of the circle?

A. 13.41
B. 11.66
★ **C.** 8.94
D. 4.47

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 3 **FR**

On a coordinate grid, $\overline{AB}$ has endpoint B at (24, 16). The midpoint of $\overline{AB}$ is P(4, -3). What is the y-coordinate of Point A?

				-	2	2

Sample Response -22

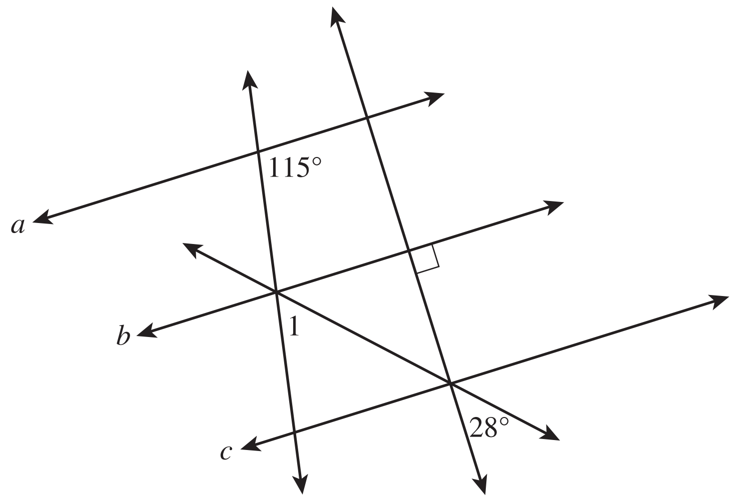
Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.1.3

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 1** Understand geometric concepts, applications, and their representations with coordinate systems. Find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, construct lines and angles, explaining and justifying the processes used.
Benchmark	**MA.912.G.1.3 Identify and use the relationships between special pairs of angles formed by parallel lines and transversals.** Also assesses 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.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarification	Students will recognize, represent, apply, and/or explain relationships of angles formed by parallel lines and transversals.
Content Limits	Items may have multiple sets of parallel lines. Items will not include more than six lines in the graphic. Items should not be set in the context of a parallelogram.
Response Attributes	Fill-in response items may require that students provide an angle measure. Items may require statements and/or justifications to complete formal and informal proofs.

Sample Item 4 **MC**

In the figure shown below, $a||b||c$.



not to scale

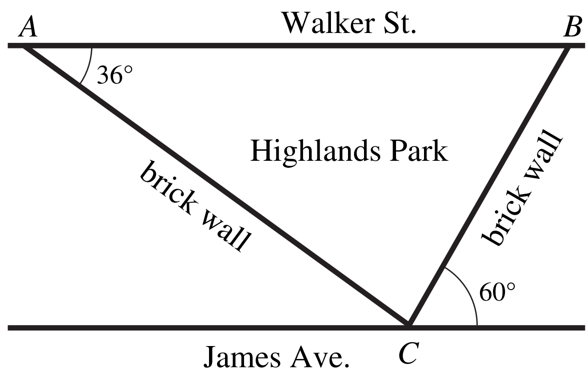
What is the measure of $\angle 1$?

★ **A.** 53°
B. 87°
C. 115°
D. 143°

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 5 **FR**

Highlands Park is located between two parallel streets, Walker Street and James Avenue. The park faces Walker Street and is bordered by two brick walls that intersect James Avenue at point *C*, as shown below.



What is the measure, in degrees, of $\angle ACB$, the angle formed by the park's two brick walls?

8	4					

Sample Response 84

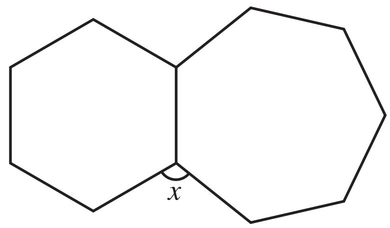
Item Context Social Studies

Benchmark MA.912.G.2.2

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 2** Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.
Benchmark	**MA.912.G.2.2 Determine the measures of interior and exterior angles of polygons, justifying the method used.**
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarification	Students will determine the measures of interior and exterior angles of polygons.

Sample Item 6 **MC**

A regular hexagon and a regular heptagon share one side, as shown in the diagram below.



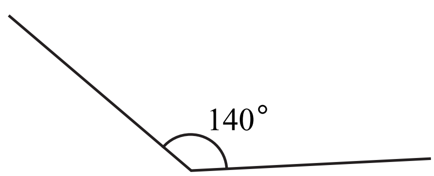
Which of the following is closest to the measure of x, the angle formed by one side of the hexagon and one side of the heptagon?

A. 102.9°
★ **B.** 111.4°
C. 120.0°
D. 124.5°

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 7 **FR**

Claire is drawing a regular polygon. She has drawn two of the sides with an interior angle of 140°, as shown below.



When Claire completes the regular polygon, what should be **the sum**, in degrees, of the measures of the interior angles?

			1	2	6	0

Sample Response 1,260

Item Context Science, Technology, Engineering, and Mathematics

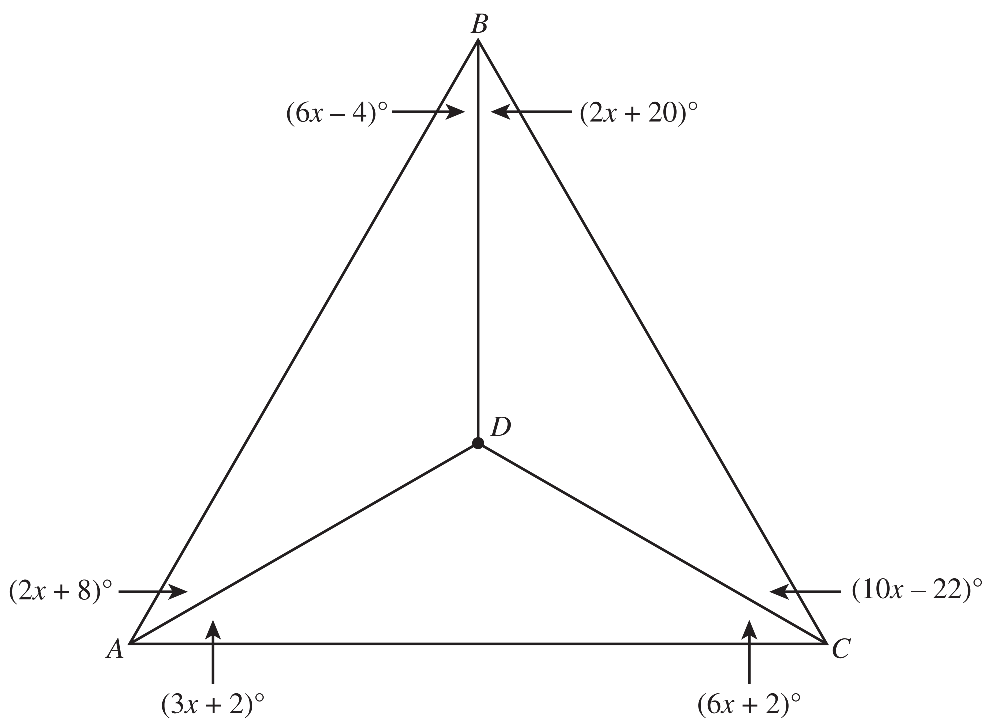
Benchmark MA.912.G.2.3

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 2** Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.
Benchmark	**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 Identify and describe convex, concave, regular, and irregular polygons. Also assesses MA.912.G.4.1 Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular. Also assesses MA.912.G.4.2 Define, identify, and construct altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter. Also assesses MA.912.G.4.4 Use properties of congruent and similar triangles to solve problems involving lengths and areas. Also assesses MA.912.G.4.5 Apply theorems involving segments divided proportionally.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will use properties of congruent and/or similar polygons to solve problems. Students will identify characteristics of a triangle based on given information. Students will identify characteristics of a polygon based on given information. Students will identify altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter based on given information.

Benchmark Clarifications	Students will use the properties of altitudes, medians, angle bisectors, and perpendicular bisectors of triangles to solve problems. Students will apply theorems involving segments divided proportionally in triangles and parallel lines.
Content Limit	Items may require statements and/or justifications to complete formal and informal proofs.

Sample Item 8 **MC**

Point *D* is in the interior of ΔABC with some angle measures given in terms of *x*. This triangle is shown below.



