

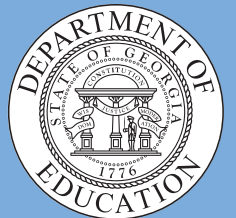
Georgia  
**Milestones**  
Assessment System



**Assessment Guide**  
**Algebra I**



**Assessment Guide**



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## THE GEORGIA MILESTONES ASSESSMENT SYSTEM

The purpose of the Georgia Student Assessment Program is to measure student achievement of the state-adopted content standards and inform efforts to improve teaching and learning. Results of the assessment program are utilized to identify students failing to achieve mastery of content, to provide educators with feedback about instructional practice, and to assist school districts in identifying strengths and weaknesses in order to establish priorities in planning educational programs.

The State Board of Education is required by Georgia law (O.C.G.A. §20-2-281) to adopt assessments designed to measure student achievement relative to the knowledge and skills set forth in the state-adopted content standards. The Georgia Milestones Assessment System (Georgia Milestones) fulfills this requirement and, as a key component of Georgia's Student Assessment Program, is a comprehensive summative assessment program spanning Grade 3 through high school. Georgia Milestones measures how well students have learned the knowledge and skills outlined in the state-adopted content standards in Language Arts, Mathematics, Science, and Social Studies. Students in grades 3 through 8 take an end-of-grade assessment in English Language Arts and Mathematics, while students in grades 5 and 8 also take an end-of-grade assessment in Science and Social Studies. High school students take an end-of-course assessment for each of the ten courses designated by the State Board of Education. In accordance with State Board Rule, Georgia Milestones end-of-course measures serve as the final exams for the specified high school courses.

The main purpose of Georgia Milestones is to inform efforts to improve student achievement by assessing student performance on the standards specific to each course or subject/grade tested. Specifically, Georgia Milestones is designed to provide students and their parents with critical information about the students' achievement and, importantly, their preparedness for the next educational level. The assessment system is a critical informant of the state's accountability measure, the College and Career Ready Performance Index (CCRPI), providing an important gauge about the quality of the educational services and opportunities provided throughout the state. The ultimate goal of Georgia's assessment and accountability system is to ensure that all students are provided the opportunity to engage with high-quality content standards, receive high-quality instruction predicated upon those standards, and are positioned to meet high academic expectations.

Features of the Georgia Milestones Assessment System include:

- technology-enhanced items in all grades and courses;
- open-ended (constructed-response) items in Language Arts and Mathematics (all grades and courses);
- a writing component (in response to passages read by students) at every grade level and course within the Language Arts assessment;
- norm-referenced items in all content areas and courses to complement the criterion-referenced information and to provide a national comparison; and
- a transition to online administration over time, with online administration considered the primary mode of administration and paper/pencil as a backup until the transition is complete.

The primary mode of administration for the Georgia Milestones program is online, with the goal of completing the transition from paper/pencil within five years after the inaugural administration (i.e., the 2014–2015 school year). Paper/pencil test materials (such as Braille) will remain available for students with disabilities who may require them in order to access the assessment.

Georgia Milestones follows guiding principles to help ensure that the assessment system:

- is sufficiently challenging to ensure Georgia students are well positioned to compete with other students across the United States and internationally;
- is intentionally designed across grade levels to send a clear signal of student academic progress and preparedness for the next level, whether it is the next grade level, course, or college or career;
- is accessible to all students, including those with disabilities or limited English proficiency, at all achievement levels;
- supports and informs the state’s educator-effectiveness initiatives, ensuring items and forms are appropriately sensitive to quality instructional practices; and
- accelerates the transition to online administration, allowing—over time—for the inclusion of innovative technology-enhanced items.

## **GEORGIA MILESTONES END-OF-COURSE (EOC) ASSESSMENTS**

As previously mentioned, Georgia law (§20-2-281) mandates that the State Board of Education adopt EOC assessments for core courses to be determined by the Board. An EOC assessment serves as a student’s final exam in the associated course. With educator input and State Board approval, the Georgia Milestones EOC assessments measure student achievement in the following courses: Ninth Grade Literature and Composition, American Literature and Composition, Algebra I, Geometry, Coordinate Algebra, Analytic Geometry, Physical Science, Biology, United States History, and Economics/Business/Free Enterprise.

Any student enrolled in and/or receiving credit for one of the above-mentioned courses, regardless of grade level, is required to take the Georgia Milestones EOC assessment upon completion of that course. This includes middle school students completing a course associated with a Georgia Milestones EOC assessment, regardless of whether they are receiving high school credit. Students enrolling from non-accredited programs are required to take and pass the Georgia Milestones EOC assessment prior to receiving credit for the course.

A student’s final grade in the course will be calculated using the Georgia Milestones EOC assessment as follows (State Board Rule 160-4-2-.13):

- For students enrolled in Grade 9 for the first time before July 1, 2011, the EOC assessment counts as 15% of the final grade.
- For students enrolled in Grade 9 for the first time on or after July 1, 2011, the EOC assessment counts as 20% of the final grade.

Results of the EOC assessments, according to the legislated and identified purposes, must:

- provide a valid measure of student achievement of the state content standards across the full achievement continuum;
- serve as the final exam for each course, contributing 15% or 20% to the student’s final course grade;
- provide a clear signal of each student’s preparedness for the next course and ultimately post-secondary endeavors (college and career);
- allow for the detection of the academic progress made by each student from one assessed course to the next;
- support and inform educator-effectiveness measures; and
- inform state and federal accountability measures at the school, district, and state levels.

Additional uses of the EOC assessments include: (1) certifying student proficiency prior to the awarding of credit for students enrolling from non-accredited private schools, home study programs, or other non-traditional educational centers and (2) allowing eligible students to demonstrate competency without taking the course and earn course credit (e.g., “test out”). In both cases, students are allotted *one* administration.

## ASSESSMENT GUIDE

The Georgia Milestones Algebra I EOC Assessment Guide is provided to acquaint Georgia educators and other stakeholders with the structure of and content assessed by the test. Importantly, this guide is not intended to inform instructional planning. It is essential to note that there are a small number of content standards that are better suited for classroom or individual assessment than for large-scale summative assessment. While those standards are not included in the tests and therefore are not included in this Assessment Guide, the knowledge, concepts, and skills inherent in those standards are often required for the mastery of the standards that are assessed. Failure to attend to all content standards within a course can limit a student’s opportunity to learn and show what he or she knows and can do on the assessment.

The Georgia Milestones Algebra I EOC Assessment Guide is in *no way* intended to substitute for the state-mandated content standards; it is provided to help educators better understand the structure and content of the assessment, *but it is not all-encompassing of the knowledge, concepts, and skills covered in the course or assessed on the test*. The state-adopted content standards and associated standards-based instructional resources, such as the Content Frameworks, should be used to plan instruction. This Assessment Guide can serve as a *supplement* to those resources, in addition to any locally developed resources, **but should not be used in isolation**. In principle, the Assessment Guide is intended to be descriptive of the assessment program and should not be considered all-inclusive. The state-adopted content standards are located at [www.georgiastandards.org](http://www.georgiastandards.org).

