Georgia Milestones Assessment System

ASSESSMENT GUIDE

Assessment Guide

Coordinate Algebra

Georgia Department of Education
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Table of Contents

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 3–8 take an end-of-grade assessment in each content area, while high school students take an end-of-course assessment for each of the eight 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:

- 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 back-up 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, be it 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. These assessments serve 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, 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 abovementioned courses, regardless of grade level, is required to take the Georgia Milestones 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 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 Coordinate Algebra EOC Assessment Guide is provided to acquaint Georgia educators and other stakeholders with the structure 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 rather than 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 Coordinate Algebra 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.

TESTING SCHEDULE

The Georgia Milestones Coordinate Algebra 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, but only during specified windows	Yes
Validation of Credit	Yes	Yes	Yes

*Winter and Spring Main Administrations cannot be used for the purpose of a retest. There will be no retest administrations during the 2014–2015 school year.

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

TEST STRUCTURE

Description of Test Format and Organization

The Georgia Milestones Coordinate Algebra EOC assessment is primarily a criterion-referenced test designed to provide information about how well a student has mastered the state-adopted content standards that comprise the course. Each student will receive one of four proficiency levels, depending on how well the student has mastered the course content standards. 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 proficiency 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 proficiency 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 Coordinate Algebra EOC assessment consists of a total of 73 items, 63 of which are operational items (and contribute to a student's criterion-referenced and/or norm-referenced score) and 10 of which are field test items (newly written items that are being tried out and do not contribute to the student's scores). The criterion-referenced score, and proficiency designation, is comprised of 53 items, for a total of 58 points. Students will respond to a variety of item types, including selected-response, and constructed-response items. Of the 63 operational items, 20 will be norm-referenced and will provide a national comparison in the form of a national percentile rank. Ten of the items have been verified as aligned to the course content standards by Georgia educators and will therefore contribute to the criterion-referenced proficiency designation. The other 10 items will contribute only to the national percentile rank and be provided as supplemental information. Only items that are aligned to the state-adopted content standards will be utilized to inform the criterion-referenced score.

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 student's criterion-referenced proficiency 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.

Coordinate Algebra EOC Assessment Design

Description	Number of Items	Points for CR[1] Score	Points for NRT[2] Feedback
CR Selected-Response Items	40	40	0
NRT Selected-Response Items	20[3]	10[4]	20
CR Constructed-Response Items	3	8	0
CR Field Test Items	10	0	0
Total Items/Points[5]	**73**	**58**	**20**

[1]CR—Criterion-Referenced: items aligned to state-adopted content standards
[2]NRT—Norm-Referenced Test: items that will yield a national comparison; may or may not be aligned to state-adopted content standards
[3]Of these items, 10 will contribute to both the CR scores and NRT feedback. The other 10 of these items will contribute to NRT feedback only and will not impact the student's proficiency designation, scale score, or grade conversion.
[4]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 CRT proficiency designation, scale score, and grade conversion score.
[5]Total number of items contributing to CR score: 53; total points: 58; total number of items contributing to NRT feedback: 20; total points: 20

The test will be given in two sections. Section 1 is divided into two parts. Students may have up to 80 minutes, per section, to complete Sections 1 and 2. The total estimated testing time for the Coordinate Algebra EOC ranges from approximately 120 to 160 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 Coordinate Algebra 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 Coordinate Algebra assessment is that students may use a graphing calculator in Part 1 of Section 1 and in all of Section 2.

Content Measured

The Coordinate Algebra EOC assessment will assess the standards that are enumerated for the Coordinate Algebra course as described on 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 Coordinate Algebra are grouped into three domains: Algebra and Functions, Algebra Connections to Geometry, 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 Coordinate Algebra 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 Coordinate Algebra EOC assessment. Educators should always use the content standards when planning instruction.