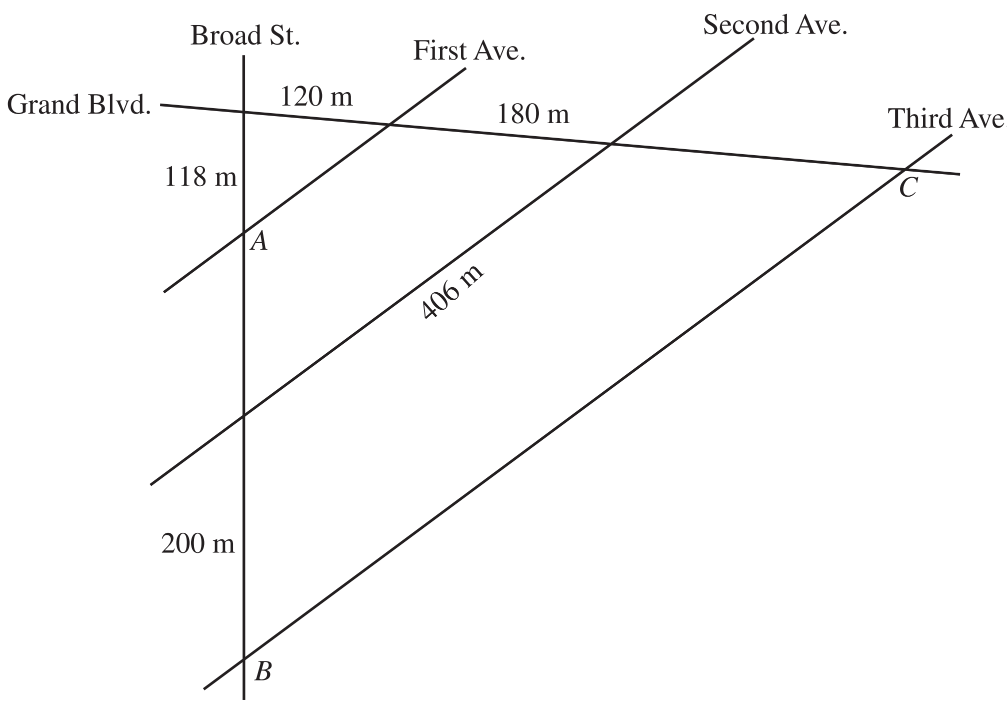
Using the given information, which term best describes point *D*?

A. centroid
B. circumcenter
★ **C.** incenter
D. orthocenter

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 9 **FR**

The diagram below shows the intersections of several roads. Each of the roads is straight. The roads First Avenue (Ave.), Second Ave., and Third Ave. are parallel.



Marisa drives from point *A* to point *B* along Broad St. and then from point *B* to point *C* along Third Ave. What distance, to the nearest meter, did she drive?

			1	0	5	8

Sample Response 1058

Item Context Social Studies

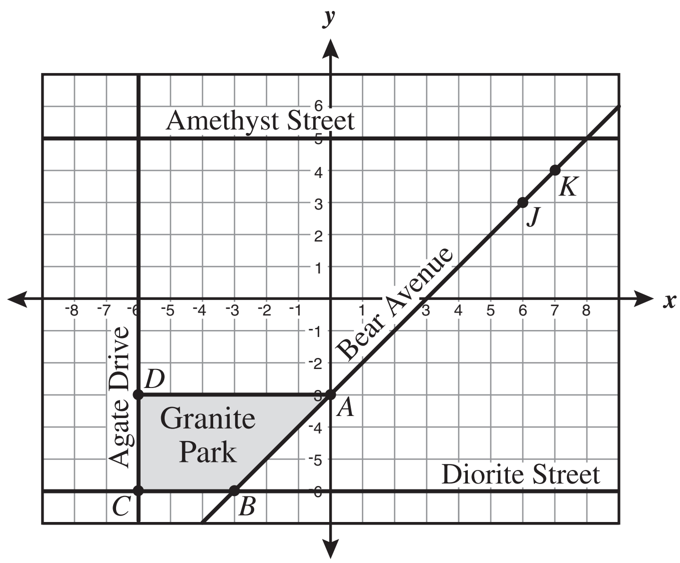
Benchmark MA.912.G.2.4

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 2** Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.
Benchmark	**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.**
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will describe a transformation applied to a polygon. Students will apply one or more transformations and/or use the result(s) to determine congruence or similarity. Students will use symmetry to plot a congruent polygon. Students will describe the transformation used to create a tessellation of the plane using polygons.
Content Limit	Items may include using coordinate geometry to perform transformations in the plane.
Stimulus Attribute	In items that assess dilations, the dilation should be centered at (0, 0).
Response Attribute	Fill-in response items may require that students provide the length of a segment or the *x*-coordinate (or *y*-coordinate) of a point of interest.

Sample Item 10 **MC**

A top view of downtown Rockford is shown on the grid below, with Granite Park represented by quadrilateral *ABCD*. The shape of a new park, Mica Park, will be similar to the shape of Granite Park. Vertices *L* and *M* will be plotted on the grid to form quadrilateral *JKLM*, representing Mica Park.

Downtown Rockford



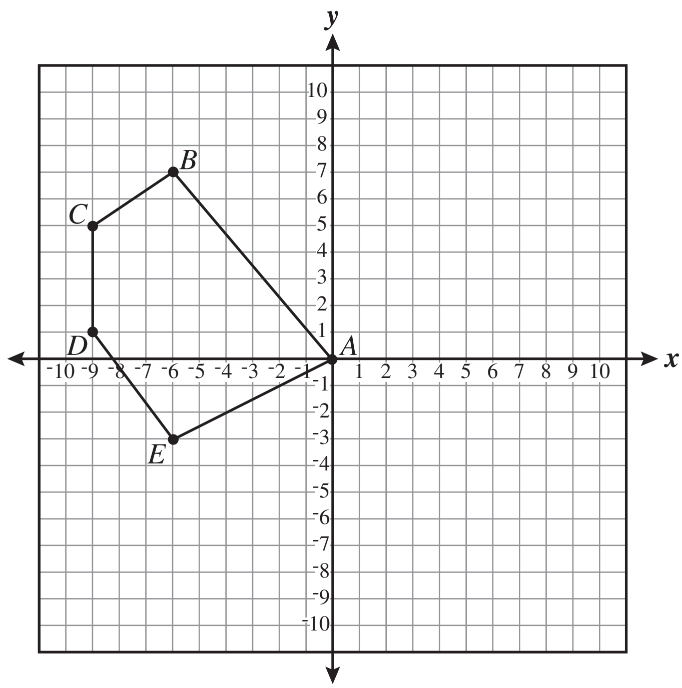
Which of the following coordinates for *L* and *M* could be vertices of *JKLM* so that the shape of Mica Park is similar to the shape of Granite Park?

A. *L*(4, 4), *M*(4, 3)
B. *L*(7, 1), *M*(6, 1)
C. *L*(7, 6), *M*(6, 6)
★ **D.** *L*(8, 4), *M*(8, 3)

Item Context Social Studies

Sample Item 11 **FR**

Pentagon *ABCDE* is shown below on a coordinate grid. The coordinates of *A*, *B*, *C*, *D*, and *E* all have integer values.



If pentagon *ABCDE* is rotated 90º clockwise about point *A* to create pentagon *A'B'C'D'E'*, what will be the *x*-coordinate of *E'*?

					-	3

Sample Response $^-3$

Item Context Science, Technology, Engineering, and Mathematics

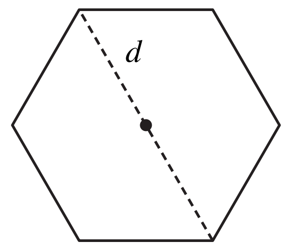
Benchmark MA.912.G.2.5

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 2** Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.
Benchmark	**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 Determine how changes in dimensions affect the perimeter and area of common geometric figures.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will find the area or perimeter of a polygon or a composite of common geometric figures by using a formula or deriving the formula. Students will determine how changes in dimensions affect the perimeter or area of common geometric figures or composite of common geometric figures.
Content Limit	Items requiring students to calculate area may require the use of the apothem.

Sample Item 12 **MC**

Marisol is creating a custom window frame that is in the shape of a regular hexagon. She wants to find the area of the hexagon to determine the amount of glass needed. She measured diagonal d and determined it was 40 inches. A diagram of the window frame is shown below.

Custom Window Frame



Which of the following is closest to the area, in square inches, of the hexagon?

A. 600
B. 849
★ **C.** 1,039
D. 1,200

Item Context Business Management and Administration

Sample Item 13 **FR**

A square with an area of 144 square centimeters was increased in length, but not in width, until the resulting rectangle had a perimeter that was 4 times the perimeter of the original square. By how many square centimeters did the area of the figure increase?