## TESTING SCHEDULE

The Georgia Milestones Algebra I EOC assessment is offered during three Main Administrations. Main Administrations are primarily intended to provide an opportunity to assess student achievement at the completion of a course and to serve as the final exam for the associated course as required by State Board Rule. As a result, the EOC assessment should occur as close to the conclusion of the course as possible. Main Administrations can also be utilized to verify credit from a non-accredited school or home schooling. In addition to the Main Administrations, Mid-Month Administrations are provided in order to allow students additional testing opportunities for the various reasons noted below.

Purpose for EOC Assessment	Winter & Spring Main Administrations	Mid-Month Administrations	Summer Main Administration
Completion of Course	Yes	Yes	Yes
Makeup from Previous Administration	Yes	Yes	Yes
Retest	No*	Yes	Yes
Test Out	No	Yes**	Yes
Validation of Credit	Yes	Yes	Yes

\*Winter and Spring Main Administrations cannot be used for the purpose of a retest.

\*\*August, September, and March Mid-Month Administrations as well as the Summer Main Administration can be used for the purpose of a test out.

**Note:** Each district determines a local testing window within the state-designated testing window.

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# TEST STRUCTURE

## DESCRIPTION OF TEST FORMAT AND ORGANIZATION

The Georgia Milestones Algebra I EOC assessment is primarily a criterion-referenced test designed to provide information about how well a student has mastered the state-adopted content standards within the course. Each student will receive one of four Achievement Level designations, depending on how well the student has mastered the course content standards. The four Achievement Level designations are Beginning Learner, Developing Learner, Proficient Learner, and Distinguished Learner. In addition to criterion-referenced information, the Georgia Milestones measures will also include a limited sample of nationally norm-referenced items to provide a signal of how Georgia students are achieving relative to their peers nationally. The norm-referenced information provided is supplementary to the criterion-referenced Achievement Level designation and will not be utilized in any manner other than to serve as a barometer of national comparison. Only the criterion-referenced scores and Achievement Level designations will be utilized in the accountability metrics associated with the assessment program (such as student course grades, student growth measures, educator-effectiveness measures, and the CCRPI).

The Algebra I EOC assessment consists of both operational items (contribute to a student's criterion-referenced and/or norm-referenced score) and field test items (newly written items that are being tried out and do not contribute to the student's score). A subset of the norm-referenced operational items have been verified as aligned to the course content standards by Georgia educators and will also contribute to the criterion-referenced score and Achievement Level designation. The other norm-referenced items will contribute only to the national percentile rank, which is provided as supplemental information.

With the inclusion of the norm-referenced items, students may encounter items for which they have not received direct instruction. These items will not contribute to the students' criterion-referenced Achievement Level designation; only items that align to the course content standards will contribute to the criterion-referenced score. Students should be instructed to try their best should they ask about an item that is not aligned to the content they have learned as part of the course.

The table on the following page outlines the number and types of items included on the Algebra I EOC assessment.

### Algebra I EOC Assessment Design

Description	Number of Items	Points for CR <sup>1</sup> Score	Points for NRT <sup>2</sup> Feedback
CR Selected-Response Items	39	39	0
NRT Selected-Response Items	20 <sup>3</sup>	9 <sup>4</sup>	20
CR Technology-Enhanced Items	1	2	0
CR Constructed-Response Items	2	4	0
CR Extended Constructed-Response Items	1	4	0
CR Field Test Items	10	0	0
<b>Total Items/Points<sup>5</sup></b>	<b>73</b>	<b>58</b>	<b>20</b>

<sup>1</sup>CR—Criterion-Referenced: items aligned to state-adopted content standards

<sup>2</sup>NRT—Norm-Referenced Test: items that will yield a national comparison; may or may not be aligned to state-adopted content standards

<sup>3</sup>Of these items, approximately 9 will contribute to both the CR scores and NRT feedback. The other 11 of these items will contribute to NRT feedback only and will not impact the student's Achievement Level designation, scale score, or grade conversion.

<sup>4</sup>Alignment of national NRT items to course content standards was verified by a committee of Georgia educators. Only approved, aligned NRT items will contribute to a student's CR Achievement Level designation, scale score, and grade conversion score.

<sup>5</sup>Of the 73 total items, 52 items contribute to the CR score, for a total of 58 points; 20 total items contribute to NRT feedback, for a total of 20 points.

The test will be given in two sections. Section 1 is divided into two parts. Students may have up to 85 minutes, per section, to complete Sections 1 and 2. The total estimated testing time for the Algebra I EOC assessment ranges from approximately 120 to 170 minutes. Total testing time describes the amount of time students have to complete the assessment. It does not take into account the time required for the test examiner to complete pre-administration and post-administration activities (such as reading the standardized directions to students). Sections 1 and 2 may be administered on the same day or across two consecutive days based on the district's testing protocols for the EOC measures (in keeping with state guidance).

During the Algebra I EOC assessment, a formula sheet will be available for students to use. There is an example of the formula sheet in the Additional Sample Items section of this guide. Another feature of the Algebra I EOC assessment is that students may use a graphing calculator in Part B of Section 1 and in all of Section 2.



## CONTENT MEASURED

The Algebra I EOC assessment will measure the Algebra I standards that are described at [www.georgiastandards.org](http://www.georgiastandards.org).

The content of the assessment is organized into three groupings, or domains, of standards for the purposes of providing feedback on student performance. A content domain is a reporting category that *broadly* describes and defines the content of the course, as measured by the EOC assessment. The standards for Algebra I are grouped into four domains: Equations, Expressions, Functions, and Algebra Connections to Statistics and Probability. Each domain was created by organizing standards that share similar content characteristics. The content standards describe the level of expertise that Algebra I educators should strive to develop in their students. Educators should refer to the content standards for a full understanding of the knowledge, concepts, and skills subject to be assessed on the EOC assessment.

The approximate proportional number of points associated with each domain is shown in the following table. A range of cognitive levels will be represented on the Algebra I EOC assessment. Educators should always use the content standards when planning instruction.

