# Table of Contents

1. **Introduction**  
   - Origin and Purpose of the *Specifications*  
   - Scope of this Document  
   - Overall Considerations

4. **Criteria for Algebra 1 End-of-Course Assessment Items**  
   - Use of Graphics  
   - Item Style and Format  
   - Scope of Items  
   - Guidelines for Item Writers

10. **Item Difficulty and Cognitive Complexity of Algebra 1 EOC Assessment Items**  
    - Item Difficulty  
    - Cognitive Complexity  
    - Universal Design

17. **Review Procedures for Algebra 1 EOC Assessment Items**  
    - Review for Potential Bias  
    - Review for Community Sensitivity  
    - Review of Test Items

18. **Guide to the Individual Benchmark Specifications**  
    - Benchmark Classification System  
    - Definitions of Benchmark Specifications  
    - General Content Limits by Grade Level or EOC Assessment  
    - Item Contexts

33. **Benchmarks Assessed at Grades 3–5**

38. **Benchmarks Assessed at Grades 6–8**

43. **Benchmarks Assessed on Algebra 1 EOC and Geometry EOC**

52. **Specifications for Algebra 1 EOC**

A–1. **Appendix A:** FCAT 2.0 and EOC Topics, Florida’s NGSSS

B–1. **Appendix B:** Mathematics Content Assessed by the Algebra 1 EOC Assessment and Item Types by Benchmark

C–1. **Appendix C:** Reporting Categories for FCAT 2.0 Mathematics and End-of-Course Assessments

D–1. **Appendix D:** Mathematics Glossary, Algebra 1 EOC and Geometry EOC

E–1. **Appendix E:** Instructions for Item Review and Algebra 1 EOC Item Rating Form
Appendix F: FCAT 2.0 Mathematics, Algebra 1 EOC, and Geometry EOC Test Design Summary

Appendix G: Mathematics Reference Sheets

Appendix H: Response Grids
INTRODUCTION

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

In January 2006, the Department of Education (the 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, Algebra 1 End-of-Course Assessment Test Item Specifications (Specifications), provides details about the portion of the Assessment designed to assess mathematics and includes 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 Biology I, Geometry, and U.S. History. The Algebra 1 EOC Assessment measures achievement of Florida students enrolled in Algebra 1, or an equivalent course, by assessing student progress on benchmarks from the NGSSS that are assigned to Algebra 1 course descriptions.

Origin and Purpose of the Specifications

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

Scope of this Document

The Specifications for the Algebra 1 EOC Assessment provide general guidelines for the development of all test items used in the Algebra 1 EOC assessment. Three additional documents provide the same information for Grades 3–5, Grades 6–8, and Geometry EOC.

The Overall Considerations section, in the Introduction, provides an explanation of the mathematics elements assessed by the test. The Criteria for Algebra 1 End-of-Course Assessment Items section addresses cognitive complexity levels as well as the review processes used to ensure the quality of the stimuli and test items. The same section explains the criteria for the general guidelines for selection and development of multiple-choice items. The 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 identifies the manner in which each benchmark is assessed in Algebra 1 EOC, provides content limits and stimulus attributes for
each benchmark, and gives specific information about content, item types, and response attributes.

**Overall Considerations**

This section of the *Specifications* describes the guidelines that apply to all test items developed for the Algebra 1 EOC Assessment.

Overall considerations are broad item development issues that should be addressed during the development of test items. Other sections of Criteria for Algebra 1 EOC Assessment Items relate more specifically to one aspect of the development (for example, individual item types or content limits).

1. Each item should be written to measure primarily one benchmark; however, other benchmarks may also be reflected in the item content.

2. When benchmarks are combined for assessment, the individual specification indicates which benchmarks are combined.

3. Items should be appropriate for students in terms of grade-level difficulty, cognitive development, and reading level.

4. At a given grade, the test items will exhibit a varied range of difficulty.

5. For mathematics items, the reading level should be approximately one grade level below the grade level of the test, except for specifically assessed mathematical terms or concepts.

6. Items should not disadvantage or exhibit disrespect to anyone in regard to age, gender, race, ethnicity, language, religion, socioeconomic status, disability, or geographic region.

7. At Grades 3–6, all items should be written so the y can be answered without using a calculator. At Grades 7 and 8, students are allowed to use a four-function calculator, although items should still be written to be answered without a calculator within the timing guidelines for each item type. For the Algebra 1 End-of-Course Assessment, a four-function calculator will also be allowed. For the Geometry End-of-Course Assessment, a scientific calculator will be used.

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

9. Some items should provide information for students to analyze and use in order to respond to the items.

10. Items should provide clear and complete instructions to students.

11. Each item should be written to clearly and unambiguously elicit the desired response.

12. A reference sheet containing appropriate for mulas and conversions is provided to students in Grades 5, 6–8, 10 (1996 Standards), Algebra 1 EOC, and Geometry EOC for use during testing. Copies of the reference sheets are included in Appendix G of this document.

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

14. The FCAT 2.0 Mathematics Grades 3 and 4 tests will require the use of a six-inch ruler with both metric and standard units. The metric edge will be in millimeter and centimeter increments. The standard edge will be in \( \frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}, \) and one-inch increments.
CRITERIA FOR ALGEBRA 1 END-OF-COURSE ASSESSMENT ITEMS

The Algebra 1 EOC assessment includes two types of test items: multiple-choice items (MC) and fill-in response items (FR). The general specifications on pages 4 through 9 cover the following criteria:

- Use of Graphics
- Item Style and Format
- Scope of Items
- Guidelines for Item Writers

Use of Graphics

Graphics are used extensively in the Algebra 1 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. The assessed benchmarks require different levels of graphics and illustrations. For example, the standards involving geometry depend heavily upon graphics to present geometric concepts and/or properties required for answering a question. In contrast, items in other Bodies of Knowledge may contain graphics or pictures that illustrate and enhance interest but are not necessary to answer the question.

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

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

Item Style and Format

This section presents stylistic guidelines and for matting 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, roman boldface type should be used to emphasize key words in fill-in response items (e.g., least, most, greatest, percent, mode, median, mean, range, etc.).
6. Masculine pronouns should NOT be used to refer to both sexes. Plural forms should be used whenever possible to avoid gender-specific pronouns (e.g., instead of “The student will make changes so that he . . .,” use “The students will make changes so that they . . .”).

7. An equal balance of male and female names should be used, including names representing different ethnic groups appropriate for Florida.

8. For clarity, operation symbols, equality signs, and ordinates should be preceded and followed by one space.

9. Decimal numbers between -1 and 1 (including currency) should have a leading zero.

10. Metric numbers should be expressed in a single unit when possible (e.g., 1.4 kilograms instead of 1 kilogram 400 grams).

11. Decimal notation should be used for numbers with metric units (e.g., 1.2 grams instead of $1\frac{2}{3}$ grams).

12. The comma should be used in a number greater than or equal to 1,000 unless the number indicates a metric unit. Metric numbers with four digits should be presented without a comma or a space (e.g., 9960 meters). For metric numbers with more than four digits, a thin space should be inserted in place of a comma (e.g., 10 123 kilograms). For all grades, dollar amounts of $1,000 or more should include commas.

13. Units of measure should be spelled out, except in graphics where an abbreviation may be used (e.g., ft or yd). Abbreviations that also spell a word must be punctuated to avoid confusion. For example, to avoid confusion with the preposition in, the abbreviation in. should include a period and should be used for the unit of measure inches. If an abbreviation is used in a graphic, an explanation of the meaning of the abbreviation should be included in the stem.

14. In titles for tables and charts and in labels for axes, the units of measure should be included, preferably in lowercase in parentheses, e.g., height (in inches).

15. Fractions should be typed with a horizontal fraction bar. The numerator and denominator should be centered with respect to each other. The bar should cover all portions (superscripts, parentheses, etc.) of the numerator and denominator. In a mixed number, a half space should appear between the whole number and the fraction. If a variable appears before or after a fraction bar, the variable should be centered with respect to the fraction bar. If a stimulus, stem, or set of responses contains a fraction in fractional notation, that portion of the item should be 1.5-spaced.

16. In general, numbers zero through nine should be presented as words, and numbers 10 and above should be presented as numerals. In the item stem, any numbers needed to compute answers should be presented as numerals.
Multiple-Choice (MC) Items

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

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

1. Grades 4–8 use GR items, while the Algebra 1 EOC and Geometry EOC use FR items.

2. GR and FR items should take an average of 1.5 minutes per item to complete.

3. GR and FR items are worth one point each.

4. The bubble grids used with GR items contain four, five, six, or seven columns. Columns in which students may bubble a numeral contain the digits 0 through 9 enclosed in bubbles. Appendix H provides examples of the various FCAT Mathematics grids.

5. The GR format is designed for items that require a positive numeric solution (whole numbers, decimals, percents, or fractions) at Grades 4–7. GR items in two benchmarks in Grade 7 and all GR items in Grade 8 may require a negative numeric solution. A seventh column is added to these grids to allow for the negative sign. Note: The only benchmarks in Grade 7 that will use negative grids are MA.7.A.3.2 and MA.7.A.3.3.

6. Multiple formats (e.g., equivalent fractions and decimals) are acceptable for items as long as each form of the correct response can be recorded in the grid.

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

8. Special grids are provided at Grades 4 and 5 for gridding decimal numbers. The decimal grid is six columns wide with a fixed decimal point in the third column from the left. That is, there are two columns preceding the column with the decimal and three columns following it.

9. There are two types of currency grids for Grades 4 and 5. One includes a decimal point for dollars and cents and one does not. Both grids have a dollar sign preceding the grid.

10. Grade 6 and Grade 7 use a six-column grid that includes the digits 0 through 9 plus two symbols: a decimal point (.) and a fraction bar (/) for gridding fractions. The fraction bar cannot be used in the first or the sixth column.

11. Gridded items assessing two Grade 7 benchmarks and all gridded items in Grade 8 use a seven-column grid. The first column of the grid is used for only a negative sign and the remaining columns include the digits 0 through 9 plus two symbols: the decimal point (.) and the fraction bar (/) for gridding fractions. The fraction bar cannot be used in the second or the seventh column.

12. All grids include light shading in alternate columns. Shading should not interfere with students’ ability to read the numbers inside each column.

13. GR/FR items should include instructions that specify the unit in which the answer is to be provided (e.g., inches). If several units of measure are in the item (e.g., in an item involving a conversion), the final unit needed for the answer should be written in boldface.

14. GR/FR items are written with consideration for the number of columns in the grid.

15. The Algebra 1 and Geometry EOC will be computer based and will use a seven-column FR for items not assessed by multiple choice.
**Scope of Items**

The scope of items for Algebra 1 EOC is presented in Appendix B, which gives the benchmarks for Algebra 1 EOC. 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 through 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](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 Algebra 1 EOC must submit items in a particular format and must include the information presented below about each item. Because items are rated by committees of Florida educators following submission to the DOE, familiarity with the directions for rating items (found in Appendix E) would prove useful to all item writers.

Format

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

Sources

Item writers are expected to provide sources of all verifiable information included in the item. Acceptable sources include up-to-date textbooks, magazines and journals respected by the mathematics community, and Internet sites operated 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 items of varying difficulty;
- include items of varying cognitive complexity;
- have an approximate balance, for multiple-choice items, of the correct response among the four answer options;
- have an equal balance of male and female names; and
- include names representing different ethnic groups in Florida.
ITEM DIFFICULTY AND COGNITIVE COMPLEXITY OF ALGEBRA 1 EOC ASSESSMENT ITEMS

Educational standards and assessments can be aligned based on the category of content covered and also on the complexity of knowledge required. Test 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 an item. In the early years of the FCAT program, the DOE used Bloom’s Taxonomy\(^1\) to classify test items; however, Bloom’s Taxonomy is difficult to use because it requires an inference about the skill, knowledge, and background of the students responding to the item. Beginning in 2004, the DOE implemented a new cognitive classification system based upon Dr. Norman L. Webb’s Depth of Knowledge (DOK) levels.\(^2\) The rationale for classifying an item by its DOK level of complexity focuses on the expectations made of the item, not on the ability of the student. When classifying an item’s demands on thinking (i.e., what the item requires the student to recall, understand, analyze, and do), it is assumed that the student is familiar with the basic concepts of the task. Items are chosen for the FCAT 2.0 and EOC based on the NGSSS and their grade-level/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 Algebra 1. 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 table of descriptors that is provided for each cognitive complexity level. This table 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 chart also provides the breakdown of the percentage of points by cognitive complexity level.

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

Low Complexity
Algebra 1 low complexity items rely heavily on the recall and recognition of previously learned concepts and principles. Items typically specify what the student is to do, which is often to carry out some procedure that can be performed mechanically. It is not left to the student to come up with an original method or solution.

Below is an example of a low complexity item that is based on Benchmark MA.912.A.3.5. For more information about this item, see page 63.

The owner of a clothing store buys leather jackets at a wholesale cost, then sells them to the public at a higher retail price. She determines the retail price of one jacket by tripling the wholesale cost and adding 10% of the wholesale cost. Which equation could be used to calculate $r$, the retail price of a jacket, based on $w$, the wholesale price of the jacket?

A. $r = 3w + 10w$

★ B. $r = 3w + 0.1w$

C. $r = w + 10(3w)$

D. $r = w + 0.1(3w)$
Moderate Complexity
Algebra 1 moderate complexity items involve more flexible thinking than low complexity items. Items require a response that goes beyond the habitual, is not explicitly specified in the text, and ordinarily has more than a single step. The student is expected to decide what to do—using informal methods of reasoning and problem-solving strategies—and to bring together skill and knowledge from various domains.

Below is an example of a moderate complexity item that is based on Benchmark MA.912.A.3.14. For more information about this item, see page 76.

Monique owns a catering business. Last weekend, she catered two events in which all attendees were served either a chicken or a steak dinner. The table below shows some pricing information about these two events.

### BEFORE-TAX PRICES FOR MONIQUE’S CATERED EVENTS

<table>
<thead>
<tr>
<th>Day of Event</th>
<th>Number of Chicken Dinners Served</th>
<th>Number of Steak Dinners Served</th>
<th>Total Before-Tax Price of Dinners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturday</td>
<td>27</td>
<td>17</td>
<td>$809.50</td>
</tr>
<tr>
<td>Sunday</td>
<td>46</td>
<td>34</td>
<td>$1,495.00</td>
</tr>
</tbody>
</table>

The following system of equations can be used to determine the before-tax prices of $c$ dollars for each chicken dinner and $s$ dollars of each steak dinner Monique served.

\[
27c + 17s = 809.50 \\
46c + 34s = 1,495.00
\]

What is the before-tax price of a chicken dinner?

\[
\boxed{1.55}
\]

Correct Answer: 15.5
High Complexity

Algebra 1 high complexity items make heavy demands on student thinking. Students must engage in more abstract reasoning, planning, analysis, judgment, and creative thought. Items require that the student think in an abstract and sophisticated way.

Below is an example of a high complexity item that is based on Benchmark MA.912.A.3.5. For more information about this item, see page 63.

Julie is required to pay a 2% state income tax on all income over $3,000. In addition to the 2% tax, she must pay an extra 2.5% state income tax on all income over $20,000. Julie earned more than $20,000 last year and paid $992.50 in state income taxes. What was her total income for the year?