				8	6	4

Sample Response 864

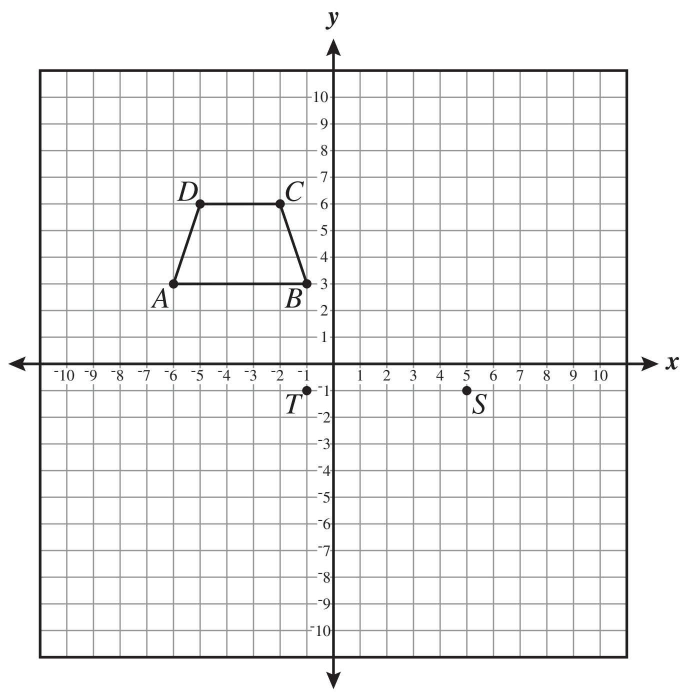
Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.3.3

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 3** Classify and understand relationships among quadrilaterals (rectangle, parallelogram, kite, etc.). Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Use properties of congruent and similar quadrilaterals to solve problems involving lengths and areas, and prove theorems involving quadrilaterals.
Benchmark	**MA.912.G.3.3 Use coordinate geometry to prove properties of congruent, regular, and similar quadrilaterals.** Also assesses 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.
Item Type	This benchmark will be assessed using MC items.
Benchmark Clarifications	Students will use coordinate geometry in applying properties of quadrilaterals and determining characteristics of quadrilaterals. Students will use coordinate geometry to classify a quadrilateral. Students will use coordinate geometry to determine congruency or similarity of quadrilaterals.
Content Limits	Items may include statements and/or justifications to complete formal and informal proofs. Items should include the use of coordinate planes.

Sample Item 14 **MC**

On the coordinate grid below, quadrilateral *ABCD* has vertices with integer coordinates.



Quadrilateral *QRST* is similar to quadrilateral *ABCD* with point *S* located at (5, -1) and point *T* located at (-1, -1). Which of the following could be possible coordinates for point *Q*?

- **A.** (6, -4)
- **B.** (7, -7)
- ★ **C.** (-3, -7)
- **D.** (-2, -4)

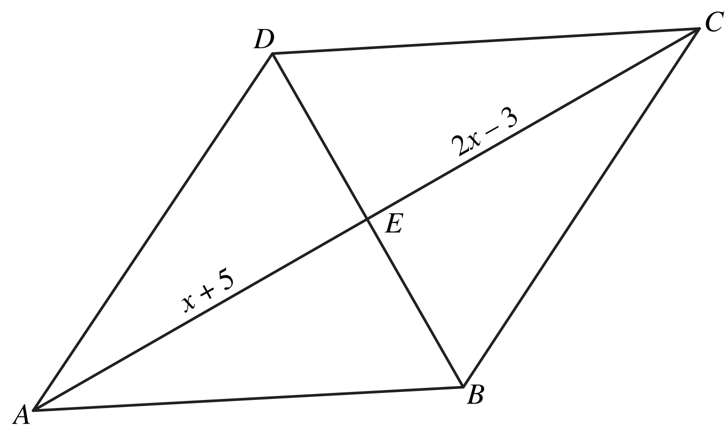
Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.3.4

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 3** Classify and understand relationships among quadrilaterals (rectangle, parallelogram, kite, etc.). Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Use properties of congruent and similar quadrilaterals to solve problems involving lengths and areas, and prove theorems involving quadrilaterals.
Benchmark	**MA.912.G.3.4 Prove theorems involving quadrilaterals.** Also assesses MA.912.D.6.4 Use methods of direct and indirect proof and determine whether a short proof is logically valid. Also assesses MA.912.G.3.1 Describe, classify, and compare relationships among quadrilaterals including the square, rectangle, rhombus, parallelogram, trapezoid, and kite. Also assesses MA.912.G.3.2 Compare and contrast special quadrilaterals on the basis of their properties. Also assesses 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.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will apply properties of special quadrilaterals to determine measures. Students will classify a quadrilateral based on its properties. Students will use properties and theorems involving quadrilaterals to complete proofs.
Content Limit	Items may require statements and/or justifications to complete formal and informal proofs.

Sample Item 15 **MC**

Figure *ABCD* is a rhombus. The length of $\overline{AE}$ is $(x + 5)$ units, and the length of $\overline{EC}$ is $(2x - 3)$ units.



Which statement best explains why the equation $x + 5 = 2x - 3$ can be used to solve for x?

A. Opposite sides of a rhombus are parallel.
★ **B.** Diagonals of a rhombus bisect each other.
C. Diagonals of a rhombus are perpendicular.
D. All four sides of a rhombus are congruent.

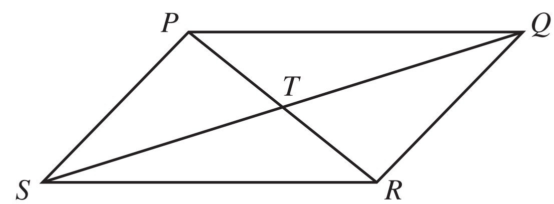
Item Context Science, Technology, Engineering, and Mathematics

Sample Item 16 **MC**

Mrs. Linder gave her students the following proof to complete.

Given: $\overline{ST} \cong \overline{TQ}$
$\overline{PS} \cong \overline{QR}$
$\angle TSR \cong \angle TQP$

Prove: *PQRS* is a parallelogram



Statement	Reason
1. $\overline{PS} \cong \overline{QR}$	1. Given
2. $\overline{ST} \cong \overline{TQ}$	2. Given
3. $\angle TSR \cong \angle TQP$	3. Given
4. $\angle QTP \cong \angle RTS$	4.
5. $\Delta QTP \cong \Delta STR$	5.
6.	6. Corresponding parts of congruent triangles are congruent.
7. *PQRS* is a parallelogram.	7. If both pairs of opposite sides of a quadrilateral are congruent then the quadrilateral is a parallelogram.

Which is the correct statement 6 for this proof?

★ **A.** $\overline{PQ} \cong \overline{SR}$
B. $\overline{ST} \cong \overline{TR}$
C. $\overline{PT} \cong \overline{TR}$
D. $\overline{PR} \cong \overline{QS}$

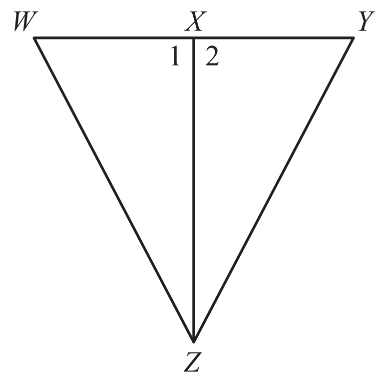
Item Context Science, Technology, Engineering, and Mathematics

BENCHMARK MA.912.G.4.6

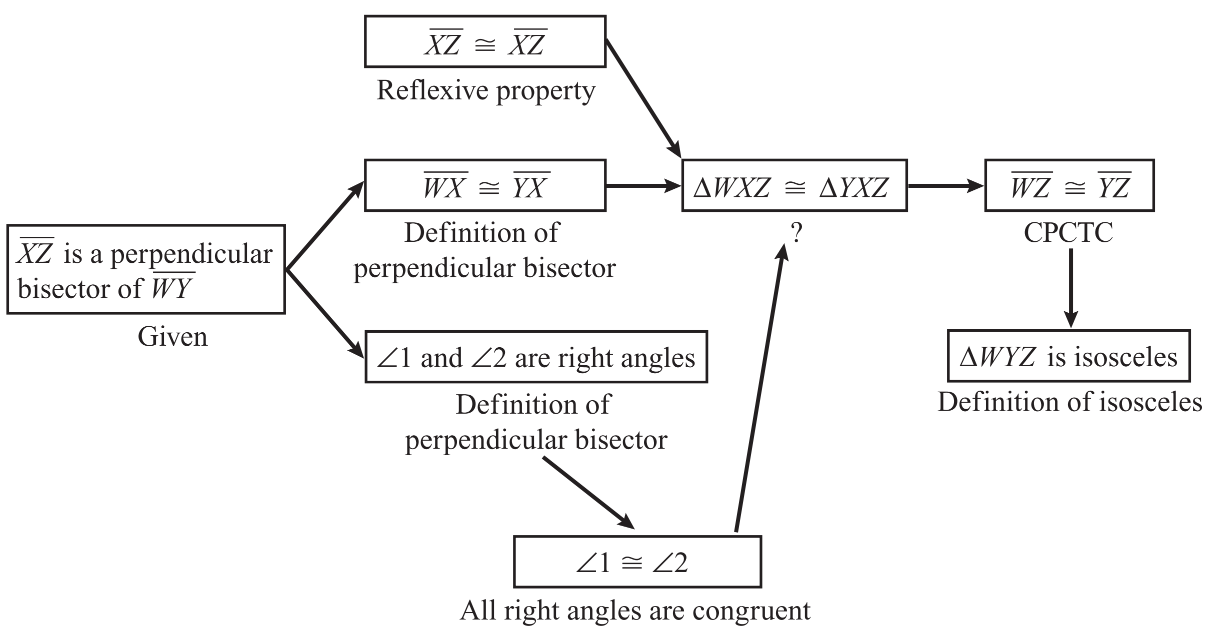
Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 4** Identify and describe various kinds of triangles (right, acute, scalene, isosceles, etc.). Define and construct altitudes, medians, and bisectors, and triangles congruent to given triangles. Prove that triangles are congruent or similar and use properties of these triangles to solve problems involving lengths and areas. Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Understand and apply the inequality theorems of triangles.
Benchmark	**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 Use methods of direct and indirect proof and determine whether a short proof is logically valid. Also assesses 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.
Item Type	This benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine the congruency or the similarity of two triangles. Students will apply triangle congruence and CPCTC (corresponding parts of congruent triangles are congruent) to determine measurements of angles or lengths. Students will complete proofs on triangle congruence or similarity.
Content Limit	Items may require statements and/or justifications to complete formal and informal proofs.