**Algebra I: Domain Structures and Content Weights**

Domain	Standard		Approximate Weight
Equations	MGSE9-12.N.Q.1a MGSE9-12.N.Q.1b MGSE9-12.N.Q.1c MGSE9-12.N.Q.2 MGSE9-12.N.Q.3 MGSE9-12.A.CED.1 MGSE9-12.A.CED.2 MGSE9-12.A.CED.3 MGSE9-12.A.CED.4	MGSE9-12.A.REI.1 MGSE9-12.A.REI.3 MGSE9-12.A.REI.4a MGSE9-12.A.REI.4b MGSE9-12.A.REI.5 MGSE9-12.A.REI.6 MGSE9-12.A.REI.10 MGSE9-12.A.REI.11 MGSE9-12.A.REI.12	30%
Expressions	MGSE9-12.N.RN.2 MGSE9-12.N.RN.3 MGSE9-12.A.SSE.1a MGSE9-12.A.SSE.1b	MGSE9-12.A.SSE.2 MGSE9-12.A.SSE.3a MGSE9-12.A.SSE.3b MGSE9-12.A.APR.1	20%

Domain	Standard		Approximate Weight
Functions	MGSE9-12.F.IF.1 MGSE9-12.F.IF.2 MGSE9-12.F.IF.3 MGSE9-12.F.IF.4 MGSE9-12.F.IF.5 MGSE9-12.F.IF.6 MGSE9-12.F.IF.7a MGSE9-12.F.IF.7e MGSE9-12.F.IF.8a MGSE9-12.F.IF.9	MGSE9-12.F.BF.1a MGSE9-12.F.BF.2 MGSE9-12.F.BF.3 MGSE9-12.F.LE.1a MGSE9-12.F.LE.1b MGSE9-12.F.LE.1c MGSE9-12.F.LE.2 MGSE9-12.F.LE.3 MGSE9-12.F.LE.5	35%
Algebra Connections to Statistics and Probability	MGSE9-12.S.ID.1 MGSE9-12.S.ID.2 MGSE9-12.S.ID.3 MGSE9-12.S.ID.5 MGSE9-12.S.ID.6a	MGSE9-12.S.ID.6c MGSE9-12.S.ID.7 MGSE9-12.S.ID.8 MGSE9-12.S.ID.9	15%

## ITEM TYPES

The Algebra I EOC assessment consists of selected-response, technology-enhanced, constructed-response, extended constructed-response, and extended writing-response items.

A selected-response item, sometimes called a multiple-choice item, is defined as a question, problem, or statement that appears on a test followed by several answer choices, sometimes called options or response choices. The incorrect choices, called distractors, usually reflect common errors. The student’s task is to choose, from the alternatives provided, the best answer to the question posed in the stem (the question). The Algebra I selected-response items will have four answer choices. All norm-referenced items will be selected-response.

A technology-enhanced item is an innovative way to measure student skills and knowledge using scaffolding within a multi-step process. For Algebra I there are two specific types of technology-enhanced items being used—a multiple-select item and a multiple-part item. In multiple-select items, the student is asked to pick two or three correct responses from five or six possible answer options. In multiple-part items, the student responds to a two-part item that combines multiple-choice and/or multiple-select. For these item types, the student selects the responses from the choices provided or writes a response. A student receives two points for selecting all correct answers or partial credit is awarded for special combinations.

A constructed-response item asks a question and solicits the student to provide a response he or she constructs on his or her own, as opposed to selecting from options provided. The constructed-response items on the EOC assessments will be worth two points. Partial credit may be awarded if part of the response is correct.

An extended constructed-response item is a specific type of constructed-response item that elicits a longer, more detailed response from the student than a two-point constructed-response item does. The extended constructed-response items on the EOC assessments will be worth four points. Partial credit may be awarded if part of the response is correct.

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## DEPTH OF KNOWLEDGE DESCRIPTORS

Items found on the Georgia Milestones assessments, including the Algebra I EOC assessment, are developed with a particular emphasis on cognitive complexity or Depth of Knowledge (DOK). DOK is measured on a scale of 1 to 4 and refers to the level of cognitive demand required to complete a task (or in this case, an assessment item). The higher the level, the *more complex* the item; however, higher levels do not necessarily mean *more difficult* items. For instance, a question can have a low DOK but a medium or even high difficulty level. Conversely, a DOK 4 question may have a low difficulty level but still require a great deal of cognitive thinking (e.g., analyzing and synthesizing information instead of just recalling it). The following descriptions and table show the expectations of the four DOK levels in greater detail.

**Level 1** (Recall of Information) generally requires students to identify, list, or define, often asking them to recall who, what, when, and where. Consequently, this level usually asks students to recall facts, terms, concepts, and trends and may ask them to identify specific information contained in documents, excerpts, quotations, maps, charts, tables, graphs, or illustrations. Items that require students to “describe” and/or “explain” could be classified at Level 1 or Level 2, depending on what is to be described and/or explained. A Level 1 “describe” and/or “explain” would require students to recall, recite, or reproduce information.

**Level 2** (Basic Reasoning) includes the engagement of some mental processing beyond recalling or reproducing a response. A Level 2 “describe” and/or “explain” would require students to go beyond a description or explanation of recalled information to describe and/or explain a result or “how” or “why.”

**Level 3** (Complex Reasoning) requires reasoning, using evidence, and thinking on a higher and more abstract level than Level 1 and Level 2. Students will go beyond explaining or describing “how and why” to justifying the “how and why” through application and evidence. Level 3 questions often involve making connections across time and place to explain a concept or “big idea.”

**Level 4** (Extended Reasoning) requires the complex reasoning of Level 3 with the addition of planning, investigating, applying significant conceptual understanding, and/or developing that will most likely require an extended period of time. Students should be required to connect and relate ideas and concepts *within* the content area or *among* content areas in order to be at this highest level. The distinguishing factor for Level 4 would be a show of evidence (through a task, a product, or an extended response) that the cognitive demands have been met.

The following table identifies skills that students will need to demonstrate at each DOK level, along with question cues appropriate for each level.

Level	Skills Demonstrated	Question Cues
<p style="text-align: center;">Level 1 Recall of Information</p>	<ul style="list-style-type: none"> <li>• Make observations</li> <li>• Recall information</li> <li>• Recognize formulas, properties, patterns, processes</li> <li>• Know vocabulary, definitions</li> <li>• Know basic concepts</li> <li>• Perform one-step processes</li> <li>• Translate from one representation to another</li> <li>• Identify relationships</li> </ul>	<ul style="list-style-type: none"> <li>• Find</li> <li>• List</li> <li>• Define</li> <li>• Identify; label; name</li> <li>• Choose; select</li> <li>• Compute; estimate</li> <li>• Express</li> <li>• Read from data displays</li> <li>• Order</li> </ul>
<p style="text-align: center;">Level 2 Basic Reasoning</p>	<ul style="list-style-type: none"> <li>• Apply learned information to abstract and real-life situations</li> <li>• Use methods, concepts, theories in abstract and real-life situations</li> <li>• Perform multi-step processes</li> <li>• Solve problems using required skills or knowledge (requires more than habitual response)</li> <li>• Make a decision about how to proceed</li> <li>• Identify and organize components of a whole</li> <li>• Extend patterns</li> <li>• Identify/describe cause and effect</li> <li>• Recognize unstated assumptions, make inferences</li> <li>• Interpret facts</li> <li>• Compare or contrast simple concepts/ideas</li> </ul>	<ul style="list-style-type: none"> <li>• Apply</li> <li>• Calculate; solve</li> <li>• Complete</li> <li>• Describe</li> <li>• Explain how; demonstrate</li> <li>• Construct data displays</li> <li>• Construct; draw</li> <li>• Analyze</li> <li>• Extend</li> <li>• Connect</li> <li>• Classify</li> <li>• Arrange</li> <li>• Compare; contrast</li> </ul>