Coordinate Algebra:
Domain Structures and Content Weights

Domain	Standard	Approximate Weight
Algebra and Functions	MCC9-12NQ1 MCC9-12NQ2 MCC9-12NQ3 MCC9-12ACED1 MCC9-12ACED2 MCC9-12ACED3 MCC9-12ACED4 MCC9-12AREI1 MCC9-12AREI3 MCC9-12AREI5 MCC9-12AREI6 MCC9-12AREI10 MCC9-12AREI11 MCC9-12AREI12 MCC9-12ASSE1 (1a, 1b) MCC9-12FIF1 MCC9-12FIF2 MCC9-12FIF3 MCC9-12FIF4 MCC9-12FIF5 MCC9-12FIF6 MCC9-12FIF7 (7a, 7e) MCC9-12FIF9 MCC9-12FBF1 (1a, 1b) MCC9-12FBF2 MCC9-12FBF3 MCC9-12FLE1 (1a, 1b, 1c) MCC9-12FLE2 MCC9-12FLE3 MCC9-12FLE5	60%
Algebra Connections to Geometry	MCC9-12GCO1 MCC9-12GCO2 MCC9-12GCO3 MCC9-12GCO4 MCC9-12GCO5 MCC9-12GGPE4 MCC9-12GGPE5 MCC9-12GGPE6 MCC9-12GGPE7	25%

Coordinate Algebra:
Domain Structures and Content Weights – continued

Domain	Standard	Approximate Weight
Algebra Connections to Statistics and Probability	MCC9-12SID1 MCC9-12SID2 MCC9-12SID3 MCC9-12SID5 MCC9-12SID6 (6a, 6b, 6c) MCC9-12SID7 MCC9-12SID8 MCC9-12SID9	15%

Item Types

The Coordinate Algebra EOC assessment consists of selected-response, constructed-response, and extended constructed-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 Coordinate Algebra selected-response items will have four answer choices. All norm-referenced items will be selected-response.

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.

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.

Depth of Knowledge Descriptors

Items found on the Georgia Milestones assessments, including the Coordinate Algebra 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."

<u>Level 3</u> (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.”

<u>Level 4</u> (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.

Many on-demand assessment instruments will not include assessment activities that could be classified as Level 4. However, standards, goals, and objectives can be stated so as to expect students to perform at this level. The items on the Analytic Geometry test will be written to DOK levels 1, 2, and 3.

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
Level 1 **Recall of Information**	• Make observations • Recall information • Recognize formulas, properties, patterns, processes • Know vocabulary, definitions • Know basic concepts • Perform one-step processes • Translate from one representation to another • Identify relationships	• Find • List • Define • Identify; label; name • Choose; select • Compute; estimate • Express • Read from data displays • Order
Level 2 **Basic Reasoning**	• Apply learned information to abstract and real life situations • Use methods, concepts, theories in abstract and real-life situations • Perform multi-step processes • Solve problems using required skills or knowledge (requires more than habitual response) • Make a decision about how to proceed • Identify and organize components of a whole • Extend patterns • Identify/describe cause and effect	• Apply • Calculate; solve • Complete • Describe • Explain how; demonstrate • Construct data displays • Construct; draw • Analyze • Extend • Connect • Classify • Arrange • Compare; contrast

Level	Skills Demonstrated	Question Cues
Level 2 **Basic Reasoning – continued**	• Recognize unstated assumptions, make inferences • Interpret facts • Compare or contrast simple concepts/ideas	
Level 3 **Complex Reasoning**	• Solve an open-ended problem with more than one correct answer • Create a pattern • Relate knowledge from several sources • Draw conclusions • Make predictions • Translate knowledge into new contexts • Assess value of methods, concepts, theories, processes, formulas • Make choices based on a reasoned argument • Verify the value of evidence, information, numbers, data	• Plan; prepare • Predict • Create; design • Generalize • Justify; explain why; support; convince • Assess • Rank; grade • Test; judge • Recommend • Select • Conclude
Level 4 **Extended Reasoning**	• Analyze and synthesize information from multiple sources • Apply mathematical models to illuminate a problem or situation • Design a mathematical model to inform and solve a practical or abstract situation • Combine and synthesize ideas into new concepts	• Design • Connect • Synthesize • Apply concepts • Analyze • Create • Prove

SCORES

Selected-response items are machine scored. However, the Coordinate Algebra EOC assessment consists of a variety of item types that contribute to the student's score, including selected-response, constructed-response, and extended constructed-response. Items that are not machine scored—i.e., constructed-response and extended constructed-response—require rubrics for manual scoring.

Students will receive an EOC scale score, an achievement level, a number correct out of the number possible, and a grade conversion score based on the items aligned to the state content standards. From the 20 embedded norm-referenced items, students will also receive scores that allow comparison to a national group of students.