Sample Item 17 **MC**

Nancy wrote a proof about the figure shown below.



In the proof below, Nancy started with the fact that $\overline{XZ}$ is a perpendicular bisector of $\overline{WY}$ and proved that ΔWYZ is isosceles.



Which of the following correctly replaces the question mark in Nancy's proof?

A. ASA
B. SAA
★ **C.** SAS
D. SSS

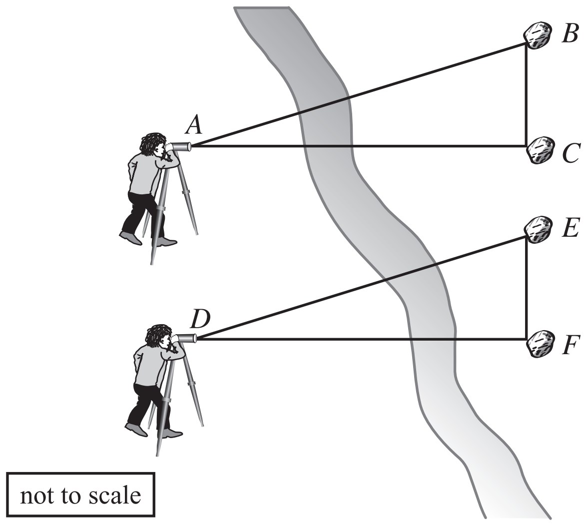
Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.4.7

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 4** Identify and describe various kinds of triangles (right, acute, scalene, isosceles, etc.). Define and construct altitudes, medians, and bisectors, and triangles congruent to given triangles. Prove that triangles are congruent or similar and use properties of these triangles to solve problems involving lengths and areas. Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Understand and apply the inequality theorems of triangles.
Benchmark	**MA.912.G.4.7 Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem.**
Item Type	This benchmark will be assessed using MC items.
Benchmark Clarification	Students will apply the inequality theorems to determine relationships about sides and angles within a triangle and between triangles.

Sample Item 18 **MC**

A surveyor took some measurements across a river, as shown below. In the diagram, $AC = DF$ and $AB = DE$.



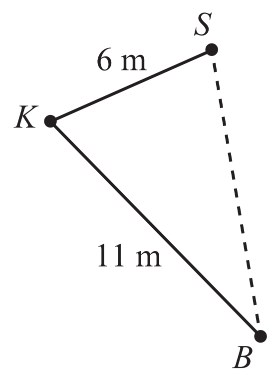
The surveyor determined that $m\angle BAC = 29°$ and $m\angle EDF = 32°$. Which of the following can he conclude?

- **A.** $BC > EF$
- ★ **B.** $BC < EF$
- **C.** $AC > DE$
- **D.** $AC < DF$

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 19 **MC**

Kristin has two dogs, Buddy and Socks. She stands at point *K* in the diagram and throws two disks. Buddy catches one at point *B*, which is 11 meters (m) from Kristin. Socks catches the other at point *S*, which is 6 m from Kristin.



If *KSB* forms a triangle, which could be the length, in meters, of segment *SB*?

A. 5
★ **B.** 8
C. 17
D. 22

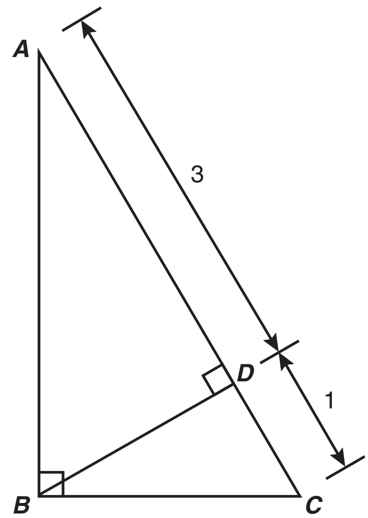
Item Context Reading and Literature

Benchmark MA.912.G.5.4

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 5** Apply the Pythagorean Theorem to solving problems, including those involving the altitudes of right triangles and triangles with special angle relationships. Use special right triangles to solve problems using the properties of triangles.
Benchmark	**MA.912.G.5.4 Solve real-world problems involving right triangles.** Also assesses MA.912.G.5.1 Prove and apply the Pythagorean Theorem and its converse. Also assesses MA.912.G.5.2 State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. Also assesses MA.912.G.5.3 Use special right triangles (30°–60°–90° and 45°–45°–90°) to solve problems.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarification	Students will apply properties of right triangles to solve real-world problems.
Content Limits	Items may require students to apply one or more of the following: • Pythagorean theorem and its converse; • geometric mean; • 30–60–90 triangles; or • 45–45–90 triangles.
Stimulus Attribute	Any radical expressions in the item stem must be in simplified form and have a rationalized denominator.
Response Attribute	Any radical expressions in multiple-choice options will be provided in simplified form and have a rationalized denominator.

Sample Item 20 **MC**

In ΔABC, $\overline{BD}$ is an altitude.



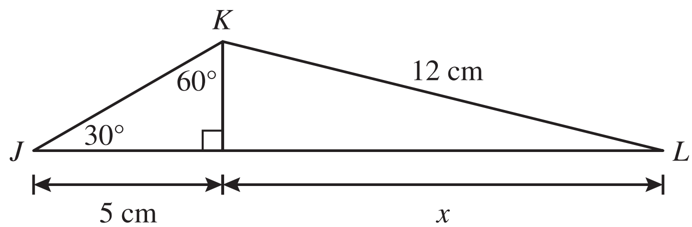
What is the length, in units, of $\overline{BD}$?

A. 1
B. 2
★ **C.** $\sqrt{3}$
D. $2\sqrt{3}$

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 21 **FR**

Nara created two right triangles. She started with ΔJKL and drew an altitude from point K to side $\overline{JL}$. The diagram below shows ΔJKL and some of its measurements, in centimeters (cm).



Based on the information in the diagram, what is the measure of x to the nearest tenth of a centimeter?

1	1	.	6			

Sample Response 11.6

Item Context Science, Technology, Engineering, and Mathematics

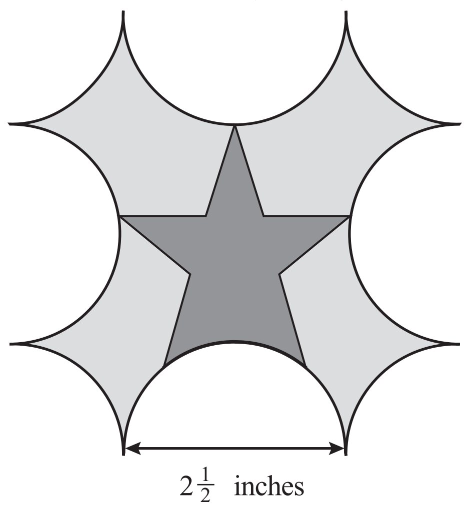
Benchmark MA.912.G.6.5

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 6** Define and understand ideas related to circles (radius, tangent, chord, etc.). Perform constructions and prove theorems related to circles. Find measures of arcs and angles related to them, as well as measures of circumference and area. Relate geometry to algebra by finding the equation of a circle in the coordinate plane.
Benchmark	**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 Define and identify: circumference, radius, diameter, arc, arc length, chord, secant, tangent, and concentric circles. Also assesses MA.912.G.6.4 Determine and use measures of arcs and related angles (central, inscribed, and intersections of secants and tangents). Also assesses 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.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will solve problems related to circles using the properties of chords, secants, tangents, and concentric circles. Students will solve problems involving circumference, arc length, area of sectors, and area of circles. Students will solve problems related to measures of arcs and their related angles (central, inscribed, and intersections of secants and tangents.)
Content Limit	Items may require statements and/or justifications to complete formal and informal proofs.

Sample Item 22 **MC**

Allison created an embroidery design of a stylized star emblem. The perimeter of the design is made by alternating semicircle and quarter-circle arcs. Each arc is formed from a circle with a $2\frac{1}{2}$-inch diameter. There are 4 semicircle and 4 quarter-circle arcs, as shown in the diagram below.