Level	Skills Demonstrated	Question Cues
<p style="text-align: center;">Level 3 Complex Reasoning</p>	<ul style="list-style-type: none"> <li>• Solve an open-ended problem with more than one correct answer</li> <li>• Create a pattern</li> <li>• Relate knowledge from several sources</li> <li>• Draw conclusions</li> <li>• Make predictions</li> <li>• Translate knowledge into new contexts</li> <li>• Assess value of methods, concepts, theories, processes, formulas</li> <li>• Make choices based on a reasoned argument</li> <li>• Verify the value of evidence, information, numbers, data</li> </ul>	<ul style="list-style-type: none"> <li>• Plan; prepare</li> <li>• Predict</li> <li>• Create; design</li> <li>• Generalize</li> <li>• Justify; explain why; support; convince</li> <li>• Assess</li> <li>• Rank; grade</li> <li>• Test; judge</li> <li>• Recommend</li> <li>• Select</li> <li>• Conclude</li> </ul>
<p style="text-align: center;">Level 4 Extended Reasoning</p>	<ul style="list-style-type: none"> <li>• Analyze and synthesize information from multiple sources</li> <li>• Apply mathematical models to illuminate a problem or situation</li> <li>• Design a mathematical model to inform and solve a practical or abstract situation</li> <li>• Combine and synthesize ideas into new concepts</li> </ul>	<ul style="list-style-type: none"> <li>• Design</li> <li>• Connect</li> <li>• Synthesize</li> <li>• Apply concepts</li> <li>• Analyze</li> <li>• Create</li> <li>• Prove</li> </ul>

## SCORES

Selected-response items and technology-enhanced items are machine scored. However, the Algebra I EOC assessment consists of selected-response, technology-enhanced, constructed-response, and extended constructed-response items. Items that are not machine scored—i.e., constructed-response, extended constructed-response, and extended writing-response items—require rubrics for manual scoring.

Students will receive a scale score and an Achievement Level designation based on total test performance. In addition, students will receive information on how well they performed at the domain level. Students will also receive a norm-referenced score based on a set of norm-referenced items included within the test; this score will allow comparison to a national norming group of students.

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## EXAMPLE ITEMS

Example items, which are representative of the applicable DOK levels across various Algebra I content domains, are provided.

All example and sample items contained in this guide are the property of the Georgia Department of Education.

### Example Item 1

**Selected-Response:** 1 point

**DOK Level:** 1

**Algebra I Content Domain:** Expressions

**Standard:** MGSE9-12.N.RN.2. Rewrite expressions involving radicals. (i.e., simplify and/or use the operations of addition, subtraction, and multiplication, with radicals within expressions limited to square roots).

Which number is equivalent to  $5\sqrt{8} \cdot 3\sqrt{4}$ ?

- A.  $15\sqrt{2}$
- B.  $60\sqrt{2}$
- C.  $30\sqrt{3}$
- D.  $60\sqrt{3}$

**Correct Answer:** B

**Explanation of Correct Answer:** The correct answer is choice (B)  $60\sqrt{2}$ . The terms are combined. Choices (A), (C), and (D) are incorrect because the radicals were not simplified correctly to be equivalent to the given expression.

**Example Item 2****Selected-Response:** 1 point**DOK Level:** 2**Algebra I Content Domain:** Functions

**Standard:** MGSE9-12.F.BF.2. Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.

**The first term in an arithmetic sequence is 5. The fourth term in the sequence is  $-4$ . The tenth term is  $-22$ .**

**Which function can be used to find the  $n$ th term of the arithmetic sequence?**

- A.  $f(n) = -n$
- B.  $f(n) = n + 4$
- C.  $f(n) = -3n + 8$
- D.  $f(n) = \frac{1}{2}(n + 5) + 2$

**Correct Answer:** C

**Explanation of Correct Answer:** The correct answer is choice (C)  $f(n) = -3n + 8$ . Since the sequence is changing at a constant rate and it is given that  $f(1) = 5$  and  $f(4) = -4$ , it can be determined that in 3 terms, the value changes by  $-9$  or that each single term changes by  $-3$ . The function will be in the form  $f(x) = -3n + b$ . Substituting  $f(1)$  can determine that  $5 = -3(1) + b$  to reveal that  $b = 8$ . Choice (A) is incorrect because it is true for  $f(4)$  but not  $f(1)$ . Choice (B) is incorrect because it is true for  $f(1)$  but not  $f(4)$ . Choice (D) is incorrect because it is true for  $f(1)$  but not  $f(4)$ .



**Example Item 3****Selected-Response:** 1 point**DOK Level:** 3**Algebra I Content Domain: Equations**

**Standard:** MGSE9-12.A.CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e., a solution) or not possible (i.e., a non-solution) under the established constraints.

Jose wants to spend no more than \$30 on apples and grapes for the month. Apples cost \$1.50 per pound, and grapes cost \$2 per pound. Jose also wants his monthly caloric intake from apples and grapes to be greater than 2000 calories. He determines that 1 pound of apples has 200 calories and 1 pound of grapes has 300 calories.

Let  $a$  represent the number of pounds of apples and  $g$  represent the number of pounds of grapes. Which system of inequalities can be used to determine the number of pounds of apples and the number of pounds of grapes that Jose can buy for a month?

- A. 
$$\begin{cases} 1.5a + 2g \geq 30 \\ 200a + 300g > 2000 \end{cases}$$
- B. 
$$\begin{cases} 1.5a + 2g \leq 30 \\ 200a + 300g > 2000 \end{cases}$$
- C. 
$$\begin{cases} 2a + 1.5g \leq 30 \\ 300a + 200g > 2000 \end{cases}$$
- D. 
$$\begin{cases} 2a + 1.5g \geq 30 \\ 200a + 300g < 2000 \end{cases}$$

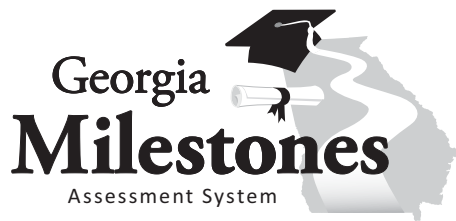
**Correct Answer:** B

**Explanation of Correct Answer:** The correct answer is choice (B)  $1.5a + 2g \leq 30$  and  $200a + 300g > 2000$ . This response correctly assigns the costs of the fruit and recognizes that the sum must be less than or equal to \$30. It also correctly assigns the calories of the fruit and recognizes that this total should be greater than 2,000 calories. Errors made while solving this item represent misunderstandings of how to represent the context in linear inequalities. Choice (A) represents a case where Jose is spending \$30 or more on the fruit. Choice (C) represents confusion over how to assign costs and calories to the proper types of fruit. Choice (D) represents confusion over how to assign the costs to the proper types of fruit, as well as misunderstandings of how to represent the context in linear inequalities.