A. $22,056
B. $25,056
C. $34,500
D. $39,700
The following table is provided for ease of reference; however, caution must be used in referring to this table 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

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

<table>
<thead>
<tr>
<th>Grades</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4</td>
<td>25–35</td>
<td>50–70</td>
<td>5–15</td>
</tr>
<tr>
<td>5</td>
<td>10–20</td>
<td>55–75</td>
<td>10–20</td>
</tr>
<tr>
<td>6–8</td>
<td>10–20</td>
<td>60–80</td>
<td>10–20</td>
</tr>
<tr>
<td>Alg 1 EOC</td>
<td>10–20</td>
<td>60–80</td>
<td>10–20</td>
</tr>
<tr>
<td>Geometry EOC</td>
<td>10–20</td>
<td>60–80</td>
<td>10–20</td>
</tr>
</tbody>
</table>

**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 bias and sensitivity reviews.

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 Algebra 1 EOC Assessment Items**

Prior to appearing on any assessment, all Algebra 1 items must pass several levels of review as part of the development process. Florida educators and citizens, in conjunction with the DOE and assessment contractors, scrutinize all material prior to accepting it for placement on the tests.

**Review for Potential Bias**

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

**Review for Community Sensitivity**

Florida citizens associated with a variety of organizations and institutions review all items for issues of potential concern to members of the community at large. The purpose of this review is to ensure that the primary purpose of assessing mathematics achievement is not undermined by inadvertently including in the test any materials that parents and nonparents 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 Algebra 1 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 items for content characteristics and item specifications. The content review focuses on validity; that is, determining whether each item is a valid measure of the designated NGSSS benchmark, as defined by the grade-level specifications for test items. Separate reviews for bias and sensitivity issues are also conducted as noted above.

Algebra 1 items are first pilot tested with small groups of students at the appropriate grade levels, then field tested with a larger 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 number(s) in the *third, fourth, and fifth positions* represents 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 grade-level Standard.

<table>
<thead>
<tr>
<th>MA. 912.A.2.3</th>
</tr>
</thead>
</table>

**Subject Area**
Mathematics

**Grade Levels**
Grades 9–12

**Body of Knowledge**
Algebra

**Benchmark**
Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.

**Standard**
Draw and interpret graphs of relations. Understand the notation and concept of a function, find domains and ranges, and link equations to functions.

<table>
<thead>
<tr>
<th>Grades 9–12</th>
<th>Body of Knowledge</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard 2: Relations and Functions</strong></td>
<td>Draw and interpret graphs of relations. Understand the notation and concept of a function, find domains and ranges, and link equations to functions.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.2.3</strong> Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Definitions of Benchmark Specifications

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

**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 Algebra 1) in mathematics.

**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 necessarily addresses another benchmark. Such groupings are indicated in the benchmark statement.

**Item Types** are used to assess the benchmark or group of benchmarks. The types of items used on the 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. In other words, the clarification statements explain what the student will do when responding to questions of each type.

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

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

**Stimulus Attributes** define the types of stimulus materials that should be used in the items, including the appropriate use of graphic materials and item context or content.

**Response Attributes** define the characteristics of the answers that a student must choose from or provide.
Sample Items are provided for each type of question assessed. The sample items are presented in a format like that used in the test. The correct answer for each sample item is identified in the following manner:

• For MC items, the correct answer is indicated with a five-point star.
• For FR items, the acceptable answers are given.

Item Context gives a topical frame of reference to real-world applications of the test items.
General Content Limits by Grade Level or EOC Assessment

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

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

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

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

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

Division
• Items may include the related division facts for $0 \times 0$ through $9 \times 9$.

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

Addition, Subtraction, Multiplication, and Division
• Not assessed at Grade 3.

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

Addition, Subtraction, Multiplication, and Division
• Not assessed at Grade 3.

Percent
• Not assessed at Grade 3.

Measurement
• Items will not assess weight/mass, capacity, or temperature in isolation.
• Time and linear measurement, including perimeter, will be assessed.
• Items may use customary and/or metric units.
**Grade 4 General Content Limits**

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

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

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

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

**Multiplication**
- Factors used may include up to two 3-digit numbers, or, when a four-digit factor is used, the other factor may not exceed two digits.

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

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

**Addition, Subtraction, Multiplication, and Division**
- Not assessed at Grade 4.

**Fractions**
- Items may have denominators of 1–10, 12, or 1,000, or denominators that are derived from basic multiplication facts through $12 \times 12$ may also be used (e.g., 24 has the two factors 6 and 4; 72 has the factors 8 and 9).

**Addition, Subtraction, Multiplication, and Division**
- Not assessed at Grade 4.

**Percent**
- Percents must be equivalent only to halves, fourths, tenths, or hundredths.
- Items dealing with percents will not involve computation using the percent.
Measurement
• Items will not assess weight/mass, time, temperature, perimeter, and/or capacity in isolation.
• Items may use customary and/or metric units.
• See Geometry and Measurement benchmarks for specifics.

Gridded-Response Items
• Answers may not exceed five digits.
• Answers may not include fractions.
• See grid types for appropriate answer formats.
**Grade 5 General Content Limits**
The content limits described below are applicable to all items developed for Grade 5; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

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

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

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

**Multiplication**
- Factors can have up to three digits by three digits or four digits by two digits and could include a 0 in the hundreds, tens, and/or ones places.

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

**Decimals**
- Place values could range from tenths through thousandths.

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

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

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

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

• Fractions should have denominators of 1–12, 75, or 1,000, or denominators that are derived from basic multiplication facts through $12 \times 12$ may also be used (e.g., 24 has the two factors 6 and 4; 72 has the factors 8 and 9).

Addition

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

Subtraction

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

Multiplication

• Not assessed at Grade 5.

Division

• Not assessed at Grade 5.

Percent

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

Measurement

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

Gridded-Response Items

• Answers may not exceed five digits.
• See grid types for appropriate answer formats.
Grade 6 General Content Limits
The content limits described below are applicable to all items developed for Grade 6; however, the content limits defined in the individual benchmark specifications can supersede these general content limits.

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

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

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

Multiplication
• Products should not exceed seven digits.

Division
• Divisors should not exceed two digits.
• Dividends should not exceed four digits.
• Quotients should be terminating decimals.

Decimals
• Place values should range from tenths through thousandths.

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

Subtraction
• Subtrahends, minuends, and differences should not exceed five digits.

Multiplication
• Products should not exceed seven digits.

Division
• Divisors should not exceed three digits.
• Dividends should not exceed four digits.
• Quotients should not exceed four digits and must terminate within three decimal places.
Fractions
• Items should use denominators of 1 through 12; any multiple of 2, 3, or 5 through 100; or 1,000, or denominators that are derived from basic multiplication facts through $12 \times 12$.
• Items may include fractions and mixed numbers.

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

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

Multiplication
• Items may include up to three factors.

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

Percent
• See benchmark for specific content limits.

Measurement
• Items will not assess conversion of units in isolation.
Grade 7 General Content Limits

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

Whole numbers

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

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

Multiplication
• Products should not exceed eight digits.

Division
• Dividends should not exceed five digits.

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

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

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

Multiplication
• Products should not exceed eight digits.

Division
• Divisors should not exceed three digits.
• Dividends should not exceed five digits.
• Quotients should not exceed seven digits.
Fractions
• Items should use denominators through 1,000.
• Items may include fractions and mixed numbers.

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

Subtraction
• See benchmark for specific content limits.

Multiplication
• See benchmark for specific content limits.

Division
• Divisors cannot be mixed numbers.

Percent
• See benchmark for specific content limits.

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

Whole numbers

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

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

Multiplication
• See benchmark for specific content limits.

Division
• 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
• See benchmark for specific content limits.

Division
• Dividends should not exceed five digits.
• Quotients should have terminating decimals.

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

Percent
• See benchmark for specific content limits.

Measurement
• See benchmark for specific content limits.
**Algebra 1 and Geometry End-of-Course General Content Limits**

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

**Whole numbers**

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

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

**Multiplication**
- Products should not exceed eight digits.

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

**Decimals**

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

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

**Multiplication**
- Products should not exceed eight digits.

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

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

**Percent**
- See benchmark for specific content limits.

**Measurement**
- See benchmark for specific content limits.
**Item Contexts**
The situation in which a test question is presented is called the item context. Algebra 1 EOC questions 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. Sample contexts can be found in Appendix A.

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, Literature, Social Studies/Consumerism, Science, Foreign Language, or Health/Physical Education. (See Appendix A for major subject areas and strand titles.)
3. As often as possible, items should be presented in real-world contexts or should be related to real-world situations.
4. Items including specific information or data should be accurate and documented against reliable sources. It may be necessary to obtain copyright permissions.
5. The item content should be timely but not likely to become dated too quickly.
6. Information should be presented through written text and/or through visual material, such as graphs, tables, diagrams, maps, models, and/or other illustrations.
7. All graphs provided to the students should be complete with title, scale, and labeled axes, except when these components are to be completed by the student.
8. All graphics in items should be uncluttered and should clearly depict the necessary information. Graphics should contain relevant details that contribute to the student’s understanding of the item or support the context of the item. Graphics should not introduce bias to the item.
9. Extraneous information may be included in items.
### Benchmarks Assessed at Grades 3–5

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

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
## Benchmarks Assessed at Grades 3–5

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

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
### Benchmarks Assessed at Grades 3–5

<table>
<thead>
<tr>
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<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big Idea 3:</strong> Describe and analyze properties of two-dimensional shapes.</td>
<td><strong>Big Idea 3:</strong> Develop an understanding of area and determine the area of two-dimensional shapes.</td>
<td><strong>Big Idea 3:</strong> Describe three-dimensional shapes and analyze their properties, including volume and surface area.</td>
</tr>
<tr>
<td>MA.3.G.3.1 Describe, analyze, compare and classify two-dimensional shapes using sides and angles—including acute, obtuse, and right angles—and connect these ideas to the definition of shapes.</td>
<td>MA.4.G.3.1 Describe and determine area as the number of same-sized units that cover a region in the plane, recognizing that a unit square is the standard unit for measuring area.</td>
<td>MA.5.G.3.1 Analyze and compare the properties of two-dimensional figures and three-dimensional solids (polyhedra), including the number of edges, faces, vertices, and types of faces.</td>
</tr>
<tr>
<td>MA.3.G.3.2 Compose, decompose, and transform polygons to make other polygons, including concave and convex polygons with three, four, five, six, eight, or ten sides.</td>
<td>MA.4.G.3.2 Justify the formula for the area of the rectangle “area = base \times height.”</td>
<td>MA.5.G.3.2 Describe, define and determine surface area and volume of prisms by using appropriate units and selecting strategies and tools.</td>
</tr>
<tr>
<td><strong>MA.3.G.3.3 Build, draw and analyze two-dimensional shapes from several orientations in order to examine and apply congruence and symmetry.</strong></td>
<td>MA.4.G.3.3 Select and use appropriate units, both customary and metric, strategies, and measuring tools to estimate and solve real-world area problems.</td>
<td></td>
</tr>
</tbody>
</table>

**Supporting Idea: Algebra**

<table>
<thead>
<tr>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.3.A.4.1 Create, analyze, and represent patterns and relationships using words, variables, tables and graphs.</td>
<td>MA.4.A.4.1 Generate algebraic rules and use all four operations to describe patterns, including nonnumeric growing or repeating patterns.</td>
<td>MA.5.A.4.1 Use the properties of equality to solve numerical and real world situations.</td>
</tr>
<tr>
<td>MA.4.A.4.2 Describe mathematics relationships using expressions, equations, and visual representations.</td>
<td>MA.4.A.4.3 Recognize and write algebraic expressions for functions with two operations.</td>
<td>MA.5.A.4.2 Construct and describe a graph showing continuous data, such as a graph of a quantity that changes over time. (Assessed with MA.5.S.7.1 and MA.5.S.7.2.)</td>
</tr>
</tbody>
</table>

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
## Benchmarks Assessed at Grades 3–5

<table>
<thead>
<tr>
<th>Supporting Idea: Geometry and Measurement</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.3.G.5.1 Select appropriate units, strategies and tools to solve problems involving perimeter.</td>
<td>MA.4.G.5.1 Classify angles of two-dimensional shapes using benchmark angles (i.e. 45°, 90°, 180°, and 360°).</td>
<td>MA.5.G.5.1 Identify and plot ordered pairs on the first quadrant of the coordinate plane.</td>
<td></td>
</tr>
<tr>
<td>MA.3.G.5.2 Measure objects using fractional parts of linear units such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{10}$.</td>
<td>MA.4.G.5.2 Identify and describe the results of translations, reflections, and rotations of 45, 90, 180, 270, and 360 degrees, including figures with line and rotational symmetry.</td>
<td>MA.5.G.5.2 Compare, contrast, and convert units of measure within the same dimension (length, mass, or time) to solve problems.</td>
<td></td>
</tr>
<tr>
<td>MA.3.G.5.3 Tell time to the nearest minute and to the nearest quarter hour, and determine the amount of time elapsed.</td>
<td>MA.4.G.5.3 Identify and build a three-dimensional object from a two-dimensional representation of that object and vice versa.</td>
<td>MA.5.G.5.3 Solve problems requiring attention to approximation, selection of appropriate measuring tools, and precision of measurement.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supporting Idea: Number and Operations</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.3.A.6.1 Represent, compute, estimate and solve problems using numbers through hundred thousands.</td>
<td>MA.4.A.6.1 Use and represent numbers through millions in various contexts, including estimation of relative sizes of amounts or distances.</td>
<td>MA.5.A.6.1 Identify and relate prime and composite numbers, factors and multiples within the context of fractions. (Assessed with MA.5.A.2.1, MA.5.A.2.2 and MA.5.A.2.4.)</td>
<td></td>
</tr>
<tr>
<td>MA.3.A.6.2 Solve non-routine problems by making a table, chart, or list and searching for patterns.</td>
<td>MA.4.A.6.2 Use models to represent division as: • the inverse of multiplication • as partitioning • as successive subtraction</td>
<td>MA.5.A.6.2 Use the order of operations to simplify expressions which include exponents and parentheses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA.4.A.6.3 Generate equivalent fractions and simplify fractions.</td>
<td>MA.5.A.6.3 Describe real-world situations using positive and negative numbers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA.4.A.6.4 Determine factors and multiples for specified whole numbers.</td>
<td>MA.5.A.6.4 Compare, order, and graph integers, including integers shown on a number line.</td>
<td></td>
</tr>
</tbody>
</table>

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## Benchmarks Assessed at Grades 3–5

<table>
<thead>
<tr>
<th>Supporting Idea: Number and Operations (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade 3</strong></td>
</tr>
<tr>
<td><strong>MA.4.A.6.5</strong> Relate halves, fourths, tenths, and hundredths to decimals and percents.</td>
</tr>
<tr>
<td><strong>MA.4.A.6.6</strong> Estimate and describe reasonableness of estimates; determine the appropriateness of an estimate versus an exact answer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supporting Idea: Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA.3.S.7.1</strong> Construct and analyze frequency tables, bar graphs, pictographs, and line plots from data, including data collected through observations, surveys, and experiments.</td>
</tr>
<tr>
<td><strong>MA.5.S.7.2</strong> Differentiate between continuous and discrete data, and determine ways to represent those using graphs and diagrams. (Also assesses MA.5.A.4.2.)</td>
</tr>
</tbody>
</table>