Embroidery Design



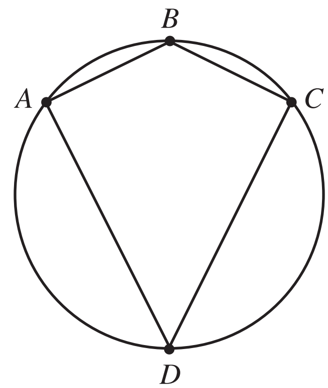
To the nearest whole inch, what is the **perimeter** of Allison's design?

A. 15 inches
B. 20 inches
★ **C.** 24 inches
D. 31 inches

Item Context The Arts

Sample Item 23 **FR**

Kayla inscribed quadrilateral *ABCD* in a circle, as shown below.



If $m\widehat{ADC}$ is 255° in Kayla's design, what is the measure, in degrees, of $\angle ADC$?

			5	2	.	5

Sample Response 52.5

Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.6.6

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 6** Define and understand ideas related to circles (radius, tangent, chord, etc.). Perform constructions and prove theorems related to circles. Find measures of arcs and angles related to them, as well as measures of circumference and area. Relate geometry to algebra by finding the equation of a circle in the coordinate plane.
Benchmark	**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 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.
Item Type	This benchmark will be assessed using MC items.
Benchmark Clarification	Students will identify the center, radius, and/or graph of a circle given the equation of a circle, or write the equation of a circle given the center, radius, and/or graph.
Content Limit	Equations of circles must be presented in center-radius form, where h and k are rational and r may be irrational. Items will not require students to manipulate equations to or from standard form.

Sample Item 24 **MC**

Circle Q has a radius of 5 units with center Q (3.7, $^-2$). Which of the following equations defines circle Q?

A. $(x + 3.7)^2 + (y - 2)^2 = 5$
B. $(x + 3.7)^2 + (y - 2)^2 = 25$
C. $(x - 3.7)^2 + (y + 2)^2 = 5$
★ **D.** $(x - 3.7)^2 + (y + 2)^2 = 25$

Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.7.1

Body of Knowledge Geometry

Reporting Category Three-Dimensional Geometry

Standard **Standard 7** Describe and make regular and nonregular polyhedra (cube, pyramid, tetrahedron, octahedron, etc.). Explore relationships among the faces, edges, and vertices of polyhedra. Describe sets of points on spheres, using terms such as great circle. Describe symmetries of solids and understand the properties of congruent and similar solids.

Benchmark **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 Describe the relationships between the faces, edges, and vertices of polyhedra.

Item Types This benchmark will be assessed using MC and FR items.

Benchmark Clarifications Students will identify the net for a given polyhedron and vice versa.

Students will identify and determine the types of faces or the numbers of edges, faces, and/or vertices of a given polyhedron or a given net.

Content Limits Items will only include:

- the five Platonic solids (tetrahedron, hexahedron or cube, octahedron, dodecahedron, and icosahedron);
- right or oblique prisms or pyramids with up to 12 edges on the base or composites;
- composites of the right or oblique prisms or pyramids; and
- other solids with fewer than 15 faces.

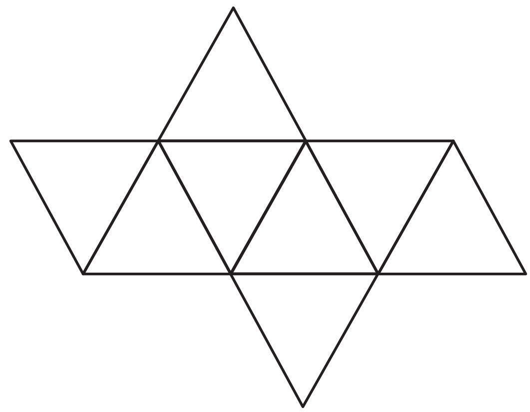
Items must not require use of formulas relating faces, edges, and vertices.

Items may not include cones, spheres, or cylinders.

Response Attribute Fill-in response items may require that students provide the number of edges, faces, or vertices of a given polyhedron.

Sample Item 25 **MC**

Below is a net of a polyhedron.



How many edges does the polyhedron have?

A. 6
B. 8
★ **C.** 12
D. 24

Item Context Science, Technology, Engineering, and Mathematics

Sample Item 26 **FR**

How many faces does a dodecahedron have?

1	2					

Sample Response 12

Item Context Science, Technology, Engineering, and Mathematics

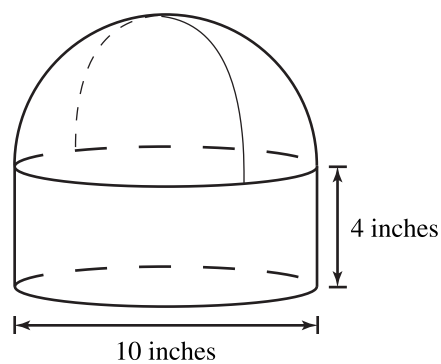
Benchmark MA.912.G.7.5

Body of Knowledge	Geometry
Reporting Category	Three-Dimensional Geometry
Standard	**Standard 7** Describe and make regular and nonregular polyhedra (cube, pyramid, tetrahedron, octahedron, etc.). Explore relationships among the faces, edges, and vertices of polyhedra. Describe sets of points on spheres, using terms such as great circle. Describe symmetries of solids and understand the properties of congruent and similar solids.
Benchmark	**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 Identify chords, tangents, radii, and great circles of spheres. Also assesses MA.912.G.7.6 Identify and use properties of congruent and similar solids.
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will explain and/or apply formulas to determine surface area, lateral area, and volume of solids. Students will use properties of congruent solids to determine the lateral area, surface area, or volume. Students will use properties of similar solids to determine the lateral area, surface area, or volume.
Content Limits	Solids will be limited to right prisms (e.g., rectangular prism, triangular prism, hexagonal prism), right-circular cylinders, spheres, right pyramids, right-circular cones, and/or composites of these solids. Items may require students to find a dimension. Items may not include oblique figures.
Response Attribute	Items may require students to give a ratio or a scale factor of the surface area or volume of similar solids.

Sample Item 27 **MC**

Abraham works at the Delicious Cake Factory. He packages cakes in cardboard containers shaped like right circular cylinders with hemispheres on top, as shown in the diagram below.

CAKE CONTAINER



Abraham wants to wrap one cake container completely in colored plastic wrap and needs to know how much wrap he will need. What is the total exterior surface area of the container?

A. 90π square inches
★ **B.** 115π square inches
C. 190π square inches
D. 308π square inches

Item Context Reading and Literature

Sample Item 28 **FR**

The two rectangular prisms shown below are similar to each other. Side *AB* corresponds to side *WX*, and side *CD* corresponds to side *YZ*.

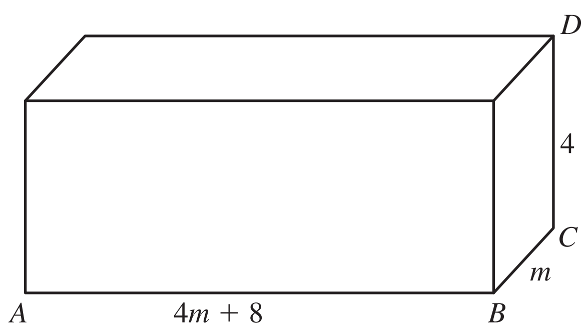


Figure 1

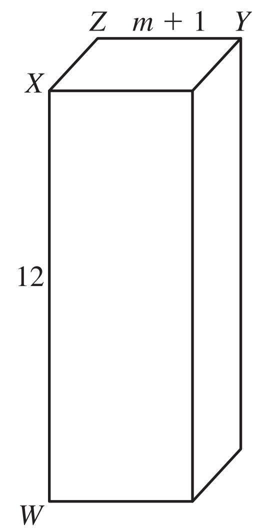


Figure 2

What is the surface area of Figure 1, in square units?

				2	0	8

Sample Response 208

Item Context Science, Technology, Engineering, and Mathematics

Benchmark MA.912.G.7.7

Body of Knowledge	Geometry
Reporting Category	Three-Dimensional Geometry
Standard	**Standard 7** Describe and make regular and nonregular polyhedra (cube, pyramid, tetrahedron, octahedron, etc.). Explore relationships among the faces, edges, and vertices of polyhedra. Describe sets of points on spheres, using terms such as great circle. Describe symmetries of solids and understand the properties of congruent and similar solids.
Benchmark	MA.912.G.7.7 **Determine how changes in dimensions affect the surface area and volume of common geometric solids.**
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarifications	Students will determine how changes in dimension(s) affect surface area or volume. Students will determine how one dimension is affected by changes in surface area or volume while other dimensions remain constant. Students will determine how changes to one dimension will change other dimensions when the surface area or volume is held constant.
Content Limits	One or two dimensions may be changed, resulting in the change of another dimension. Solids will be limited to right prisms, right circular cylinders, spheres, right pyramids, and right circular cones. Items may not include oblique figures. Changes in dimension may or may not result in similar figures.
Response Attributes	Items may require students to give a ratio or a scale factor. Items may require students to give a percent of increase or decrease.

Sample Item 29 **MC**

Kendra has a compost box that has the shape of a cube. She wants to increase the size of the box by extending every edge of the box by half of its original length. After the box is increased in size, which of the following statements is true?