## ADDITIONAL SAMPLE ITEMS

This section has two parts. The first part is a set of 13 sample items for Algebra I. The second part contains a table that shows for each item the standard assessed, the DOK level, the correct answer (key), and a rationale/explanation about the key and distractors. The sample items can be utilized as a mini test to familiarize students with the item formats found on the assessment.

**All example and sample items contained in this guide are the property of the Georgia Department of Education.**



# Algebra 1 Formula Sheet

Below are the formulas you may find useful as you take the test. However, you may find that you do not need to use all of the formulas. You may refer to this formula sheet as often as needed.

<p style="text-align: center;"><b><u>Linear Formulas</u></b></p> <p><b>Slope Formula</b></p> $m = \frac{y_2 - y_1}{x_2 - x_1}$ <p><b>Linear Equations</b></p> <p>Slope-intercept Form: <math>y = mx + b</math></p> <p>Point-slope Form: <math>y - y_1 = m(x - x_1)</math></p> <p>Standard Form: <math>Ax + By = C</math></p> <p><b>Arithmetic Sequence Formulas</b></p> <p>Recursive: <math>a_n = a_{n-1} + d</math></p> <p>Explicit: <math>a_n = a_1 + (n - 1)d</math></p> <p style="text-align: center;"><b><u>Exponential Formulas</u></b></p> <p><b>Exponential Equation</b></p> $y = ab^x$ <p><b>Geometric Sequence Formulas</b></p> <p>Recursive: <math>a_n = r(a_{n-1})</math></p> <p>Explicit: <math>a_n = a_1 \cdot r^{n-1}</math></p> <p><b>Compound Interest Formula</b></p> $A = P\left(1 + \frac{r}{n}\right)^{nt}$ <p style="text-align: center;"><b><u>Quadratic Formulas</u></b></p> <p><b>Quadratic Equations</b></p> <p>Standard Form: <math>y = ax^2 + bx + c</math></p> <p>Vertex Form: <math>y = a(x - h)^2 + k</math></p> <p><b>Quadratic Formula</b></p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	<p><b>Average Rate of Change</b></p> <p>The change in the <math>y</math>-value divided by the change in the <math>x</math>-value for two distinct points on a graph.</p> <p style="text-align: center;"><b><u>Statistics Formulas</u></b></p> <p><b>Mean</b></p> $\bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$ <p><b>Interquartile Range</b></p> $IR = Q_3 - Q_1$ <p>The difference between the first quartile and third quartile of a set of data.</p> <p><b>Mean Absolute Deviation</b></p> $\frac{\sum_{i=1}^n  x_i - \bar{x} }{n}$ <p>The sum of the distances between each data value and the mean, divided by the number of data values.</p>
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You can find mathematics formula sheets on the Georgia Milestones webpage at <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>.

### Item 1

**Selected-Response:** 1 point

**Which set of data points could be modeled by a line of best fit that is a decreasing linear function?**

- A.  $\{(0, 0), (1, 8), (2, 15), (3, 22), (4, 30)\}$
- B.  $\{(0, 5), (1, 6), (2, 10), (3, 16), (4, 28)\}$
- C.  $\{(0, 50), (1, 42), (2, 33), (3, 25), (4, 16)\}$
- D.  $\{(0, 64), (1, 60), (2, 52), (3, 39), (4, 22)\}$

### Item 2

**Selected-Response:** 1 point

**Use these functions to answer this question.**

$$P(x) = x^2 - x - 6$$

$$Q(x) = x - 3$$

**What is  $P(x) - Q(x)$ ?**

- A.  $x^2 - 3$
- B.  $x^2 - 9$
- C.  $x^2 - 2x - 3$
- D.  $x^2 - 2x - 9$

**Item 3****Selected-Response:** 1 point

The total daily expenses to operate Sheila's pie bakery are the cost of salaries and ingredients. Sheila has four employees, and she pays each employee a daily rate. On average, it costs the same amount of money to make each pie. This expression shows the total daily expenses for Sheila's bakery to make  $x$  pies.

$$4(75) + \$0.50x$$

**What does the term  $4(75)$  represent?**

- A. the amount of money Sheila must pay her employees per day
- B. the number of pies Sheila must sell per day
- C. the total cost of expenses per pie
- D. the amount of money customers pay per pie

**Item 4****Selected-Response:** 1 point**Which function represents the data in the table?**

$x$	3	6	10	15
$y$	2.5	4	6	8.5

- A.  $f(x) = 2x + 1$
- B.  $f(x) = \frac{x}{2} - 1$
- C.  $f(x) = 2x - 1$
- D.  $f(x) = \frac{x}{2} + 1$

**Item 5**

Selected-Response: 1 point

What is the solution to this system of equations?

$$x - 3y = 1$$

$$x - 2y = 6$$

- A.  $(-4, -5)$
- B.  $(-2, -1)$
- C.  $(4, 1)$
- D.  $(16, 5)$

**Item 6**

Selected-Response: 1 point

Information about the costs of three catering companies is shown in this table.

**Catering Company Costs**

<b>Acme Catering Company</b>	<b>Best Foods Company</b>	<b>Creative Catering Company</b>
\$6 per person plus a flat \$100 time and equipment charge	\$8 per person plus a flat \$40 time and equipment charge	\$10 per person charge with no other fees