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## Benchmarks Assessed at Grades 6–8

<table>
<thead>
<tr>
<th>Grade 6</th>
<th>Grade 7</th>
<th>Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big Idea 1:</strong> Develop an understanding of and fluency with multiplication and division of fractions and decimals.</td>
<td><strong>Big Idea 1:</strong> Develop an understanding of and apply proportionality, including similarity.</td>
<td><strong>Big Idea 1:</strong> Analyze and represent linear functions, and solve linear equations and systems of linear equations.</td>
</tr>
<tr>
<td><strong>MA.6.A.1.1</strong> Explain and justify procedures for multiplying and dividing fractions and decimals.</td>
<td><strong>MA.7.A.1.1</strong> Distinguish between situations that are proportional or not proportional, and use proportions to solve problems.</td>
<td><strong>MA.8.A.1.1</strong> Create and interpret tables, graphs, and models to represent, analyze, and solve problems related to linear equations, including analysis of domain, range and the difference between discrete and continuous data.</td>
</tr>
<tr>
<td><strong>MA.6.A.1.2</strong> Multiply and divide fractions and decimals efficiently. (Assessed with MA.6.A.1.3.)</td>
<td><strong>MA.7.A.1.2</strong> Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease.</td>
<td><strong>MA.8.A.1.2</strong> Interpret the slope and the x- and y-intercepts when graphing a linear equation for a real-world problem.</td>
</tr>
<tr>
<td><strong>MA.6.A.1.3</strong> Solve real-world problems involving multiplication and division of fractions and decimals. (Also assesses MA.6.A.1.2.)</td>
<td><strong>MA.7.A.1.3</strong> Solve problems involving similar figures.</td>
<td><strong>MA.8.A.1.3</strong> Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations. (Also assesses MA.8.A.1.4.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.7.A.1.4</strong> Graph proportional relationships and identify the unit rate as the slope of the related linear function.</td>
<td><strong>MA.8.A.1.4</strong> Identify the solution to a system of linear equations using graphs. (Assessed with MA.8.A.1.3.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.7.A.1.5</strong> Distinguish direct variation from other relationships, including inverse variation.</td>
<td><strong>MA.8.A.1.5</strong> Translate among verbal, tabular, graphical and algebraic representations of linear functions.</td>
</tr>
<tr>
<td></td>
<td><strong>MA.7.A.1.6</strong> Apply proportionality to measurement in multiple contexts, including scale drawings and constant speed.</td>
<td><strong>MA.8.A.1.6</strong> Compare the graphs of linear and non-linear functions for real-world situations.</td>
</tr>
</tbody>
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<tbody>
<tr>
<td><strong>Big Idea 2:</strong> Connect ratio and rates to multiplication and division.</td>
<td><strong>Big Idea 2:</strong> Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.</td>
<td><strong>Big Idea 2:</strong> Analyze two- and three-dimensional figures by using distance and angle.</td>
</tr>
<tr>
<td>MA.6.A.2.1 Use reasoning about multiplication and division to solve ratio and rate problems.</td>
<td>MA.7.G.2.1 Justify and apply formulas for surface area and volume of pyramids, prisms, cylinders, and cones.</td>
<td>MA.8.G.2.1 Use similar triangles to solve problems that include height and distances.</td>
</tr>
<tr>
<td><strong>MA.6.A.2.2</strong> Interpret and compare ratios and rates.</td>
<td>MA.7.G.2.2 Use formulas to find surface areas and volume of three-dimensional composite shapes.</td>
<td>MA.8.G.2.2 Classify and determine the measure of angles, including angles created when parallel lines are cut by transversals.</td>
</tr>
<tr>
<td><strong>Big Idea 3:</strong> Write, interpret, and use mathematical expressions and equations.</td>
<td><strong>Big Idea 3:</strong> Develop an understanding of operations on all rational numbers and solving linear equations.</td>
<td><strong>Big Idea 3:</strong> Analyze and summarize data sets.</td>
</tr>
<tr>
<td>MA.6.A.3.1 Write and evaluate mathematical expressions that correspond to given situations. (Also assesses MA.6.A.3.3.)</td>
<td>MA.7.A.3.1 Use and justify the rules for adding, subtracting, multiplying, dividing, and finding the absolute value of integers.</td>
<td>MA.8.S.3.1 Select, organize and construct appropriate data displays, including box and whisker plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships.</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td><strong>MA.6.A.3.2</strong> Write, solve, and graph one- and two-step linear equations and inequalities. (Also assesses MA.6.A.3.4.)</td>
<td><strong>MA.7.A.3.2</strong> Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts.</td>
<td><strong>MA.8.S.3.2</strong> Determine and describe how changes in data values impact measures of central tendency.</td>
</tr>
<tr>
<td><strong>MA.6.A.3.3</strong> Work backward with two-step function rules to undo expressions. (Assessed with MA.6.A.3.1.)</td>
<td><strong>MA.7.A.3.3</strong> Formulate and use different strategies to solve one-step and two-step linear equations, including equations with rational coefficients. (Also assesses MA.7.A.5.2.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.6.A.3.5</strong> Apply the Commutative, Associative, and Distributive Properties to show that two expressions are equivalent.</td>
<td><strong>MA.6.A.3.6</strong> Construct and analyze tables, graphs and equations to describe linear functions and other simple relations using both common language and algebraic notation.</td>
<td></td>
</tr>
</tbody>
</table>

**Supporting Idea: Algebra**

| MA.8.A.4.1 Solve literal equations for a specified variable. | MA.8.A.4.2 Solve and graph one- and two-step inequalities in one variable. |

**Supporting Idea: Geometry and Measurement**

| MA.6.G.4.1 Understand the concept of \( \pi \), know common estimates of \( \pi (3.14; \frac{22}{7}) \) and use these values to estimate and calculate the circumference and the area of circles. (Also assesses MA.6.A.3.4.) | MA.7.G.4.1 Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures, and apply these relationships to solve problems. | MA.8.G.5.1 Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)) and dimensions including temperature, area, volume, and derived units to solve problems. |

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## Benchmarks Assessed at Grades 6–8

<table>
<thead>
<tr>
<th>Supporting Idea: Geometry and Measurement (Continued)</th>
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<th>Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA.6.G.4.2</strong> Find the perimeters and areas of composite two-dimensional figures, including non-rectangular figures (such as semicircles) using various strategies. (Also assesses MA.6.A.3.4.)</td>
<td>MA.7.G.4.2 Predict the results of transformations, and draw transformed figures, with and without the coordinate plane.</td>
<td></td>
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</tr>
<tr>
<td><strong>MA.6.G.4.3</strong> Determine a missing dimension of a plane figure or prism, given its area or volume and some of the dimensions, or determine the area or volume given the dimensions. (Also assesses MA.6.A.3.4.)</td>
<td>MA.7.G.4.3 Identify and plot ordered pairs in all four quadrants of the coordinate plane.</td>
<td>MA.7.G.4.4 Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)), dimensions, and derived units to solve problems.</td>
<td></td>
</tr>
</tbody>
</table>

## Supporting Idea: Number and Operations

<table>
<thead>
<tr>
<th><strong>MA.6.A.5.1</strong> Use equivalent forms of fractions, decimals, and percents to solve problems.</th>
<th><strong>MA.7.A.5.1</strong> Express rational numbers as terminating or repeating decimals.</th>
<th><strong>MA.8.A.6.1</strong> Use exponents and scientific notation to write large and small numbers and vice versa and to solve problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA.6.A.5.2</strong> Compare and order fractions, decimals, and percents, including finding their approximate location on a number line.</td>
<td><strong>MA.7.A.5.2</strong> Solve non-routine problems by working backwards. (Assessed with MA.7.A.3.3.)</td>
<td><strong>MA.8.A.6.2</strong> Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions.</td>
</tr>
<tr>
<td><strong>MA.6.A.5.3</strong> Estimate the results of computations with fractions, decimals, and percents, and judge the reasonableness of the results.</td>
<td></td>
<td><strong>MA.8.A.6.3</strong> Simplify real number expressions using the laws of exponents. (Assessed with MA.8.A.6.4.)</td>
</tr>
</tbody>
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### Benchmarks Assessed at Grades 6–8

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<tr>
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<tr>
<td>MA.8.A.6.4 Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems. (Also assesses MA.8.A.6.3.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Supporting Idea: Data Analysis** |
| MA.6.S.6.1 Determine the measures of central tendency (mean, median, and mode) and variability (range) for a given set of data. |
| MA.7.S.6.1 Evaluate the reasonableness of a sample to determine the appropriateness of generalizations made about the population. |
| MA.6.S.6.2 Select and analyze the measures of central tendency or variability to represent, describe, analyze, and/or summarize a data set for the purpose of answering questions appropriately. |
| MA.7.S.6.2 Construct and analyze histograms, stem-and-leaf plots, and circle graphs. |

| **Supporting Idea: Probability** |
| MA.7.P.7.1 Determine the outcome of an experiment and predict which events are likely or unlikely, and if the experiment is fair or unfair. |
| MA.7.P.7.2 Determine, compare, and make predictions based on experimental or theoretical probability of independent or dependent events. |

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## Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

<table>
<thead>
<tr>
<th>Algebra 1 EOC</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Body of Knowledge: Algebra</strong></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.2.4 Determine the domain and range of a relation. (Also assesses MA.912.A.2.13.)</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.2.13 Solve real-world problems involving relations and functions. (Assessed with MA.912.A.2.3, MA.912.A.2.4.)</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.3.1 Solve linear equations in one variable that include simplifying algebraic expressions. (Also assesses MA.912.A.3.2.)</td>
<td></td>
</tr>
<tr>
<td>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.)</td>
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</tr>
<tr>
<td>MA.912.A.3.3 Solve literal equations for a specified variable.</td>
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</tr>
<tr>
<td>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.</td>
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## Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

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<tr>
<td><strong>Body of Knowledge: Algebra (Continued)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.5</strong> Symbolically represent and solve multi-step and real-world applications that involve linear equations and inequalities.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.7</strong> Rewrite equations of a line into slope-intercept form and standard form. (Assessed with MA.912.A.3.10.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.8</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.9</strong> Determine the slope, x-intercept, and y-intercept of a line given its graph, its equation, or two points on the line. (Also assesses MA.912.A.3.12.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.10</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.11</strong> Write an equation of a line that models a data set and use the equation or the graph to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change. (Also assesses MA.912.A.3.12.)</td>
<td></td>
</tr>
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### Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

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<tr>
<td><strong>Body of Knowledge: Algebra (Continued)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.12</strong> Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph. (Assessed with MA.912.A.3.8, MA.912.A.3.9, MA.912.A.3.10, and MA.912.A.3.11.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.13</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.14</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.3.15</strong> Solve real-world problems involving systems of linear equations and inequalities in two and three variables. (Assessed with MA.912.A.3.14.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.4.1</strong> Simplify monomials and monomial expressions using the laws of integral exponents.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.4.2</strong> Add, subtract, and multiply polynomials.</td>
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</tr>
<tr>
<td><strong>MA.912.A.4.3</strong> Factor polynomial expressions. (Also assesses MA.912.A.5.1.)</td>
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</tr>
<tr>
<td><strong>MA.912.A.4.4</strong> Divide polynomials by monomials and polynomials with various techniques, including synthetic division.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.5.1</strong> Simplify algebraic ratios. (Assessed with MA.912.A.4.3.)</td>
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</tr>
<tr>
<td><strong>MA.912.A.5.4</strong> Solve algebraic proportions.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.6.1</strong> Simplify radical expressions. (Assessed with MA.912.A.6.2.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.6.2</strong> Add, subtract, multiply, and divide radical expressions (square roots and higher). (Also assesses MA.912.A.6.1.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.7.1</strong> Graph quadratic equations with and without graphing technology. (Also assesses MA.912.A.7.8.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.7.2</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.7.8</strong> Use quadratic equations to solve real-world problems. (Assessed with MA.912.A.7.1 and MA.912.A.7.2.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.10.1</strong> 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.)</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.A.10.2</strong> Decide whether a solution is reasonable in the context of the original situation. (Assessed throughout.)</td>
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</tr>
<tr>
<td>MA.912.D.7.1 Perform set operations such as union and intersection, complement, and cross product.</td>
<td>MA.912.D.6.2 Find the converse, inverse, and contrapositive of a statement. (Also assesses MA.912.D.6.3.)</td>
</tr>
<tr>
<td>MA.912.D.7.2 Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets.</td>
<td>MA.912.D.6.3 Determine whether two propositions are logically equivalent. (Assessed with MA.912.D.6.2.)</td>
</tr>
<tr>
<td><strong>Body of Knowledge: Geometry</strong></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td>MA.912.G.1.1 Find the lengths and midpoints of line segments in two-dimensional coordinate systems.</td>
</tr>
<tr>
<td>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.)</td>
<td>MA.912.G.1.3 Identify and use the relationships between special pairs of angles formed by parallel lines and transversals.</td>
</tr>
<tr>
<td>MA.912.G.2.1 Identify and describe convex, concave, regular, and irregular polygons. (Assessed with MA.912.G.2.3.)</td>
<td>MA.912.G.2.2 Determine the measures of interior and exterior angles of polygons, justifying the method used.</td>
</tr>
<tr>
<td>MA.912.G.2.3 Use properties of congruent and similar polygons to solve mathematical or real-world problems. (Also assesses MA.912.G.2.1, MA.912.G.4.1, MA.912.G.4.2, MA.912.G.4.4, MA.912.G.4.5.)</td>
<td></td>
</tr>
</tbody>
</table>

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
### Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

<table>
<thead>
<tr>
<th>Algebra 1 EOC</th>
<th>Geometry EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body of Knowledge: Geometry (Continued)</strong></td>
<td><strong>MA.912.G.2.4</strong> 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.</td>
</tr>
<tr>
<td><strong>MA.912.G.2.5</strong> Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.). (Also assessed MA.912.G.2.7.)</td>
<td><strong>MA.912.G.2.7</strong> Determine how changes in dimensions affect the perimeter and area of common geometric figures. (Assessed with MA.912.G.2.5)</td>
</tr>
<tr>
<td><strong>MA.912.G.3.1</strong> Describe, classify, and compare relationships among quadrilaterals including the square, rectangle, rhombus, parallelogram, trapezoid, and kite. (Assessed with MA.912.G.3.4.)</td>
<td><strong>MA.912.G.3.2</strong> Compare and contrast special quadrilaterals on the basis of their properties. (Assessed with MA.912.G.3.4.)</td>
</tr>
<tr>
<td><strong>MA.912.G.3.3</strong> Use coordinate geometry to prove properties of congruent, regular and similar quadrilaterals.</td>
<td><strong>MA.912.G.3.4</strong> 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.)</td>
</tr>
<tr>
<td><strong>MA.912.G.4.1</strong> Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular. (Assessed with MA.912.G.2.3.)</td>
<td><strong>MA.912.G.4.2</strong> Define, identify, and construct altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter. (Assessed with MA.912.G.2.3.)</td>
</tr>
<tr>
<td><strong>MA.912.G.4.3</strong> Construct triangles congruent to given triangles. (Not assessed.)</td>
<td><strong>MA.912.G.2.3</strong></td>
</tr>
</tbody>
</table>