A. The volume of the new compost box is exactly 112.5% of the volume of the original box.
B. The volume of the new compost box is exactly 150% of the volume of the original box.
★ **C.** The volume of the new compost box is exactly 337.5% of the volume of the original box.
D. The volume of the new compost box is exactly 450% of the volume of the original box.

Item Context Reading and Literature

Sample Item 30 **FR**

A city is planning to replace one of its water storage tanks with a larger one. The city's old tank is a right circular cylinder with a radius of 12 feet and a volume of 10,000 cubic feet. The new tank is a right circular cylinder with a radius of 15 feet and the same height as the old tank. What is the maximum number of cubic feet of water the new storage tank will hold?

1	5	6	2	5		

Sample Response 15,625

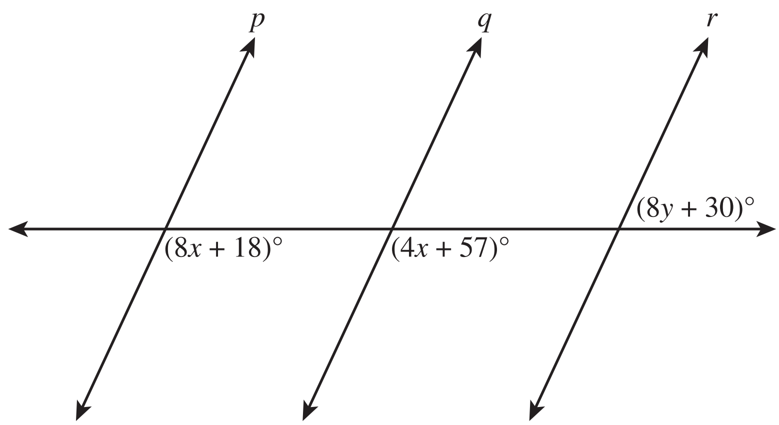
Item Context Business Management and Administration

BENCHMARK MA.912.G.8.4

Body of Knowledge	Geometry
Reporting Category	Two-Dimensional Geometry
Standard	**Standard 8** In a general sense, mathematics is problem solving. In all mathematics, use problem-solving skills, choose how to approach a problem, explain the reasoning, and check the results. At this level, apply these skills to making conjectures, using axioms and theorems, constructing logical arguments, and writing geometric proofs. Learn about inductive and deductive reasoning and how to use counterexamples to show that a general statement is false.
Benchmark	**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.**
Item Type	This benchmark will be assessed using MC items.
Benchmark Clarifications	Students will determine the relationship between a conjecture and a geometric idea. Students will justify conjectures about geometric ideas. Students will determine if the given information supports or proves a conjecture.
Content Limit	Items must adhere to the content limits stated in other benchmarks.

Sample Item 31 **MC**

In the figure below, line p is parallel to line q.



Janet makes the conjecture that line p is also parallel to line r. What must the value of y be for her conjecture to be correct?

★ **A.** 6.75
B. 7.25
C. 8.25
D. 8.75

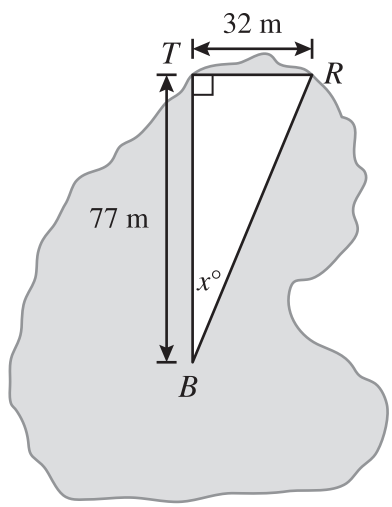
Item Context Science, Technology, Engineering, and Mathematics

BENCHMARK MA.912.T.2.1

Body of Knowledge	Trigonometry
Reporting Category	Trigonometry and Discrete Mathematics
Standard	**Standard 2** Understand how the trigonometric functions relate to right triangles, and solve word problems involving right and oblique triangles. Understand and apply the laws of sines and cosines. Use trigonometry to find the area of triangles.
Benchmark	**MA.912.T.2.1 Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, and cosecant) in terms of angles of right triangles.**
Item Types	This benchmark will be assessed using MC and FR items.
Benchmark Clarification	Students will solve real-world problems involving right-triangle trigonometry.
Content Limits	Items should not include special right triangles (30°–60°–90° and 45°–45°–90°) or the Pythagorean theorem. Items will assess only sine, cosine, and tangent to determine the length of a side or an angle measure.
Response Attributes	Fill-in response items may require the student to provide an angle measure or a length. Multiple-choice options may be written as a trigonometric equation (i.e., $\sin(A) = \frac{a}{b}$ or $\sin^{-1}\left(\frac{a}{b}\right) = A$).

Sample Item 32 **MC**

A tackle shop and restaurant are located on the shore of a lake and are 32 meters (m) apart. A boat on the lake heading toward the tackle shop is a distance of 77 meters from the tackle shop. This situation is shown in the diagram below, where point *T* represents the location of the tackle shop, point *R* represents the location of the restaurant, and point *B* represents the location of the boat.



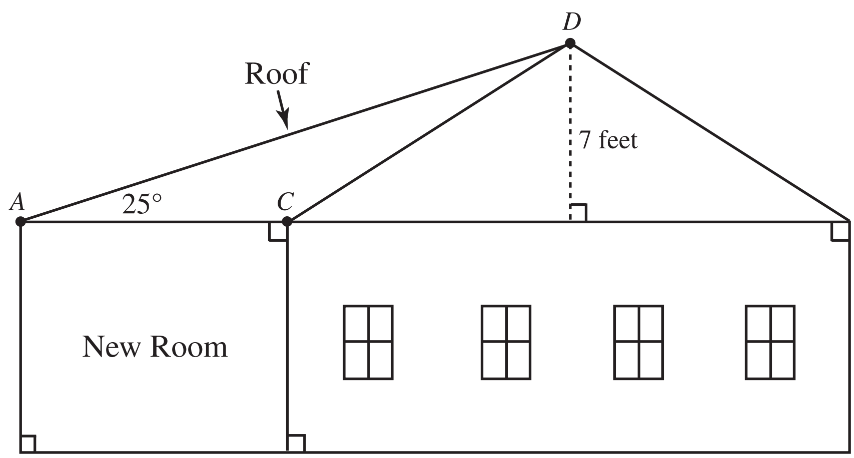
The driver of the boat wants to change direction to sail toward the restaurant. Which of the following is closest to the value of x?

★ **A.** 23
B. 25
C. 65
D. 67

Item Context Reading and Literature

Sample Item 33 **FR**

Mr. Rose is remodeling his house by adding a room to one side, as shown in the diagram below. In order to determine the length of the boards he needs for the roof of the room, he must calculate the distance from point *A* to point *D*.



What is the length, **to the nearest tenth of a foot**, of $\overline{AD}$?

			1	6	.	6

Sample Response 16.6

Item Context Social Studies/Consumerism

FCAT 2.0 and EOC Topics
Florida's NGSSS

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

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Discrete Mathematics				
Standard 6 Logic **Develop an understanding of the fundamentals of propositional logic, arguments, and methods of proof.**				
MA.912.D.6.2 Find the converse, inverse, and contrapositive of a statement. Also assesses MA.912.D.6.3. **MC**	**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				
Standard 1 Points, Lines, Angles, and Planes **Understand geometric concepts, applications, and their representations with coordinate systems. Find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, construct lines and angles, explaining and justifying the processes used.**				
MA.912.G.1.1 Find the lengths and midpoints of line segments in two-dimensional coordinate systems. **MC, FR**	**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. Also assesses MA.912.G.8.5. **MC, FR**		

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment

Body of Knowledge Geometry

Standard 2 Polygons
Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.

MA.912.G.2.1	**MA.912.G.2.2**	**MA.912.G.2.3**	**MA.912.G.2.4**	**MA.912.G.2.5**
Identify and describe convex, concave, regular, and irregular polygons.	Determine the measures of interior and exterior angles of polygons, justifying the method used.	Use properties of congruent and similar polygons to solve mathematical or real-world problems.	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.	Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.).
Assessed with MA.912.G.2.3.		Also assesses MA.912.G.2.1, MA.912.G.4.1, MA.912.G.4.2, MA.912.G.4.4, and MA.912.G.4.5.		Also assesses MA.912.G.2.7.
	MC, FR	**MC, FR**	**MC, FR**	**MC, FR**

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 2 Polygons **Identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. Find measures of angles, sides, perimeters, and areas of polygons, justifying the methods used. Apply transformations to polygons. Relate geometry to algebra by using coordinate geometry to determine transformations. Use algebraic reasoning to determine congruence, similarity, and symmetry. Create and verify tessellations of the plane using polygons.**				
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.				