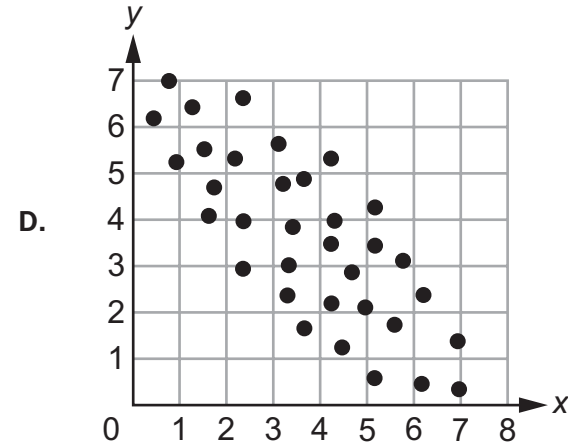
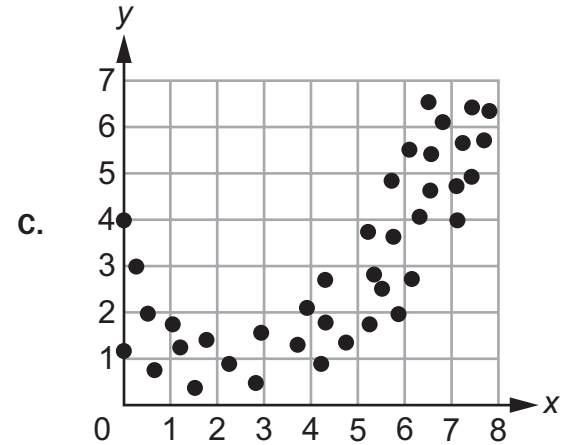
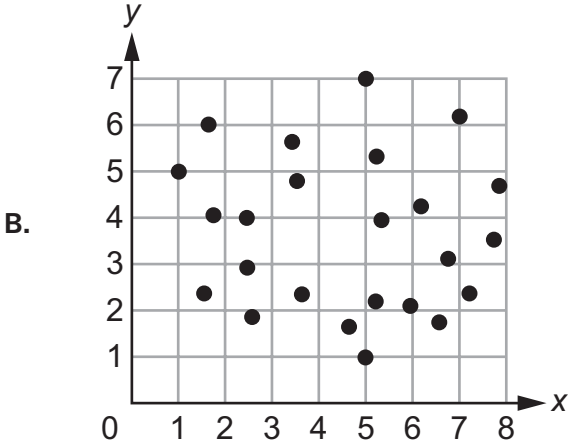
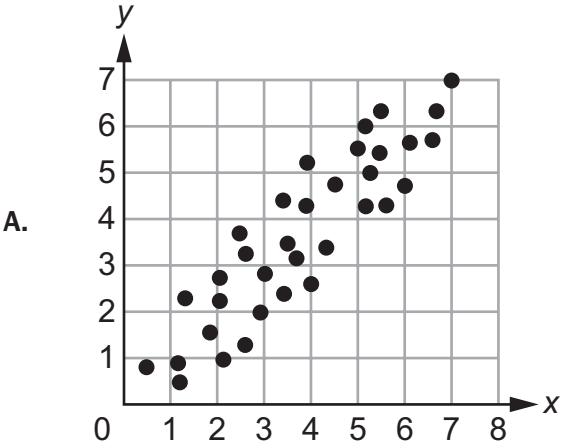
Gavin can spend no more than \$300 on the catering for an event. What is the greatest number of people that Gavin can have at his event without spending more than \$300 on catering?

- A. 30
- B. 32
- C. 33
- D. 37

Item 7

Selected-Response: 1 point

Which set of data could be BEST modeled by a quadratic function?



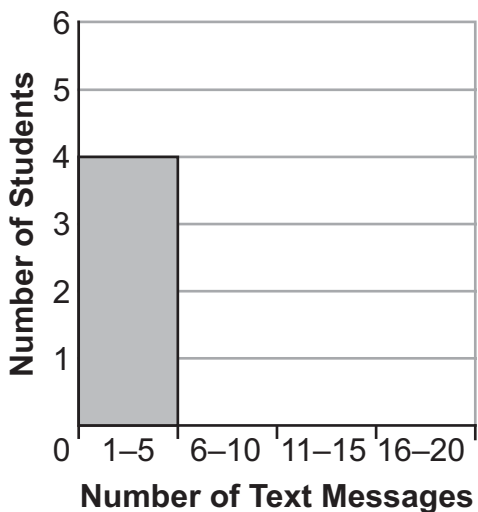
### Item 8

Selected-Response: 1 point

This list shows the number of text messages each student in a group sent in one day.

16, 2, 8, 5, 3, 20,  
15, 4, 9, 16, 19, 17

The students are creating this histogram to show their data.



What should be the height of the bar for 6–10 text messages?

- A. 1
- B. 2
- C. 4
- D. 5



**Item 9**

**Multi-Select Technology-Enhanced:** 2 points

The set of ordered pairs shown represents a function,  $f$ .

$$\{(-5, 3), (4, 9), (3, -2), (0, 6)\}$$

Select **THREE** ordered pairs that could be added to the set that would allow  $f$  to remain a function.

- A.  $(-3, -2)$
- B.  $(4, 0)$
- C.  $(0, -1)$
- D.  $(1, 6)$
- E.  $(2, 3)$
- F.  $(-5, 9)$

**Item 10**

**Multi-Part Technology-Enhanced:** 2 points

A quadratic function is shown.

$$f(x) = x^2 + 8x + 15$$

**Part A**

What is the factored form of  $f(x)$  that reveals the zeros of the function?

- A.  $f(x) = (x + 4)(x + 2)$
- B.  $f(x) = (x + 3)(x + 5)$
- C.  $f(x) = (x + 2)(x + 6)$
- D.  $f(x) = (x + 1)(x + 15)$

**Part B**

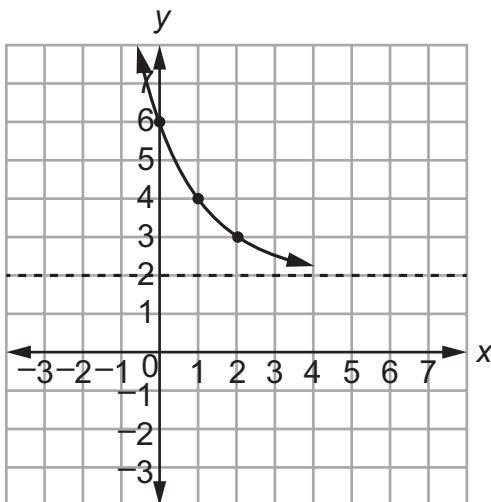
What is the equivalent form of  $f(x)$  that reveals the minimum value of the function?

- A.  $f(x) = (x + 4)^2 - 1$
- B.  $f(x) = (x + 3)^2$
- C.  $f(x) = (x + 2)^2 + 3$
- D.  $f(x) = (x + 1)^2 + 8$

**Item 11**

**Multi-Part Technology-Enhanced:** 2 points

The graph of the exponential function  $f(x) = 4(0.5)^x + 2$  is shown.



**Part A**

Which function has the same end behavior as  $f(x)$  for large, positive values of  $x$ ?