**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.
<table>
<thead>
<tr>
<th>Body of Knowledge: Geometry (Continued)</th>
<th>Algebra 1 EOC</th>
<th>Geometry EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.912.G.4.5 Apply theorems involving segments divided proportionally. (Assessed with MA.912.G.2.3.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.912.G.4.7 Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.912.G.5.1 Prove and apply the Pythagorean Theorem and its converse. (Assessed with MA.912.G.5.4.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.912.G.5.4 Solve real-world problems involving right triangles. (Also assesses MA.912.G.5.1, MA.912.G.5.2, MA.912.G.5.3.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.912.G.6.5 Solve real-world problems using measures of circumference, arc length, and areas of circles and sectors. (Also assesses MA.912.G.6.2 and MA.912.G.6.4.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
## Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

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<tr>
<th>Algebra 1 EOC</th>
<th>Geometry EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body of Knowledge: Geometry (Continued)</strong></td>
<td><strong>MA.912.G.6.6</strong> 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.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.6.7</strong> 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.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.1</strong> 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.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.2</strong> Describe the relationships between the faces, edges, and vertices of polyhedra. (Assessed with MA.912.G.7.1.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.4</strong> Identify chords, tangents, radii, and great circles of spheres. (Assessed with MA.912.G.7.5.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.5</strong> Explain and use formulas for lateral area, surface area, and volume of solids. (Also assesses MA.912.G.7.4, MA.912.G.7.6.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.6</strong> Identify and use properties of congruent and similar solids. (Assessed with MA.912.G.7.5.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.7.7</strong> Determine how changes in dimensions affect the surface area and volume of common geometric solids.</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.8.1</strong> Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems. (Embedded throughout.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.8.2</strong> Use a variety of problem-solving strategies, such as drawing a diagram, making a chart, guess-and-check, solving a simpler problem, writing an equation and working backwards. (Embedded throughout.)</td>
</tr>
</tbody>
</table>

Prior Knowledge: Items may require the student to apply mathematical knowledge described in NGSSS benchmarks from lower grades; however, the benchmarks from lower grades will not be assessed in isolation.
### Benchmarks Assessed on Algebra 1 EOC and Geometry EOC

<table>
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<tr>
<th>Algebra 1 EOC</th>
<th>Geometry EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body of Knowledge: Geometry (Continued)</strong></td>
<td><strong>MA.912.G.8.3</strong> Determine whether a solution is reasonable in the context of the original situation. (Embedded throughout.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.8.4</strong> Make conjectures with justifications about geometric ideas. Distinguish between information that supports a conjecture and the proof of a conjecture.</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.8.5</strong> Write geometric proofs, including proofs by contradiction and proofs involving coordinate geometry. Use and compare a variety of ways to present deductive proofs, such as flow charts, paragraphs, two-column, and indirect proofs. (Assessed with MA.912.G.3.4 and MA.912.G.4.6.)</td>
</tr>
<tr>
<td></td>
<td><strong>MA.912.G.8.6</strong> 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.)</td>
</tr>
<tr>
<td><strong>Body of Knowledge: Trigonometry</strong></td>
<td><strong>MA.912.T.2.1</strong> Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, and cosecant) in terms of angles of right triangles.</td>
</tr>
</tbody>
</table>

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.
**SPECIFICATIONS FOR ALGEBRA 1 EOC**

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

The set of sample items that is included throughout the *Specifications* document represents a wide range of difficulty and cognitive complexity. Although most of the items are of average difficulty and moderate complexity and can be answered correctly by students who reach Achievement Level 3, some of the items presented will be challenging for some students and are specifically included to prompt item writers to submit items that will measure the abilities of students in higher achievement levels. As the assessment is constructed to measure various achievement levels, this document was constructed to help item writers see the range of difficulties and complexities of items that may appear on a test.
**Benchmark MA.912.A.2.3**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 2**  
Draw and interpret graphs of relations. Understand the notation and concept of a function, find domains and ranges, and link equations to functions.

**Benchmark**  
**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 Solve real-world problems involving relations and functions.

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

**Benchmark Clarification**  
Students will identify and/or analyze relations and functions given in various forms, including graphs, tables, sets of ordered pairs, and equations.

**Content Limits**  
Items may ask students to write given functions as equations.

In items that require students to determine the equation of a function, only continuous linear and/or quadratic functions should be used.

Items presenting a relation as a set of ordered pairs may not exceed 6 ordered pairs in the set.

In items presenting relations as graphs for the purpose of determining if the relation is a function, the graph need not be continuous.

Items should utilize function notation as appropriate.

**Stimulus Attribute**  
Items may be set in either real-world or mathematical contexts.

**Response Attributes**  
Fill-in response items may require that students provide an element of the range (or domain) for a point of interest.

Fill-in response items may have a negative answer.
Sample Item 1  MC

As a diver swims deeper underwater, the water pressure in pounds per square inch (PSI) increases on the diver. The table below shows the pressure in PSI for several depths of water.

<table>
<thead>
<tr>
<th>WATER PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (in feet)</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>50</td>
</tr>
</tbody>
</table>

Which equation represents \( p \), the water pressure in square inches, as a function of \( d \), the depth in feet?

A. \( p = 4.3d \)
★ B. \( p = 0.43d \)
C. \( p = 23.3d \)
D. \( p = 2.33d \)

Item Context  Science

Sample Item 2  FR

For one child, a childcare facility charges $300 per month for preschool and $3.50 per hour for each hour of childcare after preschool. The function below can be used to determine \( f(h) \), the monthly fee for childcare and preschool, where \( h \) represents the number of hours spent in childcare after preschool.

\[
f(h) = 300 + 3.5h
\]

If the one-month charges for one child totaled $637.75, what was the total number of hours the child spent in childcare after preschool?

\[
\boxed{96.5}
\]

Sample Response  96.5

Item Context  Social Studies/Consumerism
**Benchmark MA.912.A.2.4**

<table>
<thead>
<tr>
<th>Body of Knowledge</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td><strong>Standard 2</strong> Draw and interpret graphs of relations. Understand the notation and concept of a function, find domains and ranges, and link equations to functions.</td>
</tr>
<tr>
<td><strong>Benchmark</strong></td>
<td><strong>MA.912.A.2.4</strong> Determine the domain and range of a relation. Also assesses MA.912.A.2.13 Solve real-world problems involving relations and functions.</td>
</tr>
<tr>
<td><strong>Item Types</strong></td>
<td>This benchmark will be assessed using MC and FR items.</td>
</tr>
<tr>
<td><strong>Benchmark Clarification</strong></td>
<td>Students will determine the domain and range of relations.</td>
</tr>
<tr>
<td><strong>Content Limits</strong></td>
<td>In items requiring students to determine the domain and/or range from an equation, only linear and quadratic functions may be used. Domains and ranges may be listed as inequalities (e.g., $0 &lt; x \leq 60$ for domain), or written as a sentence. Items should utilize function notation, as appropriate. Items may present relations in a variety of formats, including sets of ordered pairs, tables, graphs, and input/output models. In items requiring students to determine the domain and/or range from a graph, only linear, quadratic, or continuous piecewise functions may be used.</td>
</tr>
<tr>
<td><strong>Stimulus Attribute</strong></td>
<td>Items may be set in either real-world or mathematical contexts.</td>
</tr>
<tr>
<td><strong>Response Attributes</strong></td>
<td>Multiple-choice and fill-in response items may require that students provide the least value (lower bound) or greatest value (upper bound) in the domain or range, or an endpoint of the domain or range. Fill-in response items may have a negative answer.</td>
</tr>
</tbody>
</table>
Sample Item 3  MC

An economics teacher plotted the value of a stock on 11 different days during a 500-day period and used line segments to connect them. In the graph below, the horizontal axis is measured in days and the vertical axis is measured in dollars.

Based on the graph, which of the following best describes the range of the value of the stock for this 500-day period?

A. $0 \leq x \leq 500$
B. $1 \leq x \leq 500$
★ C. $10 \leq y \leq 60$
D. $0 \leq y \leq 80$

Item Context  Social Studies/Consumerism
Sample Item 4 FR

The set of ordered pairs shown below defines a relation.

\{(0, 0), (1, 5), (2, 8), (3, 9), (4, 8), (5, 5), (6, 0)\}

What is the value of the greatest element in the range of this relation?

9

Sample Response 9

Item Context Mathematics
**Benchmark MA.912.A.3.1**

**Body of Knowledge**  
Algebra

**Standard**  
Standard 3  
Solve linear equations and inequalities.

**Benchmark**  
MA.912.A.3.1  
Solve linear equations in one variable that include simplifying algebraic expressions.

Also assesses MA.912.A.3.2 Identify and apply the distributive, associative, and commutative properties of real numbers and the properties of equality.

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

**Benchmark Clarification**  
Students will solve linear equations in one variable.

Equations must be presented in all items.

**Content Limits**  
Items may include equations with the variable on both sides of the equation.

Items may include applications of commutative, associative, distributive, and identity properties.

**Stimulus Attribute**  
Items may be set in either real-world or mathematical contexts.
Sample Item 5  
MC

Mario needs to cut three book shelves from a board that is 1.8 meters long. The second shelf is 15 centimeters longer than twice the length of the first shelf. The remaining shelf is 5 centimeters longer than the first shelf. The equation below represents this situation, where \( x \) is the length of the first shelf in meters.

\[ x + (2x + 0.15) + (x + 0.05) = 1.8 \]

Which of the following is the length, in meters, of the first shelf?

- ★ A. 0.40
- B. 0.45
- C. 0.53
- D. 0.96

Item Context  
The Arts

Sample Item 6  
FR

Bill is planning to drive from his house to a baseball stadium and arrive in time for the beginning of the championship game. His arrival time depends on the traffic. If traffic is light, he will travel at an average speed of 50 miles per hour and arrive 1 hour early. If traffic is heavy, he will travel at an average speed of 30 miles per hour and arrive on time. The equation below can be used to model this situation, where \( t \) represents Bill’s driving time, in hours.

\[ 50(t - 1) = 30t \]

What is the distance, in miles, from Bill’s house to the baseball stadium?

75

Sample Response  75

Item Context  
Mathematics
**Benchmark MA.912.A.3.3**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 3** Solve linear equations and inequalities.

**Benchmark**  
**MA.912.A.3.3** Solve literal equations for a specified variable.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarification**  
Students will manipulate an equation in order to isolate a specified variable.

**Content Limit**  
Items must contain more than two variables and require two or more procedural steps to complete.

**Stimulus Attribute**  
Items may be set in either real-world or mathematical contexts.

**Sample Item 7**  
MC

The Gross Domestic Product of a country for a given year is the sum of the market values of all goods and services produced within the country during that year. The Gross Domestic Product per capita is found by using the following formula.

\[ S = \frac{C + I + G + N}{P} \]

where:

- \( S \) = Gross Domestic Product per capita
- \( C \) = consumer spending
- \( I \) = investment
- \( G \) = government purchases
- \( N \) = net exports
- \( P \) = population

Which of the following shows the Gross Domestic Product per capita formula solved for \( C \)?

A. \( C = \frac{PS}{I - G - N} \)
B. \( C = \frac{PS}{I + G + N} \)

★ C. \( C = PS - I - G - N \)

D. \( C = PS - I + G + N \)

**Item Context**  
Social Studies/Consumerism
## Benchmark MA.912.A.3.4

### Body of Knowledge
Algebra

### Standard
**Standard 3** Solve linear equations and inequalities.

### Benchmark
**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.

### Item Type
This benchmark will be assessed using MC items.

### Benchmark Clarification
Students will solve simple and compound inequalities and graph solutions on a number line.

### Content Limit
Items will not include inequalities without a solution.

### Stimulus Attribute
Items may be set in either real-world or mathematical contexts.

### Sample Item 8  MC
Taylor has a total of $25 to spend on dinner, which includes a 6.5% sales tax and a 20% tip. Taylor used the inequality shown below to calculate the amount in dollars, \( a \), she can spend before tax and tip.

\[
1.2(a + 0.065a) \leq 25
\]

Which of the following shows the solution to this inequality?

- A. \( a \leq 22.74 \)
- B. \( a \leq 22.34 \)
- C. \( a \leq 19.76 \)
- ★ D. \( a \leq 19.56 \)

### Item Context
Social Studies/Consumerism
Sample Item 9   MC

Which graph shows the solution to the inequality shown below?

\[ 15 \leq 7n - 2(n - 10) < 35 \]

A. 

B. 

C. 

**D.** 

Item Context   Mathematics
**Benchmark MA.912.A.3.5**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 3**  
Solve linear equations and inequalities.

**Benchmark**  
**MA.912.A.3.5**  
Symbolically represent and solve multi-step and real-world applications that involve linear equations and inequalities.

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

**Benchmark Clarification**  
Students will interpret and/or solve real-world problems involving linear equations or linear inequalities.

**Content Limits**  
Items may require students to express inequalities on a number line, or to use an inequality for a response.

Items may include compound inequalities presented in written format, graphically, and/or algebraically.

Items will not include the use of interval notation, e.g. $(3, \infty)$, or set notation, e.g. $\{ x \mid x > 3\}$.

**Stimulus Attributes**  
Items must be set in real-world contexts.

Items should use methods that are graphical and/or algebraic.

Graphics should be used in some of these items, as appropriate.
Sample Item 10    MC

The out-of-pocket costs to an employee for health insurance and medical expenses for one year are shown in the table below.

**EMPLOYEE’S ANNUAL HEALTH CARE COSTS**

<table>
<thead>
<tr>
<th>Type of Cost</th>
<th>Definition</th>
<th>Cost to Employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium</td>
<td>Total amount employee pays insurance company for the policy</td>
<td>$3,626</td>
</tr>
<tr>
<td>Deductible</td>
<td>Amount of medical expenses employee pays before insurance company pays for anything</td>
<td>$500</td>
</tr>
<tr>
<td>Co-payment</td>
<td>Percentage of medical expenses after the first $500 that employee has to pay</td>
<td>20%</td>
</tr>
</tbody>
</table>

According to the plan outlined in the table, total annual health care costs, $C$, depend on the employee’s medical expenses for that year. If $x$ represents the total medical expenses of an employee on this plan and $x \geq 500$, which of the following equations can be used to determine this employee’s total health care costs for that year?

- **A.** \( C = 3,626 - 500 + 0.20(x - 500) \)
- **B.** \( C = 3,626 - 500 + 0.20x \)
- **C.** \( C = 3,626 + 500 + 0.20(x - 500) \)
- **D.** \( C = 3,626 + 500 + 0.20x \)

**Item Context**    Social Studies/Consumerism
Sample Item 11 FR

Karen works as a salesperson for a local marketing company. Using the equations shown below, the company calculates her monthly earnings based upon her total sales for the month.