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 3 Quadrilaterals **Classify and understand relationships among quadrilaterals (rectangle, parallelogram, kite, etc.). Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Use properties of congruent and similar quadrilaterals to solve problems involving lengths and areas, and prove theorems involving quadrilaterals.**				
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. Also assesses MA.912.G.8.5. **MC**	**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. **MC, FR**	

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 4 Triangles **Identify and describe various kinds of triangles (right, acute, scalene, isosceles, etc.). Define and construct altitudes, medians, and bisectors, and triangles congruent to given triangles. Prove that triangles are congruent or similar and use properties of these triangles to solve problems involving lengths and areas. Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Understand and apply the inequality theorems of triangles.**				
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.
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. **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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 4 Triangles **Identify and describe various kinds of triangles (right, acute, scalene, isosceles, etc.). Define and construct altitudes, medians, and bisectors, and triangles congruent to given triangles. Prove that triangles are congruent or similar and use properties of these triangles to solve problems involving lengths and areas. Relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. Understand and apply the inequality theorems of triangles.**				
MA.912.G.4.7 Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem. **MC**				
Standard 5 Right Triangles **Apply the Pythagorean Theorem to solving problems, including those involving the altitudes of right triangles and triangles with special angle relationships. Use special right triangles to solve problems using the properties of triangles.**				
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, and MA.912.G.5.3. **MC, FR**	

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 6 Circles **Define and understand ideas related to circles (radius, tangent, chord, etc.). Perform constructions and prove theorems related to circles. Find measures of arcs and angles related to them, as well as measures of circumference and area. Relate geometry to algebra by finding the equation of a circle in the coordinate plane.**				
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, MA.912.G.6.4, and MA.912.G.8.5. **MC, FR**	**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. **MC**	**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.

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 7 Polyhedra and Other Solids **Describe and make regular and nonregular polyhedra (cube, pyramid, tetrahedron, octahedron, etc.). Explore relationships among the faces, edges, and vertices of polyhedra. Describe sets of points on spheres, using terms such as great circle. Describe symmetries of solids and understand the properties of congruent and similar solids.**				
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. **MC, FR**	**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 and MA.912.G.7.6. **MC, FR**	**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. **MC, FR**				

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Geometry				
Standard 8 Mathematical Reasoning and Problem Solving **In a general sense, mathematics is problem solving. In all mathematics, use problem-solving skills, choose how to approach a problem, explain the reasoning, and check the results. At this level, apply these skills to making conjectures, using axioms and theorems, constructing logical arguments, and writing geometric proofs. Learn about inductive and deductive reasoning and how to use counterexamples to show that a general statement is false.**				
MA.912.G.8.1 Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems. Assessed 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. Assessed throughout.	**MA.912.G.8.3** Determine whether a solution is reasonable in the context of the original situation. Assessed 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. **MC**	**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.1.3, MA.912.G.3.3, MA.912.G.3.4, MA.912.G.4.6, and MA.912.G.6.5.
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.				

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 FR = Fill-in response

Mathematics Content Assessed by the Geometry EOC Assessment and Item Types by Benchmark

Geometry End-of-Course Assessment				
Body of Knowledge Trigonometry				
Standard 2 Trigonometry in Triangles **Understand how the trigonometric functions relate to right triangles, and solve word problems involving right and oblique triangles. Understand and apply the laws of sines and cosines. Use trigonometry to find the area of triangles.**				
MA.912.T.2.1 Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, and cosecant) in terms of angles of right triangles. **MC, FR**				

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 FR = Fill-in 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 Algebra 1 End-of-Course and Geometry End-of-Course Assessments along with the approximate percentage of raw-score points derived from each content category.

Course	Reporting Category 1	Reporting Category 2	Reporting Category 3
Algebra 1	Functions, Linear Equations, and Inequalities (55%)	Rationals, Radicals, Quadratics, and Discrete Mathematics (25%)	Polynomials (20%)
Geometry	Two-Dimensional Geometry (65%)	Three-Dimensional Geometry (20%)	Trigonometry and Discrete Mathematics (15%)

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

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 EOC assessments in Algebra 1 and Geometry.

Acute angle—An angle that has a measure between 0° and 90°.

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).

Altitude—The perpendicular distance from a vertex in a polygon to its opposite side.

Angle—Two rays extending from a common endpoint called the vertex.

Angle of depression—An angle defined by a horizontal ray and a ray extending from the common endpoint to a point below the horizontal ray.

Angle of elevation—An angle defined by a horizontal ray and a ray extending from the common endpoint to a point above the horizontal ray.

Apothem—The perpendicular distance from the center of a regular polygon to the midpoint of any of its sides.

Arc—A continuous part of a circle. The measure of an arc is the measure of the angle formed by two radii with endpoints at the endpoints of the arc.

Area—The measure, in square units, of the interior 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).

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 $(2 \times 3) \times 8 = 2 \times (3 \times 8)$].

Axiom—See postulate.

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

Base of a power—The number or variable that undergoes repeated multiplication. For example, 2^3 is the exponential form of $2 \times 2 \times 2$. The numeral two (2) is the base.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Binomial—A polynomial with two terms. In $2x + 5$, the terms are $2x$ and 5.

Bisect—To divide into two congruent parts.

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

Center of dilation—The intersection of the lines that connect each point of a figure with the corresponding point of the similar figure.

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

Centroid—The point of concurrency of the three medians of a triangle.

Chord—A line segment with endpoints on the circle.

Circumcenter of a triangle—The point of concurrency of three perpendicular bisectors of a triangle.

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 $4 \times 7 = 7 \times 4$).

Complement of set A—Denoted by A' or $\sim A$, the set of all elements in the universal set that are not in A.

Complementary angles—Two angles in which the measures have the sum of exactly 90°.

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.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

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

Conclusion—The "then" part of a conditional statement.

Conditional statement—A logical statement consisting of two parts, a hypothesis and a conclusion.

Congruent—Having the same size and shape.

Conjecture—An unproven statement based on observations.

Contrapositive—The statement formed by negating and reversing the hypothesis and conclusion of a conditional statement.

Converse—The statement formed by reversing the hypothesis and conclusion of a conditional statement.

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

Coordinate grid—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. Also called a coordinate plane or rectangular coordinate system.

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.

Cosine (cos)—In a right triangle, the ratio of the length of the leg adjacent to the reference angle to the length of the hypotenuse.

Cross product of sets (discrete mathematics)—The set of all pairs wherein the first element is a member of the set A and the second element is a member of the set B [e.g., let $A = \{1, 2\}$ and $B = \{x, y, z\}$. Then $A \times B = \{(1, x), (1, y), (1, z), (2, x), (2, y), (2, z)\}$].

Cube—A solid figure with six congruent square faces.

Degree of a monomial—The sum of the exponents of the variables in a monomial.

Degree of a polynomial—The greatest degree of the monomials in a polynomial.

Dependent variable—The output of a function.

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

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Dilation—A transformation of a polygon that involves a proportional increase or decrease in size of all dimensions.

Distributive property—The distribution of multiplication over addition [e.g., $x(a + b) = ax + bx$].

Dodecahedron—A polyhedron with twelve faces.

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

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

Element—A number, letter, point, line, or any other object contained in a set.

Enlargement—A dilation in which the scale factor, or size change, is greater than one.

Equation—A mathematical sentence stating that the two expressions have the same value.

Equilateral triangle—A triangle with three congruent sides.

Exponent—The value that indicates how many times the base occurs as a factor (e.g., 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 collection of numbers, symbols, and/or operation signs that stands for a number.

Exterior angle—The angle formed by any side of a polygon and an extended adjacent side.

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

Flow chart proof—A convincing argument that uses boxes and arrows to show the logical connections between the statements.

Formal proof—A convincing argument containing statements and reasons.

Function—A relation in which each value of the independent variable is paired with a unique value of the dependent variable.

Geometric mean—The geometric mean between two positive numbers a and b is the positive number x where: $\frac{a}{x} = \frac{x}{b}$.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Great circle—A circle formed when a plane intersects a sphere with its center at the center of the sphere. A great circle divides a sphere into two hemispheres.

Hexahedron—A polyhedron with six faces.

Hypotenuse—The side opposite the right angle.

Hypothesis—The "if" part of a conditional statement. Plural: hypotheses.

Icosahedron—A polyhedron with twenty faces.

Incenter—The point of concurrency of the three angle bisectors of a triangle.

Independent variable—The input of a function.

Indirect proof—A proof in which the statement to be proven is assumed to be false, and this assumption leads to a contradiction.

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

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

Intercept—On a graph, the values where a function intersects the axes.

Interior angle—An angle formed by two sides of a polygon sharing a common vertex.

Intersection of sets—The intersection of sets A and B is the set of elements of A that are also elements of B. It is denoted by $A \cap B$ and is read "A intersection B."

Inverse—The statement formed by negating both the hypothesis and conclusion of a conditional statement.

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

Isosceles triangle—A triangle with at least two congruent sides.

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

Lateral area—The surface area of a three-dimensional figure that includes only the area of the lateral faces.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Lateral edge—The edges formed by the intersection of the lateral faces of a prism or pyramid.

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

Leading coefficient—The coefficient of the first term of a polynomial whose terms are written in descending order from largest degree to smallest degree.