EXAMPLE ITEMS

Example items, which are representative of the DOK levels across various Coordinate Algebra content domains, are provided on the following pages. **All example and sample items contained in this guide are the property of the Georgia Department of Education.**

Example Item 1

DOK Level: 1

Coordinate Algebra Content Domain: Algebra Connections to Geometry

Standard: MCC9-12GCO1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

Which statement BEST defines a circle?

A A circle is the set of all points in a plane equidistant from each other.
B A circle is the set of all points in a plane equidistant from a given point
C A circle is the set of all points in a plane equidistant from a given segment.
D A circle is the set of all points in a plane equidistant from a given arc.

Correct Answer: B

Explanation of Correct Answer: The correct answer is choice (B) A circle is the set of all points in a plane equidistant from a given point from each other. This is how a circle is defined. Choices (A), (C), and (D) are incorrect because they are defining a circle as being the points equidistant from a set of points, rather than from a single given point: the center of the circle.

Example Item 2

DOK Level: 2

Coordinate Algebra Content Domain: Algebra and Functions

Standard: MCC9-12FIF3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

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 nth 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 each value in the sequence changes by –3, that number can be multiplied by *n* and then added to 8 to solve the function and find the nth value. With this function, any number can be substituted for *n*, resulting in an answer of *n*. 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 true for f(1) but not f(4).

Example Item 3

DOK Level: 3

Coordinate Algebra Content Domain: Algebra and Functions

Standard: MCC9-12ACED3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

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 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. The errors 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 and 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 errors in the directions of the inequality symbols.

ADDITIONAL SAMPLE ITEMS

This section has two parts. The first part is a set of 10 sample items for Coordinate Algebra. 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.**

Georgia Milestones Assessment System

Coordinate Algebra Formula Sheet

Below are the formulas you may find useful as you work the problems. However, some of the formulas may not be used. You may refer to this page as you take the test.

Area

Rectangle and Parallelogram $A = bh$

Triangle $A = \frac{1}{2}bh$

Circle $A = \pi r^2$

Trapezoid $A = \frac{1}{2}(h)(b_1 + b_2)$

Circumference

$C = \pi d \quad \pi \approx 3.14$

Volume

Rectangular Prism/Cylinder $V = Bh$

Pyramid/Cone $V = \frac{1}{3}Bh$

Sphere $V = \frac{4}{3}\pi r^3$

Surface Area

Rectangular Prism $SA = 2lw + 2wh + 2lh$

Cylinder $SA = 2\pi r^2 + 2\pi rh$

Pythagorean Theorem

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

Mean Absolute Deviation

$$\frac{\sum_{i=1}^{n} |x_i - \bar{x}|}{n}$$

the average of the absolute deviations from the mean for a set of data

Distance Formula

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

Slope Formula

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

Midpoint Formula

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

Interquartile Range

the difference between the first quartile and third quartile of a set of data

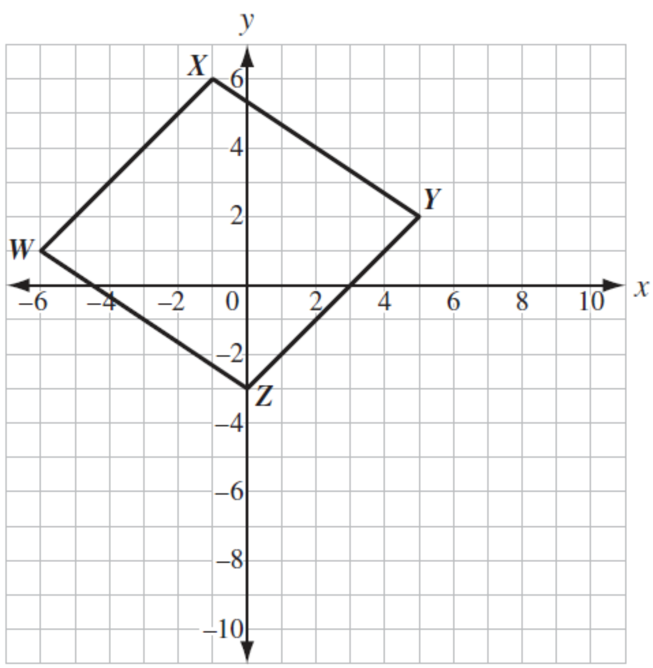
Item 1

Which set of data points could be modeled by 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

Look at quadrilateral *WXYZ* on this coordinate grid.



What are the coordinates of the midpoint of $\overline{XY}$?