MONTHLY EARNINGS EQUATIONS

<table>
<thead>
<tr>
<th>Total Sales for the Month (s in dollars)</th>
<th>Earnings Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s \leq 5,000</td>
<td>\ \ \ \ \ \ \ \ \ E = 1,600 + 0.1s</td>
</tr>
<tr>
<td>$s &gt; 5,000</td>
<td>\ \ \ \ \ \ \ \ \ E = 1,600 + 0.1s + 0.15(s - 5000)</td>
</tr>
</tbody>
</table>

where:

- $E$ represents total monthly earnings before taxes and withholding
- $s$ represents the dollar amount of her total sales

Karen’s total sales were greater than $5,000 in October. If her total monthly earnings for October were $3,000, what was the value of her total monthly sales, $s$?

Sample Response 8600

Item Context Social Studies/Consumerism
**Benchmark MA.912.A.3.8**

**Body of Knowledge**  
Algebra

**Standard**  
Standard 3  
Solve linear equations and inequalities.

**Benchmark**  
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 Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarification**  
Students will identify graphs given:
- a table of values;
- the x- and y-intercepts;
- two points;
- the slope and a point; or
- the equation of the line in slope-intercept form, standard form, or point-slope form.

**Content Limit**  
Items may include lines that have zero slope or undefined slope.

**Stimulus Attributes**  
Items may be set in either real-world or mathematical contexts.

Items may include linear equations in various forms, including standard, slope-intercept, and point-slope forms.

Graphics should be used in all items.

Equations should not be presented in function notation.
Sample Item 12       MC

Roger went to a garage sale where hardback books sold for $5 each and paperback books sold for $2.50 each. He has $20 to spend. The equation below can be used to find how many books of each type Roger can buy, where x is the number of hardback books and y is the number of paperback books.

\[ 5x + 2.5y = 20 \]

Which of the following shows the graph of this equation?

A. 

B. 

C. 

D. 

Item Context       Social Studies/Consumerism
**Benchmark MA.912.A.3.9**

**Body of Knowledge**  
Algebra

**Standard**  
Standard 3  
Solve linear equations and inequalities.

**Benchmark**  
MA.912.A.3.9  
Determine the slope, x-intercept, and y-intercept of a line given its graph, its equation, or two points on the line.

Also assesses: MA.912.A.3.12  
Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph.

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

**Benchmark Clarification**  
Students will determine the slope, x-intercept, and/or y-intercept of a line given its graph, its equation, or two points on the line.

**Content Limit**  
Items may include lines that have zero slope or undefined slope.

**Stimulus Attributes**  
Items may be set in either real-world or mathematical contexts.  
Items may include linear equations in various forms, including standard, slope-intercept, and point-slope forms.  
Graphics should be used in most of these items, as appropriate.

**Response Attributes**  
Fill-in response items may require that students provide a slope or the x-coordinate (or y-coordinate) of a point of interest.  
Fill-in response items may have a negative answer.

---

**Sample Item 13**  
MC

An architect designed an outdoor staircase for a house. The relationship between the height of the steps and the length of the tread is modeled by the equation $57x - 95y = 0$.

Which of the following represents the slope of the equation?

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

B. $\frac{3}{2}$

C. $\frac{2}{3}$

★ D. $\frac{3}{5}$

**Item Context**  
Social Studies/Consumerism
Sample Item 14 FR

An engineer needs to determine the slope between two points on a gondola ride in order to evaluate the power requirements when the gondola is full of passengers. A coordinate grid has been placed over a diagram between the two points, as shown below. For estimation purposes, a straight line between the two points can be used to find the slope.

Assuming the cable runs in a straight line, what is the slope of the line between the two points shown?

\[ \frac{1}{4} \]

Sample Response \( \frac{1}{4} \)

Item Context Science
**Benchmark MA.912.A.3.10**

**Body of Knowledge**  
Algebra

**Standard**  
Standard 3  
Solve linear equations and inequalities.

**Benchmark**  
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 Rewrite equations of a line into slope-intercept form and standard form.

Also assesses 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.

Also assesses MA.912.G.1.4 Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines.

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

**Benchmark Clarification**  
Students will write linear equations, including lines parallel or perpendicular to a given line.

**Content Limits**  
Information given to determine equations of lines may include a table of values, the x- and y-intercepts, two points, the slope and a point, a graph, or an equation.

Items may include lines that have zero slope or undefined slope.

Given coordinates will be limited to rational numbers.

**Stimulus Attributes**  
Items may include linear equations in various forms, including standard, slope-intercept, and point-slope forms.

Graphics should be used in most of these items, as appropriate.

**Response Attributes**  
Fill-in response items may require that students provide a slope of a line parallel or perpendicular to a given line.

Fill-in response items may require that students provide coefficients for a linear equation.

Fill-in response items may have a negative answer.
Sample Item 15  MC

In a technical drawing class, students are analyzing the side view of a house that has been positioned on a coordinate grid, as shown below.

Which of the following equations best represents the line that contains \( \overline{PQ} \)?

A. \( y = \frac{-5}{2}x + 14.4 \)

B. \( y = \frac{5}{2}x + 27 \)

★ C. \( y = \frac{-2}{3}x + 14.4 \)

D. \( y = \frac{2}{3}x + 27 \)

Item Context  The Arts
Sample Item 16 FR

On the coordinate grid below, line \( l \) is perpendicular to \( AB \).

What is the slope of line \( l \)?

Sample Response 2

Item Context Mathematics
**Benchmark MA.912.A.3.11**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 3**  
Solve linear equations and inequalities.

**Benchmark**  
**MA.912.A.3.11**  
Write an equation of a line that models a data set and use the equation or the graph to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change.

Also assesses **MA.912.A.3.12**  
Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph.

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

**Benchmark Clarification**  
Students will use linear equations to make predictions and/or find and use the rate of change (slope).

**Content Limits**  
Graphs may be located in any of the quadrants.

Items may include linear equations in various forms, including standard, point-intercept, and point-slope forms.

In items assessing slope as a rate of change, the slope should be presented as a ratio.

**Stimulus Attributes**  
Items may be set in either real-world or mathematical contexts.

Graphics should be used in most of these items, as appropriate.

**Response Attributes**  
Fill-in response items may require that students provide a slope, the x-coordinate of the x-intercept, the y-coordinate of the y-intercept, or the x-coordinate or y-coordinate of a point of interest.

Fill-in response items may have a negative answer.
Sample Item 17 MC

David is training for a marathon. He writes down the time and distance for each training run and then records the data on a scatter plot. He has drawn a line of best fit on the scatter plot, as shown below.

Which statement best expresses the meaning of the slope as a rate of change for this line of best fit?

A. It represents the number of miles he will have to run to finish the marathon.
★ B. It represents the average speed, in miles per hour, of his training runs.
C. It represents the number of hours he will need to finish the marathon.
D. It represents the distances, in miles, that he ran while he was training.

Item Context Health/Physical Education
Sample Item 18  FR

Joel graphed the line shown on the coordinate plane below.

What is the $x$-coordinate of the point at which this line intersects the $x$-axis?

Sample Response  5.5

Item Context  Mathematics
**Benchmark MA.912.A.3.14**

**Body of Knowledge**  
Algebra

**Standard**  
Standard 3  
Solve linear equations and inequalities.

**Benchmark**  
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 Use a graph to approximate the solution of a system of linear equations or inequalities in two variables with and without technology.

Also assesses MA.912.A.3.15 Solve real-world problems involving systems of linear equations and inequalities in two and three variables.

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

**Benchmark Clarification**  
Students will solve systems of linear equations in two variables.

**Content Limits**  
Items will not specify a method for solving systems of linear equations, such as substitution or elimination.

Items will not assess systems of linear inequalities.

Items will not assess systems of linear equations in three variables.

Items may ask students to write and/or solve systems of linear equations in two variables.

Items may ask students to solve systems of linear equations given a graph of the system.

In items with equations given, equations may be in the stem or options.

**Response Attribute**  
Fill-in response items may ask students to provide the $x$-coordinate (or $y$-coordinate) of a solution to a system of linear equations.
Sample Item 19 MC

Russ bought 3 medium and 2 large submarine sandwiches for a total of $29.95. Stacy bought 4 medium and 1 large submarine sandwiches for a total of $28.45.

Which statement shows the cost of each medium and each large submarine sandwich?

A. Each medium sandwich costs $5.69 and each large sandwich costs $6.89.
B. Each medium sandwich costs $5.69 and each large sandwich costs $6.39.
★ C. Each medium sandwich costs $5.39 and each large sandwich costs $6.89.
D. Each medium sandwich costs $5.39 and each large sandwich costs $6.39.

Item Context Social Studies/Consumerism

Sample Item 20 FR

A website that sells songs for downloading increased its price per song from $0.99 to $1.29. Macy spent $15.36 downloading songs during the month of the price increase. She downloaded 4 more songs at $0.99 than at $1.29. The set of equations below represents the situation where \( x \) is the number of songs Macy downloaded at $0.99 and \( y \) is the number of songs she downloaded at $1.29.

\[
\begin{align*}
x &= y + 4 \\
0.99x + 1.29y &= 15.36
\end{align*}
\]

What is the exact number of songs Macy downloaded at the $0.99 price?

Sample Response 9

Item Context Social Studies/Consumerism
**Benchmark MA.912.A.4.1**

**Body of Knowledge**  Algebra

**Standard**  

Standard 4  Perform operations on polynomials. Find factors of polynomials, learning special techniques for factoring quadratics. Understand the relationships among the solutions of polynomial equations, the zeros of a polynomial function, the $x$-intercepts of a graph, and the factors of a polynomial.

**Benchmark**  

MA.912.A.4.1  Simplify monomials and monomial expressions using the laws of integral exponents.

**Item Types**  

This benchmark will be assessed using MC and FR items.

**Benchmark Clarification**  

Students will apply the laws of exponents to simplify monomials and monomial expressions with integral exponents.

**Content Limits**  

Exponents should adhere to the general content limits.

- Items must have a variable base and may include a numerical base.
- Monomials may have no more than three variables.
- Items may use negative exponents.

**Stimulus Attribute**  

Items may be set in either real-world or mathematical contexts.

**Response Attributes**  

Fill-in response items may require that students provide an exponent for a specified monomial term.

Fill-in response items may have a negative answer.

---

**Sample Item 21**  

MC

The expression $(m^6n^5q^3)^2$ is equivalent to which of the following?

★ A. $m^{12}n^{10}q^6$
B. $m^{16}n^{25}q^9$
C. $2m^8n^7q^5$
D. $2m^{12}n^{10}q^6$

**Item Context**  

Mathematics
Mina simplified the expression shown below.

\[(a^3b^4)(a^2b^2)\]

Her final answer was in the form \(a^mb^n\). If she simplified the expression correctly, what is the value of \(n\), the exponent on \(b\)?

- 4

Sample Response

-4

Item Context

Mathematics
**Benchmark MA.912.A.4.2**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 4**  
Perform operations on polynomials. Find factors of polynomials, learning special techniques for factoring quadratics. Understand the relationships among the solutions of polynomial equations, the zeros of a polynomial function, the $x$-intercepts of a graph, and the factors of a polynomial.

**Benchmark**  
MA.912.A.4.2  
Add, subtract, and multiply polynomials.

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

**Benchmark Clarification**  
Students will simplify (add, subtract, and multiply) polynomial expressions.

**Content Limits**  
Items requiring multiplication of polynomials are limited to a product of: two monomials, a monomial and a binomial, a monomial and a trinomial, or two binomials.

Items requiring addition and subtraction are limited to combining monomials, binomials, and/or trinomials. The simplified sum or difference should contain no more than five terms.

**Stimulus Attribute**  
Items may be set in either real-world or mathematical contexts.

**Response Attributes**  
Fill-in response items may require that students provide an exponent or coefficient for a specified term.

Fill-in response items may have a negative answer.
Sample Item 23  MC

Which expression is equivalent to the perimeter of the shaded portion of the rectangle?

A. $2x + 10$
B. $2x + 12$
★ C. $4x + 14$
D. $8x + 28$

Item Context  Mathematics
Sample Item 24 FR

New photo imaging techniques on computers allow artists to distort an image from its original shape. Figure 1 is a square image. Figure 2 is stretched 4 units wider and shrunk 4 units shorter than Figure 1.

How many square units greater is the area of Figure 1 than the area of Figure 2?

Sample Response 16

Item Context The Arts
**Benchmark MA.912.A.4.3**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 4**  
Perform operations on polynomials. Find factors of polynomials, learning special techniques for factoring quadratics. Understand the relationships among the solutions of polynomial equations, the zeros of a polynomial function, the $x$-intercepts of a graph, and the factors of a polynomial.

**Benchmark**  
**MA.912.A.4.3**  
Factor polynomial expressions.

Also assesses **MA.912.A.5.1** Simplify algebraic ratios.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarifications**  
Students will completely factor polynomial expressions, which may include a greatest common factor, difference of two squares, and trinomials.

Students will use factoring methods to simplify rational expressions.

**Content Limits**  
All monomials in items will have, at most, two variables.

Coefficients must be integers.

In items requiring first factoring the greatest common factor and then factoring the remaining polynomial, the remaining polynomial must have a maximum degree of two.

**Stimulus Attributes**  
Rational expressions that may be simplified using any of the factoring methods involving the greatest common factor, difference of two squares, and/or trinomials may be provided.

Items should be set in either real-world or mathematical contexts.

Items including rational expressions must state restrictions to the domain.

**Response Attributes**  
Distractors may include expressions that are equivalent to the correct answer, but are not completely factored.

Distractors of rational expression items will not include expressions that are equivalent to the correct answer.
Sample Item 25  MC

Members of the art club want to raise money for their next field trip. They plan to decorate greeting cards with glitter and origami animals made of origami paper. They wrote the expression below to help calculate their total expenses.

\( (np + ng) + nc \)

where:
- \( c \) = cost of one greeting card
- \( g \) = cost of glitter per card
- \( p \) = cost of origami animals per card
- \( n \) = number of cards

Which of the following expressions is equivalent to the expression above?

★ A. \( n(p + g + c) \)
B. \( n(p + g) + c \)
C. \( 3n(p + g) + c \)
D. \( 3n(p + g + c) \)

Item Context  The Arts

Sample Item 26  MC

If \( x \neq 3 \), which of the following shows the expression below in simplest form?

\( \frac{3x^2 - 27}{x - 3} \)

★ A. \( 3(x + 3) \)
B. \( 3(x - 3) \)
C. \( 3(x + 9) \)
D. \( 3(x - 9) \)

Item Context  Mathematics
**Benchmark MA.912.A.4.4**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 4** Perform operations on polynomials. Find factors of polynomials, learning special techniques for factoring quadratics. Understand the relationships among the solutions of polynomial equations, the zeros of a polynomial function, the $x$-intercepts of a graph, and the factors of a polynomial.

**Benchmark**  
MA.912.A.4.4 Divide polynomials by monomials and polynomials with various techniques, including synthetic division.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarification**  
Students will divide polynomials by monomials.

**Content Limits**  
Items will be limited to dividing a polynomial by a monomial.

Synthetic division will not be assessed.

**Stimulus Attributes**  
Items should be set in a mathematical context.

Items including rational expressions must state restrictions to the domain.