Line of best fit—A line drawn on a scatter plot of data that comes closest to all points in the data set.

Line of symmetry—The line over which two figures are mirror images of each other.

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

Mapping diagram—A diagram that illustrates how the elements of a relation's domain are paired with the elements of the relation's range.

Median of a triangle—The line segment that connects a vertex with the midpoint of the opposite side.

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

Monomial—A number, variable, or the product of a number and one or more variables with whole number exponents.

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

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

Obtuse angle—An angle with a measure between 90° and 180°.

Octahedron—A polyhedron with eight faces.

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 $(3, ^{-}4)$].

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).

Orthocenter—The point of concurrency of the three altitudes of a triangle.

MATHEMATICS GLOSSARY
ALGEBRA 1 EOC AND GEOMETRY EOC

Parabola—The shape of the graph of a quadratic function.

Paragraph proof—A convincing argument that uses statements and reasons connected in sentences.

Parallel lines—Two lines that are coplanar and do not intersect.

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

Perimeter—The distance around a polygon.

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 $\frac{22}{7}$.

Platonic solid—A polyhedron for which the faces are regular congruent polygons with the same number of edges meeting at each vertex. The five Platonic solids are: tetrahedron, hexahedron, octahedron, dodecahedron, and icosahedron.

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

Point of concurrency—A point where three or more lines intersect.

Point-slope form—A form of a linear equation, $y - y_1 = m(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a point on the line.

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

Polyhedron—A solid figure bounded by polygons. Plural: polyhedra.

Polynomial—A monomial or the sum or difference of two or more monomials.

Postulate—A mathematical statement accepted as true without proof. Also called an axiom.

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

Proof—A logical argument that demonstrates the truth of a given statement. In a formal proof, each step can be justified with a reason, such as a given, a definition, an axiom, or a previously proven property or theorem.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

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

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

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—A line segment extending from the center of a circle or sphere to a point on the circle or sphere. Plural: radii.

Range—The complete set of all possible resulting values of the dependent variable of a function.

Rate of change—The ratio that compares the change in the dependent variable to the change in the independent variable.

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 expression—An algebraic expression that can be written as a fraction for which numerator and denominator are polynomials.

Rational numbers—The set of all numbers that can be expressed as a ratio of two integers.

Ray—A part of a line that begins at a point and goes on indefinitely in one direction.

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

Rectangular coordinate system—See coordinate grid.

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

Reflection—A transformation that produces the mirror image of a geometric figure over a line or point of reflection. A reflection over a line is also called a flip.

Regular polygon—A polygon that is both equilateral and equiangular.

MATHEMATICS GLOSSARY
ALGEBRA 1 EOC AND GEOMETRY EOC

Regular polyhedron—A solid figure with congruent regular polygons for all faces.

Relation—A set of ordered pairs.

Rhombus—A parallelogram with four congruent sides.

Right angle—An angle for which the measure is exactly 90°.

Right circular cone—A three-dimensional figure that has a circular base, a vertex not in the plane of the circle, a curved lateral surface, and an altitude that contains the center of the base.

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, which is directly above the center of the base.

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

Roots (zeros) of a quadratic function—See zeros of a quadratic function.

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. Also called a turn.

Rule—A mathematical expression that describes a pattern or relationship, or a written description of the pattern or relationship.

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

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.

Scalene triangle—A triangle having no congruent sides.

Secant of a circle—A line that intersects a circle in two points.

Sector—The region formed by a central angle and an arc.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Set—A collection of items.

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

Sine (sin)—In a right triangle, the ratio of the length of the leg opposite the reference angle to the length of the hypotenuse.

Slant height of a regular pyramid—The distance from the vertex to the midpoint of an edge of the base.

Slant height of a right cone—The distance from a vertex to a point on the edge of the base.

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 $y = mx + b$.

Slope-intercept form—A form of a linear equation, $y = mx + b$, where m is the slope of the line and b is the y-intercept.

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

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 form of a linear equation—$Ax + By = C$.

Straight angle—An angle that measures exactly 180°.

Supplementary angles—Two angles in which the measures have the sum of exactly 180°.

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. When a figure is rotated around a point and fits exactly on itself, the figure has rotational symmetry.

Tangent (tan)—In a right triangle, the ratio of the length of the leg opposite the reference angle to the length of the leg adjacent to the given angle.

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

Tangent to a circle—A line in the plane of the circle that intersects the circle in exactly one point, called the point of tangency.

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).

Tessellation—A covering of a plane without overlaps or gaps using combinations of congruent figures.

Tetrahedron—A polyhedron with four faces.

Theorem—A mathematical statement that can be shown to be true based on postulates, definitions, or other proven theorems.

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

Transformation—An operation on a geometric figure by which an image is created. Common transformations include reflections (flips), translations (slides), rotations (turns), 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.

Trigonometric ratio—The ratio of two sides of a right triangle (e.g., cosine, sine, and tangent).

Two-column proof—A proof in which the statements are written in the left column and the reasons are written in the right column.

Union of sets—The union of two sets A and B is the set of elements that are in A or in B or in both. It is denoted by $A \cup B$ and is read "A union B."

Variable—A symbol used to represent a quantity that can change.

Venn diagram—A diagram that shows relationships among sets.

Vertex—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. Plural: vertices.

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

Mathematics Glossary
Algebra 1 EOC and Geometry EOC

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 by cubic units.

***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. Can be expressed as an ordered pair or x-intercept equals a value.

***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. Can be expressed as an ordered pair or y-intercept equals a value.

Zero product property—If the product of two or more quantities equals zero, then at least one of the quantities is equal to zero.

Zeros (roots) of a quadratic equation—The solution(s) of an equation that has the form $Ax^2 + Bx + C = 0$.

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 test items you will be reviewing. The chart on the next page 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 *Geometry End-of-Course Assessment Test Item Specifications*?
3. Is the wording/context of the item (stem and stimulus) appropriate for the course?
4. In your professional judgment, what is the cognitive complexity of the item for students who have attained benchmark mastery? 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 benchmark mastery?
   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 the item correct)
   C = challenging (less than 40% of the students should get the item correct)
6. Is the NGSSS topic appropriate for the item?
7. Is the assigned content focus appropriate for the item?
8. Is the keyed response the correct, best, and only answer? For fill-in response items: Does the problem result in an answer that will fit in the fill-in response boxes? 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.

<u>Overall Quality</u>

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

Please provide a brief explanation of ratings of AR, RR, and R 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.

GEOMETRY EOC ITEM RATING FORM

Page # of Item	Item ID Number	Measures Benchmark	Adheres to Content Limits	Is Appropriate for the Course	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 Options	Overall Rating A/AM/AR/RR/R	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 and EOC mathematics assessments. These ranges include both operational and field-test items.

Grade/Course	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	35–40 MC 20–25 FR
Geometry	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 and EOC mathematics assessments.

Grade/Course	Duration (in minutes)
3	140
4	140
5	140
6	140
7	140
8	140
Algebra 1	160
Geometry	160

Length of Tests

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

Grade/Course	Number of Items
3	50–55
4	50–55
5	50–55
6	50–55
7	50–55
8	55–60
Algebra 1	60–65
Geometry	60–65

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	$A = \frac{1}{2}aP$

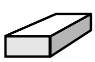
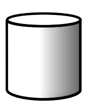
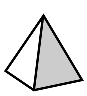
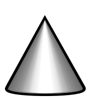
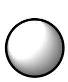
KEY

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 $= \dfrac{180(n-2)}{n}$

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 $P_2(x_2, y_2)$

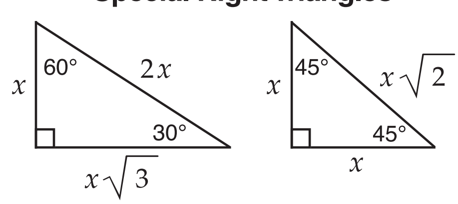
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Quadratic formula

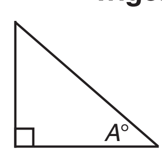
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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
1 pound = 16 ounces
1 ton = 2,000 pounds

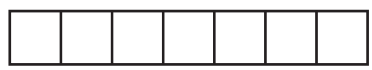
1 meter = 100 centimeters = 1000 millimeters
1 kilometer = 1000 meters
1 liter = 1000 milliliters = 1000 cubic centimeters
1 gram = 1000 milligrams
1 kilogram = 1000 grams

Response Grids

Mathematics FR items are written with consideration for the number of columns in the fill-in response box. Students may enter a digit 0 through 9, a decimal point, a negative sign, or the symbol for the fraction bar (/) in each column in the response box. The symbol for the fraction bar may not be entered in the first or last column.

Algebra 1 EOC and Geometry EOC

The Algebra 1 EOC and Geometry EOC Assessments are computer based and use a seven-column fill-in response box.



Florida Recycles

The Florida Department of Education and its test contractors currently employ strategies to protect the environment in the production and destruction of FCAT 2.0 materials. The Department encourages schools and districts to recycle nonsecure FCAT 2.0 interpretive publications after use.