A (3, 2)
B (2, 4)
C (2, 5)
D (−1, 6)

Item 3

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 worker 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 Each of the 4 employees earns $75 per day.
B Sheila must sell 600 pies per day.
C The total daily expenses are $300.
D Customers pay $4.50 per pie.

Item 4

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

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

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

Catering Company Costs

Acme Catering Company	Best Foods Company	Creative Catering Company
\$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 catering. What is the greatest number of people he can invite using one of the three caterers?

A 30
B 32
C 33
D 37

Item 7

Parallelogram *ABCD* has four congruent sides but no right angles. The diagonals of *ABCD* intersect at point *P*. A single transformation maps parallelogram *ABCD* onto itself.

Which phrase could NOT describe this transformation?

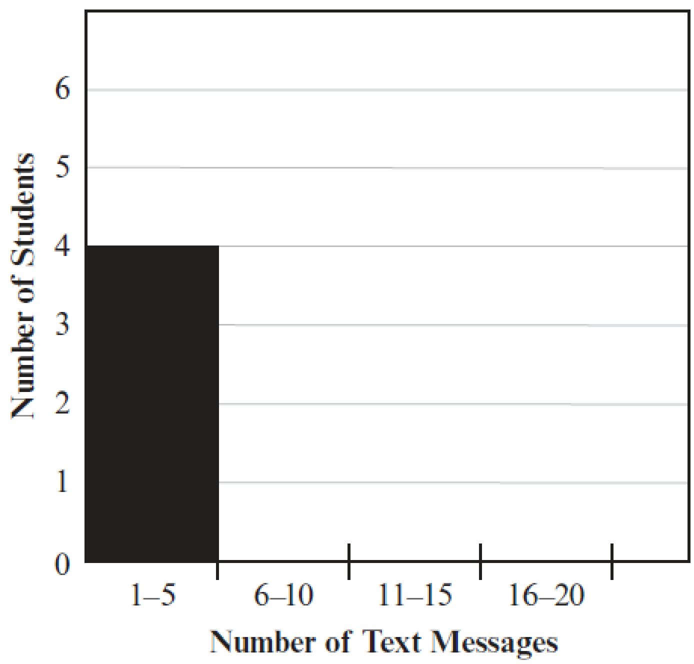
A a rotation 90° clockwise about point *P*
B a rotation 180° about point *P*
C a reflection across the line that passes through points *A* and *C*
D a reflection across the line that passes through points *B* and *D*

Item 8

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

Jill solved the inequality $-\frac{x}{4} < \frac{x+2}{3}$ for *x*.

Her solution is shown.

Step 1: $-3x < 4x + 8$
Step 2: $-3x - 4x < 8$
Step 3: $-7x < 8$
Step 4: $x < -\frac{8}{7}$

Part A: Explain the mistake Jill made when solving for *x*.
Part B: Solve the inequality $-\frac{x}{4} < \frac{x+2}{3}$ for *x*.

Item 10

A student invests money in a bond whose value after m months is given by the function $v(m) = 2,000(1.005)^m$. The student is saving money to buy a second bond. The amount saved toward the second bond is represented by the function $f(m) = 250 + 100m$, where m is the number of months the student has been saving. The interest is earned on the last day of the month, which is the same day the student sets aside the money, so *m* has only integer values. She began saving during the same month she invested in the first bond.

Part A: How much money did the student invest in the first bond?

Part B: What is the interest rate of the first bond?

Part C: How much money is the student saving each month toward buying the second bond?

Part D: If the student needs the same amount of money to invest in the second bond as she needed to invest in the first bond, how many months will she need to save to invest in the second bond?

Part E: What will be the value of the first bond when the student has enough money to buy the second bond?