**Response Attribute**  
Quotients will either not have a remainder or be presented as a rational expression.

**Sample Item 27**  
MC

Charlie needs to simplify the expression below before he substitutes values for $x$ and $y$.

\[
\frac{x^{18}y^{12} + x^{9}y^{8}}{x^{3}y^{4}}
\]

If $x \neq 0$ and $y \neq 0$, which of the following is a simplified version of the expression above?

A. $x^9y^5$

B. $x^{24}y^{16}$

C. $x^{6}y^{3} + x^{3}y^{2}$

★ D. $x^{15}y^{8} + x^{9}y^{4}$

**Item Context**  
Mathematics
### Benchmark MA.912.A.5.4

**Body of Knowledge**  
Algebra

**Standard**  
*Standard 5*  
Simplify rational expressions and solve rational equations using what has been learned about factoring polynomials.

**Benchmark**  
MA.912.A.5.4  
Solve algebraic proportions.

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

**Benchmark Clarification**  
Students will solve algebraic proportions.

**Content Limit**  
Products of the means and extremes of proportions cannot exceed degree 1.

**Stimulus Attribute**  
Items should be set in either real-world or mathematical contexts.

**Response Attribute**  
Fill-in response items may have a negative answer.
Sample Item 28  MC

Tammy made similar models of a building, with dimensions, in inches, as shown in the diagram below.

What is the value, in inches, of \( x \)?

★ A. 3  
B. 4  
C. 5  
D. 6

Item Context  The Arts

Sample Item 29  FR

What is the solution of the equation below?

\[
\frac{2}{x - 14} = \frac{3}{4x}
\]

-42/5 or -8.4

Sample Response  -42/5 or -8.4

Item Context  Mathematics
**Benchmark MA.912.A.6.2**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 6**  
Simplify and perform operations on radical expressions and equations. Rationalize square root expressions and understand and use the concepts of negative and rational exponents. Add, subtract, multiply, divide, and simplify radical expressions and expressions with rational exponents. Solve radical equations and equations with terms that have rational exponents.

**Benchmark**  
**MA.912.A.6.2**  
Add, subtract, multiply and divide radical expressions (square roots and higher).

Also assesses MA.912.A.6.1 Simplify radical expressions.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarification**  
Students will add, subtract, multiply and/or divide radical expressions and simplify the results.

**Content Limits**  
Items will assess square roots only.

Radicands with variables will contain positive integral exponents.

**Stimulus Attribute**  
Items should be set in a mathematical context.

**Response Attribute**  
Multiple-choice options must be presented with rationalized denominators.

**Sample Item 30**  
**MC**

Neelam simplified the expression below for a homework assignment.

\[ \sqrt{12} + \sqrt{3x} + 7\sqrt{3} \]

If Neelam simplified the expression correctly, which of the following is her answer?

★ **A.**  
\[ 9\sqrt{3} + \sqrt{3x} \]

**B.**  
\[ 11\sqrt{3} + \sqrt{3x} \]

**C.**  
\[ 7\sqrt{15} + \sqrt{3x} \]

**D.**  
\[ 8\sqrt{15} + \sqrt{3x} \]

**Item Context**  
Mathematics
**Benchmark MA.912.A.7.1**

**Body of Knowledge**  
Algebra

**Standard**  
**Standard 7**  
Draw graphs of quadratic functions. Solve quadratic equations and solve these equations by factoring, completing the square, and by using the quadratic formula. Use graphing calculators to find approximate solutions of quadratic equations.

**Benchmark**  
**MA.912.A.7.1**  
Graph quadratic equations with and without graphing technology.

Also assesses **MA.912.A.7.8** Use quadratic equations to solve real-world problems.

**Item Type**  
This benchmark will be assessed using MC items.

**Benchmark Clarification**  
Students will identify the graph of a quadratic function given its equation.

**Content Limits**  
Items must use quadratic equations with integral coefficients and roots only.

- All intercepts and vertices labeled on a graph must have integral coordinates.
- Quadratic equations will be presented in standard form only.
- For items requiring students to identify the graph of a quadratic equation, the equation must generate a function.

**Stimulus Attributes**  
Items may be set in either real-world or mathematical contexts. Graphics should be used in all of these items.
Sample Item 31    MC

Which of the following is the graph of \( y = x^2 + 2x - 8 \)?

- **A.**
- **C.**
- **B.**
- **D.**

**Item Context**  Mathematics
**Benchmark MA.912.A.7.2**

**Body of Knowledge**
Algebra

**Standard**
*Standard 7* Draw graphs of quadratic functions. Solve quadratic equations and solve these equations by factoring, completing the square, and by using the quadratic formula. Use graphing calculators to find approximate solutions of quadratic equations.

**Benchmark**
*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 Use the zero product property of real numbers in a variety of contexts to identify solutions to equations.

Also assesses MA.912.A.7.8 Use quadratic equations to solve real-world problems.

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

**Benchmark Clarification**
Students will solve quadratic equations over the set of real numbers.

**Content Limits**
Items must have real solutions only.

Quadratic equations must have integer coefficients only.

Items may assess special forms like the difference of squares and perfect square trinomials.

Items will not require the use of the “completing the square” method of solving quadratic equations.

**Stimulus Attribute**
Items may be set in either real-world or mathematical contexts.

**Response Attributes**
MC options may be given in the form that results from application of the quadratic formula, e.g., \(-\frac{2 \pm 4}{7}\).

MC options may be given using set notation.

Fill-in response items may ask the student to provide the greater (or lesser) of two solutions explicitly or implicitly.

Fill-in response items may have a negative answer.
Sample Item 32  
MC

Jeannie solved the quadratic equation shown below by factoring.

\[ x^2 + 2x - 8 = 0 \]

Which of the following shows a step in solving the equation shown?

A. \((x + 2)(x + 4) = 0\)
B. \((x + 2)(x - 4) = 0\)
★ C. \((x - 2)(x + 4) = 0\)
D. \((x - 2)(x - 4) = 0\)

Item Context  
Mathematics

Sample Item 33  
FR

A ball is kicked from ground level into the air. Its height \(y\), in feet, after \(x\) seconds can be represented by the equation \(y = 40x - 16x^2\). What is the total elapsed time, in seconds, from the time the ball is kicked until it reaches ground level again?

\[
\begin{array}{c}
2.5
\end{array}
\]

Sample Response  
2.5

Item Context  
Health/Physical Education
**Benchmark MA.912.D.7.1**

**Body of Knowledge**
Discrete Mathematics

**Standard**
**Standard 7** Operate with sets, and use set theory to solve problems.

**Benchmark**
MA.912.D.7.1 Perform set operations such as union and intersection, complement, and cross product.

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

**Benchmark Clarification**
Students will perform set operations such as union and intersection, complement, and cross product.

**Content Limits**
Items may include set notation and symbols from set theory.

Finite sets should contain no more than a total of 15 unordered elements and no more than 30 ordered elements.

If an item follows a numerical pattern, data may be represented by infinite sets. Example: Natural numbers \{1, 2, 3, 4 \ldots\}

Notation for the complement of set A will be limited to \(A'\) and \(\sim A\).

**Stimulus Attributes**
Items may be set in either real-world or mathematical contexts.

Graphics should be used for most of these items, as appropriate.

Sets should list all elements in the stem (e.g., do not use natural numbers between 2 and 5.).

**Sample Item 34**

**MC**

The set \(T\) represents several Taurine breeds of cattle.

\[ T = \{\text{Angus, Devon, Shorthorn, Texas Longhorn}\} \]

The set \(Z\) represents several Zebu breeds of cattle.

\[ Z = \{\text{Boran, Nelore, Ponwar}\} \]

What is the total number of elements in the set \(T \times Z\)?

- **A.** 7
- **B.** 9
- **C.** 12 **★**
- **D.** 20

**Item Context**
Science
Sample Item 35 FR

Set $D$ lists the ages of Dianna’s grandchildren.

$$D = \{2, 5, 6, 8, 10, 11\}$$

Set $K$ lists the ages of Karen’s grandchildren.

$$K = \{2, 10, 18\}$$

Set $P$ lists the ages of Patrick’s grandchildren.

$$P = \{10, 11, 14\}$$

What is the greatest age in the set $(K \cup P) \cap D$?

11

Sample Response 11

Item Context Social Studies/Consumerism
<table>
<thead>
<tr>
<th><strong>Body of Knowledge</strong></th>
<th>Discrete Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td><strong>MA.912.D.7.2</strong></td>
</tr>
<tr>
<td>Standard 7</td>
<td>Operate with sets, and use set theory to solve problems.</td>
</tr>
<tr>
<td><strong>Benchmark</strong></td>
<td><strong>MA.912.D.7.2</strong></td>
</tr>
<tr>
<td></td>
<td>Use Venn diagrams to explore relationships and patterns, and to make arguments about relationships between sets.</td>
</tr>
<tr>
<td><strong>Item Types</strong></td>
<td>This benchmark will be assessed using MC and FR items.</td>
</tr>
<tr>
<td><strong>Benchmark Clarification</strong></td>
<td>Students will use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets.</td>
</tr>
<tr>
<td><strong>Content Limits</strong></td>
<td>Items may include set notation and symbols from set theory.</td>
</tr>
<tr>
<td></td>
<td>Items should contain no more than a total of 15 ordered data points.</td>
</tr>
<tr>
<td></td>
<td>Notation for the complement of set A will be limited to A' and ~A.</td>
</tr>
<tr>
<td><strong>Stimulus Attributes</strong></td>
<td>Items may be set in either real-world or mathematical contexts.</td>
</tr>
<tr>
<td></td>
<td>Graphics should be used for most of these items, as appropriate.</td>
</tr>
<tr>
<td></td>
<td>Fill-in response items may ask the student to provide the number of elements in a set or a specific element if it is the only element in that set.</td>
</tr>
</tbody>
</table>
Sample Item 36 MC

The universal set contains only sets $R$, $S$, and $T$. These sets are related as shown in the Venn diagram below.

![Venn Diagram]

Which set represents $(\sim R \cap S) \cup (\sim T \cap S)$?

A. $\{d, e, f, j\}$

★ B. $\{d, j, k, m, n\}$

C. $\{d, e, f, j, k, m, n\}$

D. $\{d, e, f, g, j, k, m, n\}$

Item Context Mathematics
Sample Item 37  FR

The Venn diagram below shows the number of students who chose to participate in each of the three sports offered at Sports Camp.

Based on the diagram, what is the total number of students who did NOT participate in volleyball?

Sample Response  35

Item Context  Health/Physical Education
FCAT 2.0 AND EOC TOPICS
FLORIDA’S NGSSS

Social Studies/Consumerism (SS)

History
- Historical Chronology
  - individuals and events
  - primary and secondary sources: maps and graphs, letters, and newspapers
  - measurement of time
- History from Its Beginning to the Renaissance
  - government
  - achievements up to the Renaissance
  - trade and exploration
  - Middle Ages (development)
  - scientific achievements
  - transportation and communication
  - social structures
- Civilization since the Renaissance
  - individual contributions to society
  - humanities since the Renaissance
  - government and laws
  - Age of Discovery
- U.S. History to 1880
  - implications of American exploration
  - American Revolution
  - ideas and documents
  - growth and change 1801 to 1861
  - Civil War
- U.S. History from 1880 to Present Day
  - implications of World War I
  - Great Depression
  - implications of World War II
- Florida Immigration and Implications

Geography
- Geographic Tools
- Implications of Physical Environment

Government
- Functions of All Branches of American Government
- Implications of Citizenship in American Democracy

Economics
- Consumer Rights
- Earning and Spending

Science (SC)

- Nature of Matter
- Properties of Matter
  - tools of comparison
  - states, weights, combinations
  - organizations
- Energy
- Forms and Transformation of Energy
- Heat
- Energy and Uses
- Force and Motion
- Motion and Wave
- Forces of Gravity, Magnetism, Electricity
- Processes That Shape Earth
- Substances and Processes in the Lithosphere, Atmosphere, Hydrosphere, and Biosphere
- Recycling
- Interaction and Organization of the Solar System
- Patterns of Structure and Function of Living Things
- Process and Importance of Nature and Nurture
- Interaction of Living Things
- Nature of Living Things
- Nature of Science
- Scientific Process of Solving Problems

The Arts (AR)

Music
- Cultural and Historical Connections
- Music Types and Composers
- Relationship between Music, the Other Arts, and Disciplines outside the Arts
- Relationship between Music and the World

Visual Arts
- Tools and Techniques of the Visual Arts
- Visual Arts in Relation to Culture and History
- Criteria to Evaluate Characteristics of Works of Art
- Influences of Artists

Theater
- Theater Environment
- Cultural Traditions of Dance in Various Cultures and Historical Periods
**FCAT 2.0 AND EOC TOPICS**

**FLORIDA’S NGSSS**

**Health/Physical Education (HP)**

- **Health Education**
  - Health Promotion and Disease Prevention
  - Strategic Behaviors That Reduce Health Risks
  - Factors That Influence Health
  - Promotion of Healthy Living

- **Physical Education**
  - Specialized Techniques of Human Movement
  - Benefits of Physical Activity

**Foreign Language (FL)**

- Cultural Practices
- Patterns of Communication

**Literature (LT)**

- Types of Mass Media
- Techniques Used in Media Messages
- Technologies for Communication
- Fables, Stories, Legends
- Drama, Poetry
### Mathematics Content Assessed by the Algebra 1 EOC Assessment and Item Types by Benchmark

<table>
<thead>
<tr>
<th>Algebra 1 End of Course Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body of Knowledge</td>
</tr>
</tbody>
</table>

**Standard 1  Real and Complex Number System**
Expand and deepen understanding of real and complex numbers by comparing expressions and performing arithmetic computations, especially those involving square roots and exponents. Use the properties of real numbers to simplify algebraic expressions and equations, and convert between different measurement units using dimensional analysis.