- A.  $g(x) = 4(1.1)^x + 3$
- B.  $g(x) = 0.5(1.1)^x + 2$
- C.  $g(x) = 4(0.8)^x + 3$
- D.  $g(x) = 0.5(0.8)^x + 2$

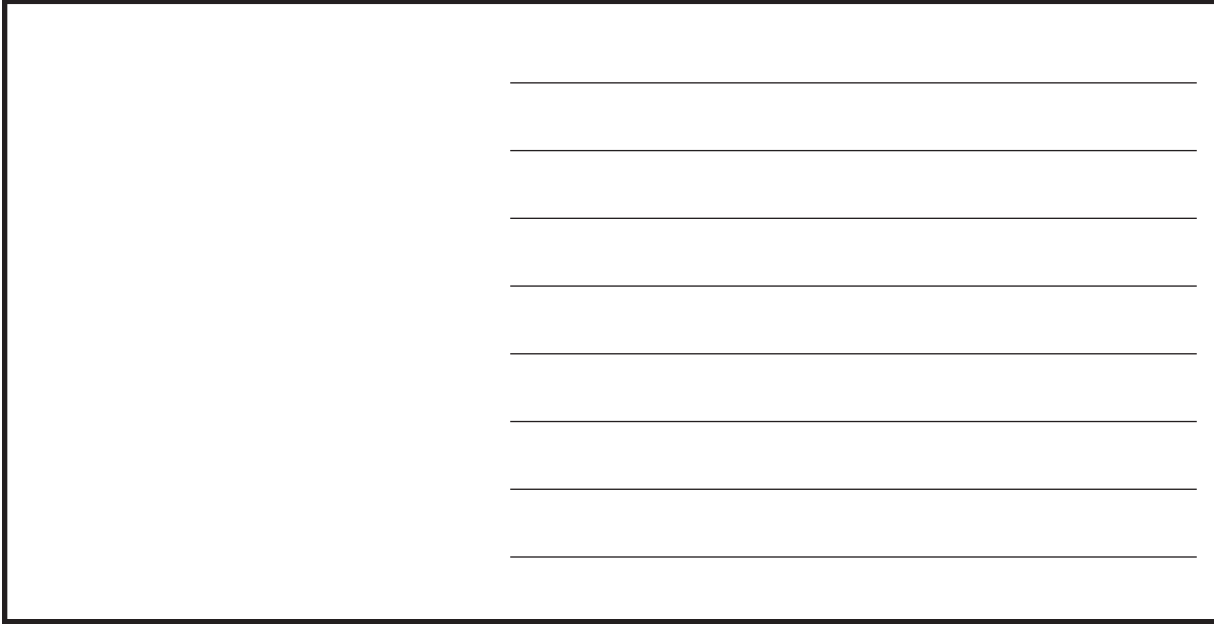
**Part B**

Which function's graph has a y-intercept of 1?

- A.  $h(x) = 5(2)^x$
- B.  $h(x) = 5(0.5)^x + 0.5$
- C.  $h(x) = (0.5)^x + 1$
- D.  $h(x) = 0.5(2)^x + 0.5$

**Item 12****Constructed-Response:** 2 points

Solve the inequality  $-\frac{x}{4} < \frac{x+2}{3}$  for  $x$ . Show or explain how you found your answer. Write your answer in the space provided.



A large rectangular box with a black border, intended for the student's response. It contains eight horizontal lines for writing.

### Item 13

**Extended Constructed-Response:** 4 points

The student council makes an initial investment in a savings account that earns interest. The value of the savings account after  $m$  months is determined by the function  $v(m) = 2,000(1.005)^m$ . The student council also has a checking account that has a value after  $m$  months that is determined by the function  $c(m) = 250 + 100m$ .

**Part A** What is the interest rate of the savings account? Write your answer in the space provided.

When the student council has \$2,450 in its checking account, it will purchase new computers for the library.

**Part B** After how many months will the student council purchase new computers for the library? Write your answer in the space provided.

**Part C** How much money will be in the student council's savings account when they purchase the new computers? Explain your reasoning. Write your answer in the space provided.

<b>Part A</b> _____
<b>Part B</b> _____
<b>Part C</b> _____ _____ _____ _____ _____ _____ _____ _____

## ADDITIONAL SAMPLE ITEM KEYS

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
1	MGSE9-12S.ID.6a	1	C	The correct answer is choice (C) $\{(0, 50), (1, 42), (2, 33), (3, 25), (4, 16)\}$ . This set of data points is the only one from the list that could be modeled by a decreasing linear function, which has a negative value for $a$ in the linear function formula: $f(x) = ax + b$ . Choice (A) is incorrect because the data points correspond to an increasing linear function. Choice (B) is incorrect because the data points correspond to an increasing nonlinear function. Choice (D) is incorrect because the data points correspond to a nonlinear function.
2	MGSE9-12A.APR.1	2	C	The correct answer is choice (C) $x^2 - 2x - 3$ . This indicates a correct calculation of $P(x) - Q(x) = x^2 - x - 6 - (x - 3) = x^2 - x - 6 - x + 3 = x^2 - 2x - 3$ . Choice (A) is incorrect due to a sign error on the term $x$ . Choice (B) is incorrect due to adding $P(x)$ and $Q(x)$ . Choice (D) is incorrect due to a sign error on the number 3.
3	MGSE9-12A.SSE.1a	2	A	The correct answer is choice (A) The amount of money Sheila must pay her employees per day. The 4 represents the number of employees and the 75 represents the daily rate she pays each employee. Choice (B) is incorrect because the number of pies Sheila must sell per day is represented by $x$ . Choice (C) is incorrect because the total cost of expenses per pie is represented by the value of the entire expression. Choice (D) is incorrect because the amount of money customers pay per pie is not represented in the expression.
4	MGSE9-12F.BF.1	2	D	The correct answer is choice (D) $f(x) = \frac{x}{2} + 1$ . When the $x$ -values in the table are substituted for $x$ in this function, the results are equal to the corresponding $y$ -values. Choice (A) is incorrect because it indicates multiplication of 2 and $x$ instead of division of $x$ by 2. Choice (B) is incorrect because it indicates subtraction of 1 instead of addition of 1. Choice (C) is incorrect because it indicates multiplication of 2 and $x$ instead of division of $x$ by 2 and indicates subtraction of 1 instead of addition of 1.

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
5	MGSE9-12A.REI.6	2	D	The correct answer is choice (D) (16, 5). When the values of the coordinate pair are substituted into the system of equations, both sides are equal for both equations. As such, the coordinate pair represents a solution to the system of equations. Choice (A) is incorrect because the values of the coordinate pair, when substituted into the system of equations, result in an incorrect solution for the first equation. Choices (B) and (C) are incorrect because the values of the coordinate pairs, when substituted into the system of equations, result in incorrect solutions for the second equation.
6	MGSE9-12A.CED.1	3	C	The correct answer is choice (C) 33. At \$6 per person, and with a \$100 flat service charge added, Acme Catering Company can provide services for 33 people at a cost of \$298. Choice (A) is incorrect because it is the number from the Creative Catering Company, but not the largest number possible. Choice (B) is incorrect because it is the number from the Best Foods Company, but not the largest number possible. Choice (D) is incorrect because the student selects the highest number without basing the response on the context provided.
7	MGSE9-12S.ID.6a	2	C	The correct answer is choice (C). The data in the graph represent a quadratic trend. The graphs in (A) and (D) represent a correlation to linear trends. The graph in (B) represents data with no clear correlation.
8	MGSE9-12S.ID.1	2	B	The correct answer is choice (B) 2. Only 2 students sent 6–10 text messages. Choice (A) is incorrect because it corresponds to the number of students that sent 11–15 text messages. Choice (C) is incorrect because it corresponds to the number of students that sent 1–5 text messages. Choice (D) is incorrect because it corresponds to the number of students that sent 16–20 text messages.
9	MGSE9-12.F.IF.1	2	A/D/E	The correct answers are choices (A), (D), and (E). Choices (B), (C), and (F) are incorrect because each has the same $x$ -value as an ordered pair already in the function. If any of these values were added, the set would no longer represent a function because there would one $x$ -value with two different $y$ -values.