**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.

<table>
<thead>
<tr>
<th><strong>MA.912.A.2.3</strong></th>
<th><strong>MA.912.A.2.4</strong></th>
<th><strong>MA.912.A.2.13</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.</td>
<td>Determine the domain and range of a relation.</td>
<td>Solve real-world problems involving relations and functions.</td>
</tr>
</tbody>
</table>

**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**
<table>
<thead>
<tr>
<th>Standard 3</th>
<th>Linear Equations and Inequalities</th>
<th>Solve linear equations and inequalities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.912.A.3.1</td>
<td>Solve linear equations in one variable that include simplifying algebraic expressions.</td>
<td>Also assesses MA.912.A.3.2.</td>
</tr>
<tr>
<td>MA.912.A.3.2</td>
<td>Identify and apply the distributive, associative, and commutative properties of real numbers and the properties of equality.</td>
<td>Assessed with MA.912.A.3.1.</td>
</tr>
<tr>
<td>MA.912.A.3.3</td>
<td>Solve literal equations for a specified variable.</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.3.4</td>
<td>Solve and graph simple and compound inequalities in one variable and be able to justify each step in a solution.</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.3.5</td>
<td>Symbolically represent and solve multi-step and real world applications that involve linear equations and inequalities.</td>
<td></td>
</tr>
<tr>
<td>MA.912.A.3.8</td>
<td>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.</td>
<td>Also assesses MA.912.A.3.7.</td>
</tr>
<tr>
<td>MA.912.A.3.9</td>
<td>Determine the slope, x-intercept, and y-intercept of a line given its graph, its equation, or two points on the line.</td>
<td>Also assesses MA.912.A.3.12.</td>
</tr>
<tr>
<td>MA.912.A.3.10</td>
<td>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.</td>
<td>Also assesses MA.912.A.3.7, MA.912.A.3.12, and MA.912.G.1.4.</td>
</tr>
<tr>
<td>MA.912.A.3.11</td>
<td>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.</td>
<td>Also assesses MA.912.A.3.12.</td>
</tr>
</tbody>
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B–2 | Algebra 1 EOC Test Item Specifications | Florida Department of Education
### Mathematics Content Assessed by the Algebra 1 EOC Assessment and Item Types by Benchmark

#### Algebra 1 End of Course Assessment

<table>
<thead>
<tr>
<th>Body of Knowledge</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard 3</strong></td>
<td><strong>Linear Equations and Inequalities</strong></td>
</tr>
<tr>
<td><strong>Solve linear equations and inequalities.</strong></td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
<th>Assessed with</th>
<th>Item Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.912.A.3.12</td>
<td>Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph.</td>
<td>MA.912.A.3.8, MA.912.A.3.9, MA.912.A.3.10, and MA.912.A.3.11.</td>
<td>MC, FR</td>
</tr>
<tr>
<td>MA.912.A.3.13</td>
<td>Use a graph to approximate the solution of a system of linear equations or inequalities in two variables with and without technology.</td>
<td>MA.912.A.3.14.</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
<th>Item Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.912.A.4.1</td>
<td>Simplify monomials and monomial expressions using the laws of integral exponents.</td>
<td>MC, FR</td>
</tr>
<tr>
<td>MA.912.A.4.2</td>
<td>Add, subtract, and multiply polynomials.</td>
<td>MC, FR</td>
</tr>
<tr>
<td>MA.912.A.4.3</td>
<td>Factor polynomial expressions.</td>
<td>MC</td>
</tr>
<tr>
<td>MA.912.A.4.4</td>
<td>Divide polynomials by monomials and polynomials with various techniques, including synthetic division.</td>
<td>MC</td>
</tr>
</tbody>
</table>

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# Mathematics Content Assessed by the Algebra 1 EOC Assessment and Item Types by Benchmark

<table>
<thead>
<tr>
<th>Algebra 1 End of Course Assessment</th>
<th>Body of Knowledge</th>
<th>Algebra Standard 5 Rational Expressions and Equations</th>
</tr>
</thead>
</table>
| **MA.912.A.5.1**  
Simplify algebraic ratios.  
Assessed with MA.912.A.4.3. |                  | **MA.912.A.5.4**  
Solve algebraic proportions.  
**MC, FR** | |

**Standard 6 Radical Expressions and Equations**  
Simplify and perform operations on radical expressions and equations. Rationalize square root expressions and understand and use the concepts of negative and rational exponents. Add, subtract, multiply, divide, and simplify radical expressions and expressions with rational exponents. Solve radical equations and equations with terms that have rational exponents.

| MA.912.A.6.1  
Simplify radical expressions.  
Assessed with A.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.  
**MC** | |

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# Mathematics Content Assessed by the Algebra 1 EOC Assessment and Item Types by Benchmark

## Algebra 1 End of Course Assessment

<table>
<thead>
<tr>
<th>Body of Knowledge</th>
<th>Standard 7</th>
<th>Quadratic Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Draw graphs of quadratic functions. Solve quadratic equations and solve these equations by factoring, completing the square and by using the quadratic formula. Use graphing calculators to find approximate solutions of quadratic equations.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.912.A.7.1</td>
<td>Graph quadratic equations with and without graphing technology. Also assesses MA.912.A.7.8.</td>
</tr>
<tr>
<td>MA.912.A.7.2</td>
<td>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.</td>
</tr>
<tr>
<td>MA.912.A.7.10</td>
<td>Use graphing technology to find approximate solutions of quadratic equations. Not assessed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard 10</th>
<th>Mathematical Reasoning and Problem Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In a general sense, all of mathematics is problem-solving. In all of mathematics, use problem-solving skills, choose how to approach a problem, explain the reasoning, and check the results.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Benchmark</th>
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</thead>
<tbody>
<tr>
<td>MA.912.A.10.1</td>
<td>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.</td>
</tr>
<tr>
<td>MA.912.A.10.2</td>
<td>Decide whether a solution is reasonable in the context of the original situation. Assessed throughout.</td>
</tr>
<tr>
<td>MA.912.A.10.3</td>
<td>Decide whether a given statement is always, sometimes, or never true (statements involving linear or quadratic expressions, equations, or inequalities, rational or radical expressions, or logarithmic or exponential functions). Not assessed.</td>
</tr>
</tbody>
</table>

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## Mathematics Content Assessed by the Algebra 1 EOC Assessment

### and Item Types by Benchmark

<table>
<thead>
<tr>
<th>Algebra 1 End of Course Assessment</th>
<th>Body of Knowledge</th>
<th>Discrete Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard 7</strong></td>
<td><strong>Set Theory</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.D.7.1</strong></td>
<td>Perform set operations such as union and intersection, complement, and cross product.</td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.D.7.2</strong></td>
<td>Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets.</td>
<td><strong>MC, FR</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Algebra 1 End of Course Assessment</th>
<th>Body of Knowledge</th>
<th>Geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard 1</strong></td>
<td><strong>Points, Lines, Angles, and Planes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MA.912.G.1.4</strong></td>
<td>Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines.</td>
<td><strong>Assessed with MA.912.A.3.10.</strong></td>
</tr>
</tbody>
</table>

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REPORTING CATEGORIES FOR
FCAT 2.0 MATHEMATICS AND END-OF-COURSE ASSESSMENTS

Reporting Categories
As of the time that the Algebra 1 End-of-Course Assessment Test Item Specifications were developed, the final determination of reporting categories and their weights had not yet been made. When this final determination is made, supplemental material will be posted to the FDOE website and school districts will be notified.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

The terms defined in this glossary pertain to the NGSSS in mathematics for EOC assessments in Algebra 1 and Geometry. Included are the glossary terms from Grades 3 through 8.

**Absolute value**—a number’s distance from zero (0) on a number line. Distance is expressed as a positive value (e.g., \(|3| = 3\) and \(|-3| = 3\).

**Acute angle**—an angle that measures less than 90° and greater than 0°.

**Addend**—any number being added.

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

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

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

**Algebraic expression**—an expression containing numbers and variables (e.g., \(7x\)), and operations that involve numbers and variables (e.g., \(2x + y\) or \(3a^2 - 4b + 2\)). Algebraic expressions do not contain equality or inequality symbols.

**Algebraic order of operations**—the order of performing computations is parentheses first, then exponents, followed by multiplication and/or division (as read from left to right), then addition and/or subtraction (as read from left to right). For example:

\[
\begin{align*}
    &= 5 + (12 - 2) ÷ 2 - 3 × 2 \\
    &= 5 + 10 ÷ 2 - 3 × 2 \\
    &= 5 + 5 - 6 \\
    &= 10 - 6 \\
    &= 4
\end{align*}
\]

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

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

**Angle**—two rays extending from a common end point called the vertex. Angles are measured in degrees.
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 line segment from the center of a regular polygon to the midpoint of any of its sides. The length of the apothem is usually denoted as $a$.

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).

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.

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.

Axis (of a graph)—a horizontal or vertical number line used in a coordinate plane system. Plural: axes.

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

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

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

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.

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

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

Chart—a data display that presents information in columns and rows.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

**Chord**—a line segment with endpoints on the circle.

**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 with measures the sum of which is exactly $90^\circ$.

**Composite number**—a whole number that has more than two factors.

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

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

**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. A conditional and its contrapositive always have the same truth value.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

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

**Cylinder**—a three-dimensional figure with two parallel bases that are congruent circles.

**Decimal number**—any number written with a decimal point in the number. A decimal number falls between two whole numbers (e.g., 1.5 falls between 1 and 2). Decimal numbers smaller than 1 are sometimes called decimal fractions (e.g., five-tenths is written 0.5).

**Deductive reasoning**—applying a general rule to a specific case.

**Degree**—a unit of measure for angles or temperature (º).

**Diagonal**—a line segment that joins two nonadjacent vertices of a polygon.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

**Difference**—a number that is the result of subtraction.

**Dilation**—a proportional increase or decrease in size in all dimensions.

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

**Direct measure**—the measure of an object obtained by using measuring devices, either standard devices of the customary or metric systems, or nonstandard devices such as a paper clip or pencil.

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

**Dividend**—a quantity that is to be divided.

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

**Divisor**—the number by which another number is divided.

**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.

**Elevation**—the height or altitude above sea level.

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

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

**Equilateral triangle**—a triangle with three congruent sides.

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

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

**Estimation**—the use of rounding and/or other strategies to determine a reasonably accurate approximation, without calculating an exact answer (e.g., clustering, front-end estimating, grouping, etc.).

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

**Exponent (exponential form)**—the number of 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.

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

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

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

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

**Flip**—see reflection.

**Flow proof**—a convincing argument that uses arrows to show the logical connections between the statements.

**Formal proof**—a convincing argument containing statements and reasons.

**Fraction**—any part of a whole (e.g., one-half written in fractional form is $\frac{1}{2}$).

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

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

**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.

**Grid**—see coordinate grid.

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

**Hexahedron**—a polyhedron with six faces.

**Hinge Theorem**—if two sides of one triangle are congruent to two sides of another triangle, and the included angles are not congruent, then the longer third side is opposite the larger included angle.

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

**Hypothesis**—the “if” part of a conditional statement. Plural: hypotheses.

**Icosahedron**—A polyhedron with twenty faces.

**Included angle**—an angle shared by two specific sides of a polygon.

**Included side**—a side shared by two specific angles of a polygon.

**Indirect proof**—a convincing argument in which you assume that what you are trying to prove is 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 \( 2y + 3 \geq 11 \)). See also algebraic inequality.

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

**Integers**—the numbers in the set \( \{ \ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4 \ldots \} \).

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

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

**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.”
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

**Inverse operation**—an operation that undoes a previously applied operation (e.g., subtraction is the inverse operation of addition).

**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 two congruent sides and two congruent angles.

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

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

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

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

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

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

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

**Line of reflection**—the line over which two figures are mirror images of each other.

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

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

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

**Literal equation**—an equation involving two or more variables.
**Mathematics Glossary**

**Algebra 1 EOC and Geometry EOC**

**Mass**—the amount of matter in an object.

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

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

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

**Monomial**—an expression that is a number, a variable, or a product of a number and one or more variables.

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

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

**Multiplicative inverse**—any two numbers with a product of 1 (e.g., 4 and 1/4). Zero (0) has no multiplicative inverse. Also called a reciprocal.

**Natural numbers (counting numbers)**—the numbers in the set \(\{1, 2, 3, 4, 5 \ldots\}\). Also called counting numbers.

**Negation** (\(\sim\))—the negative of a statement.

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

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

**Nonstandard units of measure**—objects such as blocks, paper clips, crayons, or pencils that can be used to obtain a measure.

**Number line**—a line on which ordered numbers can be written or visualized.

**Oblique**—a relationship between lines and/or plane figures that is not perpendicular or parallel.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

**Oblique prism**—a prism in which the lateral edges are not perpendicular to the bases.

**Obtuse angle**—an angle with a measure of more than $90^\circ$ but less than $180^\circ$.

**Octahedron**—a polyhedron with eight faces.

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

**Operational shortcut**—a method having fewer arithmetic calculations.

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

**Organized data**—data arranged in a display that is meaningful and that assists in the interpretation of the data.

**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).

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

**Parallel lines**—two lines in the same plane that are a constant distance apart. Parallel lines have equal slopes.

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

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

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

**Perimeter**—the distance around a polygon.

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

**Pi ($\pi$)**—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 $\frac{22}{7}$. 
Place value—the position of a single digit in a number.

Plane—an infinite, two-dimensional geometric surface defined by three non-linear points or two distinct parallel or intersecting lines.

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

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-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—the sum or difference of two or more monomials.

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

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

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

Product—the result of multiplying numbers together.

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.

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

Proportional—having the same or a constant ratio. Two quantities that have the same ratio are considered directly proportional (e.g., If \( y = kx \), then \( y \) is said to be directly proportional to \( x \) and the constant of proportionality is \( k \)). Two quantities in which the products are always the same are considered inversely proportional (e.g., If \( xy = k \), then \( y \) is said to be inversely proportional to \( x \)).
Pyramid—a three-dimensional figure in which the base is a polygon and in which the faces are triangles with a common vertex.

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

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

Quadratic equation—a polynomial equation containing one or more terms in which the variable is raised to the second power but no higher.

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

Quotient—the result of dividing two numbers.

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

Radical equation—an equation that contains a radical.

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

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

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

Rational expression—an algebraic expression that can be written as a fraction for which numerator and denominator are polynomials.
**Mathematics Glossary**

**Algebra 1 EOC and Geometry EOC**

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

**Rationalize**—write an equivalent expression or equation without radicals.

**Ray**—a portion 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.

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

**Reciprocal**—see multiplicative inverse.

**Rectangle**—a parallelogram with four right angles.

**Rectangular coordinate system**—see coordinate grid or plane.

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

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

**Reference angle**—the acute angle being referred to in a trigonometric ratio.

**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.

**Reflexive property of equality**—a number or expression is equal to itself (e.g., $7 = 7$ or $ab = ab$).

**Regular polygon**—a polygon that is both equilateral and equiangular.

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

**Relation**—a set of ordered pairs $(x, y)$.

**Rhombus**—a parallelogram with four congruent sides. Plural: rhombi.

**Right angle**—an angle for which the measure is exactly $90^\circ$.

**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.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

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

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

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

**Run**—the horizontal change on a graph between two points.

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

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

**Scalene triangle**—a triangle having no congruent sides.

**Scientific notation**—a shorthand method of writing very large or very small numbers using exponents in which a number is expressed as the product of a power of 10 and a number that is greater than or equal to one (1) and less than 10 (e.g., $7.59 \times 10^4 = 759,000$).

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

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

**Sequence**—an ordered list of numbers with either a constant difference (arithmetic) or a constant ratio (geometric).
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

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

**Similarity**—a term describing figures that are the same shape but are not necessarily the same size or in the same position.

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

**Slide**—see translation.

**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.

**Solid figures**—three-dimensional figures that completely enclose a portion of space (e.g., a rectangular prism, cube, sphere, right circular cylinder, right circular cone, and square pyramid).

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

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

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

**Squiggle**—see break.

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

**Straight angle**—an angle that measures exactly 180°.
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

**Subset**—a set in which the members are all contained in another set.

**Sum**—the result of adding numbers together.

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

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

**Symbolic representations of numbers**—expressions represented by symbols (e.g., circles shaded to represent \( \frac{1}{4} \) or variables used to represent quantities).