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
10	MGSE9-12.A.SSE.3	2	Part A: B Part B: A	Part A: The correct answer is choice (B) $f(x) = (x + 3)(x + 5)$ . When multiplied, $(x + 3)(x + 5) = x^2 + 8x + 15$ . Choice (A) is incorrect because $(x + 4)(x + 2) = x^2 + 6x + 8$ . Choice (C) is incorrect because $(x + 2)(x + 6) = x^2 + 8x + 12$ . Choice (D) is incorrect because $(x + 1)(x + 15) = x^2 + 16x + 15$ . Part B: The correct answer is choice (A) $f(x) = (x + 4)^2 - 1$ . When multiplied, $(x + 4)^2 - 1 = x^2 + 8x + 15$ . Choice (B) is incorrect because $(x + 3)^2 = x^2 + 6x + 9$ . Choice (C) is incorrect because $(x + 2)^2 + 3 = x^2 + 4x + 7$ . Choice (D) is incorrect because $(x + 1)^2 + 8 = x^2 + 2x + 9$ .
11	MGSE9-12.F.IF.7e	2	Part A: D Part B: D	Part A: The correct answer is choice (D) $g(x) = 0.5(0.8)^x + 2$ . As $x$ increases to infinity, $y$ approaches 2, and as $x$ decreases to negative infinity, $y$ increases to infinity. Choice (A) is incorrect because as $x$ increases to infinity, $y$ increases to infinity, and as $x$ decreases to negative infinity, $y$ approaches 3. Choice (B) is incorrect because as $x$ increases to infinity, $y$ increases to infinity, and as $x$ decreases to negative infinity, $y$ approaches 2. Choice (C) is incorrect because as $x$ increases to infinity, $y$ approaches 3 instead of 2. Part B: The correct answer is choice (D) $g(x) = 0.5(2)^x + 0.5$ . Choice (A) is incorrect because the $y$ -intercept is 5. Choice (B) is incorrect because the $y$ -intercept is 5.5. Choice (C) is incorrect because the $y$ -intercept is 2.
12	MGSE9-12A.REI.3	3	N/A	See scoring rubric and exemplar responses beginning on page 32.
13	MGSE9-12F.LE.5	3	N/A	See scoring rubric and exemplar responses beginning on page 34.

## EXAMPLE SCORING RUBRICS AND EXEMPLAR RESPONSES

### Item 12

#### Scoring Rubric

Points	Rationale
2	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a complete understanding of solving inequalities.</li> <li>• The response is correct and complete.</li> <li>• The response shows the application of a reasonable and relevant strategy.</li> <li>• Mathematical ideas are expressed coherently in the response, which is clear, complete, logical, and fully developed.</li> </ul>
1	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a partial understanding of solving inequalities.</li> <li>• The response is mostly correct but contains either a computation error or an unclear or incomplete explanation.</li> <li>• The response shows the application of a relevant strategy, though the strategy may be only partially applied or may remain unexplained.</li> <li>• Mathematical ideas are expressed only partially in the response.</li> </ul>
0	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates limited to no understanding of solving inequalities.</li> <li>• The response is incorrect.</li> <li>• The response shows no application of a strategy.</li> <li>• Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding.</li> </ul>



## Item 12

## Exemplar Response

Points Awarded	Response
2	$x > -\frac{8}{7}$ <p><b>AND</b></p> <p>First I multiplied both sides by 12 to get <math>-3x &lt; 4(x + 2)</math>, then I distributed the 4 to get <math>-3x &lt; 4x + 8</math>. Then I added <math>3x</math> to both sides and subtracted 8 from both sides to get <math>-8 &lt; 7x</math>. Then I divided by 7 to get <math>-\frac{8}{7} &lt; x</math> or <math>x &gt; -\frac{8}{7}</math></p> <p><i>Or other valid explanation.</i></p>
1	$x > -\frac{8}{7}$ <p><i>with no explanation or an incorrect explanation</i></p> <p><b>OR</b></p> <p><i>an explanation that contains a computation error but contains the correct process</i></p>
0	<p><i>Response is irrelevant, inappropriate, or not provided.</i></p>

## Item 13

## Scoring Rubric

Points	Rationale
4	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a complete understanding of interpreting parameters for linear and exponential functions in context.</li> <li>• The response is correct and complete.</li> <li>• The response shows the application of a reasonable and relevant strategy.</li> <li>• Mathematical ideas are expressed coherently in the response, which is clear, complete, logical, and fully developed.</li> </ul>
3	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a nearly complete understanding of interpreting parameters for linear and exponential functions in context.</li> <li>• The response is mostly correct but contains either a computation error or an unclear or incomplete explanation.</li> <li>• The response shows the application of a relevant strategy, though the strategy may be only partially applied or may remain unexplained.</li> <li>• Mathematical ideas are expressed only partially in the response.</li> </ul>
2	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a partial understanding of interpreting parameters for linear and exponential functions in context.</li> <li>• The response is only partially correct.</li> <li>• The response shows the application of a relevant strategy, though the strategy may be only partially applied or may remain unexplained.</li> <li>• Mathematical ideas are expressed only partially in the response.</li> </ul>
1	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates a minimal understanding of interpreting parameters for linear and exponential functions in context.</li> <li>• The response is only minimally correct.</li> <li>• The response shows the incomplete or inaccurate application of a relevant strategy.</li> <li>• Mathematical ideas are expressed only partially in the response.</li> </ul>
0	<p>The response achieves the following:</p> <ul style="list-style-type: none"> <li>• The response demonstrates limited to no understanding of interpreting parameters for linear and exponential functions in context.</li> <li>• The response is incorrect.</li> <li>• The response shows no application of a strategy.</li> <li>• Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding.</li> </ul>

## Item 13

## Exemplar Response

Points Awarded	Response
4	Part A: 0.5%. <b>AND</b> Part B: 22 months <b>AND</b> Part C: \$2,231.94 <b>AND</b> I found $v(22) = 2,000(1.005)^{22}$ , which is \$2,231.94. <i>Or other valid process.</i>
3	The student correctly answers three of the four parts.
2	The student correctly answers two of the four parts.
1	The student correctly answers one of the four parts.
0	<i>Response is irrelevant, inappropriate, or not provided.</i>

*Note: If a student makes an error in one part that is carried through to subsequent parts, then the student is not penalized again for the same error.*

Assessment Guide  
Algebra I  
End-of-Course