**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.

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

**Table**—a data display that organizes information about a topic into categories. See also chart.

**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.

**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).
**MATHEMATICS GLOSSARY**

**ALGEBRA 1 EOC AND GEOMETRY EOC**

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

**Transitive property**—when the first element has a particular relationship to a second element that in turn has the same relationship to a third element, the first has this same relationship to the third element (e.g., if \(a = b\) and \(b = c\), then \(a = c\)).

**Translation**—a transformation in which every point in a figure is moved in the same direction and by the same distance. Also called a slide.

**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.

**Turn**—see rotation.

**Two-column proof**—a convincing argument that uses statements and reasons aligned in two columns.

**Two-dimensional figure**—a figure having length and width.

**Union of sets**—the union of two sets \(A\) and \(B\) is the set of elements, which are in \(A\) or in \(B\) or in both. It is denoted by \(A \cup B\) and is read “\(A\) union \(B\)”.

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

**Variable**—any symbol, usually a letter, that could represent a number.

**Venn diagram**—a diagram that shows relationships among sets of objects.

**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 non-adjacent angles formed when two lines intersect.

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

**Weight**—a measure that represents the force of gravity on an object.

**Whole numbers**—the numbers in the set \(\{0, 1, 2, 3, 4 \ldots\}\).
**Mathematics Glossary**

**Algebra 1 EOC and Geometry EOC**

*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.
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 attached chart is an example of the one you will use to record your rating of each item. You will review the items independently before discussing each item with other committee members. If you identify any problem area in the item during the independent review, you should put a crossmark (✘) in the appropriate column. Crossmarks (✘) will indicate problem areas, and blank spaces or checks (✓) will indicate no problems.

Questions 1–9

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

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

<table>
<thead>
<tr>
<th>Overall Quality</th>
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<tbody>
<tr>
<td>A (Accept)</td>
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<td>AM (Accept with Metadata changes)</td>
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<tr>
<td>AR (Accept as Revised)</td>
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<td>RR (Revise and Re-present, including art)</td>
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<td>D (Delete)</td>
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</table>

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

After the group discussion and possible revision of an item, you may wish to change your overall rating. If so, place a slash (/) through your original rating and give the item a new rating.
### Algebra 1 EOC Item Rating Form

<table>
<thead>
<tr>
<th>Page # of Item</th>
<th>Item ID Number</th>
<th>Measures Benchmark</th>
<th>Adheres to Content Limits</th>
<th>Is Appropriate for Grade</th>
<th>Appropriate Cognitive Complexity (L, M, H)</th>
<th>Estimated Item Difficulty (E, A, C)</th>
<th>Appropriate FCAT Topic</th>
<th>Appropriate Content Focus</th>
<th>Only One Correct Answer</th>
<th>Appropriate MC Options</th>
<th>Overall Rating A/AM/AR/RR/D</th>
<th>Additional Comments</th>
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</tr>
</tbody>
</table>

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

Signature  Date ___________________________ ___________________________
# FCAT 2.0 Mathematics, Algebra 1 EOC, and Geometry EOC Test Design Summary

## Item Types and Numbers

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Item Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>50–55 MC</td>
</tr>
<tr>
<td>4</td>
<td>35–40 MC</td>
</tr>
<tr>
<td></td>
<td>10–15 GR</td>
</tr>
<tr>
<td>5</td>
<td>35–40 MC</td>
</tr>
<tr>
<td></td>
<td>10–15 GR</td>
</tr>
<tr>
<td>6</td>
<td>35–40 MC</td>
</tr>
<tr>
<td></td>
<td>10–15 GR</td>
</tr>
<tr>
<td>7</td>
<td>35–40 MC</td>
</tr>
<tr>
<td></td>
<td>10–15 GR</td>
</tr>
<tr>
<td>8</td>
<td>35–40 MC</td>
</tr>
<tr>
<td></td>
<td>20–25 GR</td>
</tr>
<tr>
<td>Retake</td>
<td>30–35 MC</td>
</tr>
<tr>
<td></td>
<td>20–25 GR</td>
</tr>
<tr>
<td>Alg 1 EOC</td>
<td>30–35 MC</td>
</tr>
<tr>
<td></td>
<td>20–25 FR</td>
</tr>
<tr>
<td>Geometry EOC</td>
<td>30–35 MC</td>
</tr>
<tr>
<td></td>
<td>20–25 FR</td>
</tr>
</tbody>
</table>
**Duration of Tests**

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Duration (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>140</td>
</tr>
<tr>
<td>5</td>
<td>140</td>
</tr>
<tr>
<td>6</td>
<td>120</td>
</tr>
<tr>
<td>7</td>
<td>120</td>
</tr>
<tr>
<td>8</td>
<td>140</td>
</tr>
<tr>
<td>Alg 1 EOC</td>
<td>180</td>
</tr>
<tr>
<td>Geom EOC</td>
<td>180</td>
</tr>
</tbody>
</table>

**Lengths of Tests**

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>50–55</td>
</tr>
<tr>
<td>4</td>
<td>50–55</td>
</tr>
<tr>
<td>5</td>
<td>50–55</td>
</tr>
<tr>
<td>6</td>
<td>50–55</td>
</tr>
<tr>
<td>7</td>
<td>50–55</td>
</tr>
<tr>
<td>8</td>
<td>55–60</td>
</tr>
<tr>
<td>Alg 1 EOC</td>
<td>55–60</td>
</tr>
<tr>
<td>Geom EOC</td>
<td>55–60</td>
</tr>
</tbody>
</table>
**Grade 5 FCAT 2.0 Mathematics Reference Sheet**

### Area

<table>
<thead>
<tr>
<th>Shape</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangle</td>
<td>( A = bh )</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>( A = bh )</td>
</tr>
<tr>
<td>Triangle</td>
<td>( A = \frac{1}{2}bh ) or ( A = (bh) + 2 )</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>( A = \frac{1}{2}h(b_1 + b_2) ) or ( A = h(b_1 + b_2) + 2 )</td>
</tr>
</tbody>
</table>

**KEY**

- \( b \) = base
- \( A \) = area
- \( h \) = height
- \( B \) = area of base
- \( w \) = width
- \( V \) = volume
- \( S.A. \) = surface area

### Volume of Rectangular Prism

\[
V = bhw \quad \text{or} \quad V = Bh
\]

### Surface Area of Rectangular Prism

\[
S.A. = 2bh + 2hw + 2hw
\]

**Customary Conversions**

- 1 foot = 12 inches
- 1 yard = 3 feet
- 1 mile = 5,280 feet
- 1 mile = 1,760 yards
- 1 acre = 43,560 square feet

**Metric Conversions**

- 1 centimeter = 10 millimeters
- 1 meter = 100 centimeters
- 1 meter = 1000 millimeters
- 1 kilometer = 1000 meters

**Time Conversions**

- 1 minute = 60 seconds
- 1 hour = 60 minutes
- 1 day = 24 hours
- 1 week = 7 days
- 1 year = 365 days
- 1 year = 52 weeks

**REW**

- 1 liter = 1000 milliliters
- 1 liter = 1000 cubic centimeters

*Note: Metric numbers with four digits are presented without a comma (e.g., 9960 kilometers). For metric numbers greater than four digits, a space is used instead of a comma (e.g., 12 500 liters).
## Grades 6-8 FCAT 2.0 Mathematics Reference Sheet

### Area

<table>
<thead>
<tr>
<th>Shape</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangle</td>
<td>$A = bh$</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>$A = bh$</td>
</tr>
<tr>
<td>Triangle</td>
<td>$A = \frac{1}{2}bh$</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>$A = \frac{1}{2}h(b_1 + b_2)$</td>
</tr>
<tr>
<td>Circle</td>
<td>$A = \pi r^2$</td>
</tr>
</tbody>
</table>

**KEY**

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

Use $3.14$ or $\frac{22}{7}$ for $\pi$.

### Circumference

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

### Volume/Capacity

<table>
<thead>
<tr>
<th>Shape</th>
<th>Formula</th>
<th>Total Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular Prism</td>
<td>$V = bhw$ or $V = Bh$</td>
<td>$S.A. = 2bh + 2bw + 2hw$ or $S.A. = Ph + 2B$</td>
</tr>
<tr>
<td>Right Circular Cylinder</td>
<td>$V = \pi r^2h$ or $V = Bh$</td>
<td>$S.A. = 2\pi rh + 2\pi r^2$ or $S.A. = 2\pi rh + 2B$</td>
</tr>
<tr>
<td>Right Square Pyramid</td>
<td>$V = \frac{1}{3}Bh$</td>
<td>$S.A. = \frac{1}{2}P\ell + B$</td>
</tr>
<tr>
<td>Right Circular Cone</td>
<td>$V = \frac{1}{3}\pi r^2h$ or $V = \frac{1}{3}Bh$</td>
<td>$S.A. = \frac{1}{2}(2\pi r)\ell + B$</td>
</tr>
</tbody>
</table>

### Other Information

- Sum of the measures of the interior angles of a polygon = $180(n - 2)$
- Measure of an interior angle of a regular polygon = $\frac{180(n - 2)}{n}$
  where: $n$ represents the number of sides
## Grades 6–8 FCAT 2.0 Mathematics Reference Sheet

### Pythagorean theorem

\[
\begin{align*}
\text{a}^2 + \text{b}^2 &= \text{c}^2 \\
\end{align*}
\]

### Simple interest formula

\[
I = p \times r \times t
\]

where \( p \) = principal, \( r \) = rate, \( t \) = time

### Slope-intercept form of a linear equation

\[
y = mx + b
\]

where \( m \) = slope and \( b \) = \( y \)-intercept

### Distance, rate, time formula

\[
d = rt
\]

where \( d \) = distance, \( r \) = rate, \( t \) = time

### Conversions within a System of Measure

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 yard = 3 feet</td>
<td>1 meter = 100 centimeters</td>
</tr>
<tr>
<td>1 mile = 1,760 yards = 5,280 feet</td>
<td>1 kilometer = 1000 meters</td>
</tr>
<tr>
<td>1 acre = 43,560 square feet</td>
<td>1 liter = 1000 milliliters = 1000 cubic centimeters</td>
</tr>
<tr>
<td>1 cup = 8 fluid ounces</td>
<td>1 gram = 1000 milligrams</td>
</tr>
<tr>
<td>1 pint = 2 cups</td>
<td>1 kilogram = 1000 grams</td>
</tr>
<tr>
<td>1 quart = 2 pints</td>
<td>1 minute = 60 seconds</td>
</tr>
<tr>
<td>1 gallon = 4 quarts</td>
<td>1 hour = 60 minutes</td>
</tr>
<tr>
<td>1 pound = 16 ounces</td>
<td>1 year = 52 weeks = 365 days</td>
</tr>
<tr>
<td>1 ton = 2,000 pounds</td>
<td></td>
</tr>
</tbody>
</table>

### Conversions between Systems of Measure

When converting from Customary to Metric, use these approximations.

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

When converting from Metric to Customary, use these approximations.

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

### Temperature conversions between Celsius and Fahrenheit

\[
\begin{align*}
^\circ\text{C} &= \left( ^\circ\text{F} - 32 \right) \div 1.8 \\
^\circ\text{F} &= \left( ^\circ\text{C} \times 1.8 \right) + 32
\end{align*}
\]
### Algebra 1 End-of-Course and Geometry End-of-Course Assessments Reference Sheet

#### Area

<table>
<thead>
<tr>
<th>Shape</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallelogram</td>
<td>$A = bh$</td>
</tr>
<tr>
<td>Triangle</td>
<td>$A = \frac{1}{2}bh$</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>$A = \frac{1}{2}h(b_1 + b_2)$</td>
</tr>
<tr>
<td>Circle</td>
<td>$A = \pi r^2$</td>
</tr>
<tr>
<td>Regular Polygon</td>
<td>$A = \frac{1}{2}aP$</td>
</tr>
</tbody>
</table>

**KEY**

- $b$ = base
- $h$ = height
- $w$ = width
- $d$ = diameter
- $r$ = radius
- $\ell$ = slant height
- $a$ = apothem
- $V$ = volume
- $P$ = perimeter
- $S.A.$ = surface area

### Volume/Capacity

<table>
<thead>
<tr>
<th>Shape</th>
<th>Formula</th>
<th>Total Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular Prism</td>
<td>$V = bwh$ or $V = Bh$</td>
<td>$S.A. = 2bh + 2bw + 2hw$ or $S.A. = Ph + 2B$</td>
</tr>
<tr>
<td>Right Circular Cylinder</td>
<td>$V = \pi r^2h$ or $V = Bh$</td>
<td>$S.A. = 2\pi rh + 2\pi r^2$ or $S.A. = 2\pi rh + 2B$</td>
</tr>
<tr>
<td>Right Square Pyramid</td>
<td>$V = \frac{1}{3}Bh$</td>
<td>$S.A. = \frac{1}{2}P\ell + B$</td>
</tr>
<tr>
<td>Right Circular Cone</td>
<td>$V = \frac{1}{3}\pi r^2h$ or $V = \frac{1}{3}Bh$</td>
<td>$S.A. = \frac{1}{2}(2\pi r)\ell + B$</td>
</tr>
<tr>
<td>Sphere</td>
<td>$V = \frac{4}{3}\pi r^3$</td>
<td>$S.A. = 4\pi r^2$</td>
</tr>
</tbody>
</table>

**Circumference**

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

#### Sum of the measures of the interior angles of a polygon

$\text{Sum} = 180(n-2)$

**Measure of an interior angle of a regular polygon**

$\text{Measure} = \frac{180(n-2)}{n}$

where:

- $n$ represents the number of sides
### Algebra 1 End-of-Course and Geometry End-of-Course Assessments Reference Sheet

#### Slope formula

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

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

#### Distance between two points

$$ P_1(x_1, y_1) \text{ and } P_2(x_2, y_2) $$

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

#### Midpoint between two points

$$ P_1(x_1, y_1) \text{ and } P_2(x_2, y_2) $$

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

#### Quadratic formula

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

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

#### Trigonometric Ratios

- $\sin A^\circ = \frac{\text{opposite}}{\text{hypotenuse}}$
- $\cos A^\circ = \frac{\text{adjacent}}{\text{hypotenuse}}$
- $\tan A^\circ = \frac{\text{opposite}}{\text{adjacent}}$

#### Special Right Triangles

- $60^\circ$ triangle:
  - $\sqrt{3}$ for the side opposite the $60^\circ$ angle.
  - $2\sqrt{3}$ for the side opposite the $30^\circ$ angle.

- $45^\circ$ triangle:
  - $\sqrt{2}$ for each leg.

#### 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

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

Grades 4 and 5

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

There are two types of currency grids for Grades 4 and 5. The five-column grid includes a fixed decimal point for dollars and cents. The four-column grid does not include a decimal point. Both grids have a dollar sign preceding the grid.
A special grid is provided at Grades 4 and 5 for gridding decimal numbers. It is six columns wide with a fixed decimal point in the third column from the left.

Grades 6 and 7

Grades 6 and 7 use a six-column grid that includes the digits 0 through 9 plus two symbols: a decimal point (.) and a fraction bar (/) for gridding fractions.
**Grades 7–8**
Grades 7 (two benchmarks) and 8 use a seven-column grid that includes the digits 0 through 9, plus two symbols: the decimal point (.) and the fraction bar (/), and a seventh column to allow for the negative sign.

![Grid Diagram]

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

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