Additional Sample Item Keys

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
1	MCC9-12SID61a	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: $f(x) = ax + b$. Choices (A), (B), and (D) are incorrect because the data points do not correspond to a function with a negative value for *a* in the linear function formula.
2	MCC9-12GGPE6	1	B	The correct answer is choice (B) (2, 4). Choice (A) is incorrect because the coordinates lie inside the quadrilateral, not at the midpoint of the side. Choice (C) is incorrect because the coordinates lie outside of the quadrilateral. Choice (D) is incorrect because the coordinates are for point *X*.
3	MCC9-12ASSE1a	2	A	The correct answer is choice (A) Each of the 4 employees earns $75 per day. The term 4 • $75 represents the number of employees times the amount each worker is paid daily. This is added to the amount it takes to make each piece to represent the total daily expenses for the business. Choices (B) and (D) are incorrect because the price that Sheila charges for her pies is not given. Choice (C) is incorrect because $300 is the constant expense, but doesn't take into account the expense per pie.
4	MCC9-12FBF1	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 result is equal to the corresponding *y*-value. Choice (A) is incorrect because the function mistakenly multiplies 2 and *x* instead of dividing *x* by 2. Choice (B) is incorrect because the function mistakenly subtracts 1 instead of adding it. Choice (C) is incorrect because the function mistakenly multiplies 2 and *x* instead of dividing *x* by 2, and it subtracts 1 instead of adding it.

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
5	MCC9-12AREI6	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. Choices (B) and (C) are incorrect because the values of the coordinate pair, when substituted into the system of equations, result in an incorrect solution for the second equation. 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.
6	MCC9-12ACED1	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	MCC9-12GCO3	3	A	The correct answer is choice (A) a rotation 90° clockwise about point *P*. A rotation of only 90° would not result in a transformation that maps parallelogram *ABCD* onto itself. Choices (B), (C), and (D) are incorrect because they would, in fact, result in a transformation that maps parallelogram *ABCD* onto itself. As such, there is more than one way to achieve this, and a clockwise rotation of 90° is not one of them.
8	MCC9-12SID1	2	B	The correct answer is choice (B) 2. Only 2 students sent 6–10 text messages. Choices (A), (C), and (D) are incorrect because the student either made a counting mistake or looked at the numbers for 11–15 or 16–20 text messages instead of those for 6–10.
9	MCC9-12AREI3	3	N/A	See scoring rubric and exemplar responses on page 28.
10	MCC9-12FLE5	3	N/A	See scoring rubric and exemplar responses beginning on page 29.

Example Scoring Rubrics and Exemplar Responses

Item 9

Scoring Rubric

Points	Description
2	The response achieves the following: • student gets Part A AND Part B correct
1	The response achieves the following: • student gets Part A OR Part B correct
0	The response achieves the following: • student gets neither Part A nor Part B correct

Exemplar Response

Points Awarded	Response
2	Part A Jill did not invert the inequality sign in step 4 when dividing by a negative number. AND Part B $-3x < 4x + 8$ $-7x < 8$ $\text{x} > \frac{8}{-7}$
1	Part A Jill did not invert the inequality sign in step 4 when dividing by a negative number. OR Part B $-3x < 4x = 8$ $-7x < 8$ $\text{x} > \frac{8}{-7}$
0	*Student does not produce a correct response or a correct process.*

Item 10

Scoring Rubric

<table>
<tr><th>Points</th><th>Description</th></tr>
<tr><td>4</td><td>The response achieves the following:
Student demonstrates a complete and thorough understanding of interpreting the parameters in a linear function in terms of a context. Award 4 points for a student response that contains all of the following elements:
Part A: $2,000
Part B: 0.5% per month
Part C: $100
Part D: 18 months
Part E: $2,187.86</td></tr>
<tr><td>3</td><td>The response achieves the following:
Student demonstrates nearly complete understanding of interpreting the parameters in a linear function in terms of a context. Award 3 points for a student response that contains any 4 of the following elements:
Part A: $2,000
Part B: 0.5% per month
Part C: $100
Part D: 18 months
Part E: $2,187.86
Scoring Note: If an error is made in one of these response elements, future response elements based on that should count as correct based upon the previous error. For example, if the student indicates 8 months as the response to Part D and computes a response to Part E that is correct for v(8), then the Part E element should be scored as correct.</td></tr>
<tr><td>2</td><td>The response achieves the following:
Student demonstrates partial understanding of interpreting the parameters in a linear function in terms of a context. Award 2 points for a student response that contains any 3 of the following elements:
Part A: $2,000
Part B: 5% per month (see “Not for Educators” below)
Part B: 0.5% (with or without “rate” duration included)
Part C: $100
Part D: 18 months
Part E: $2,187.86
Scoring Note: If an error is made in one of these response elements, future response elements based on that should count as correct based upon the previous error. For example, if the student indicates 8 months as the response to Part D and computes a response to Part E that is correct for v(8), then the Part E element should be scored as correct.</td></tr>
</table>

Item 10

Scoring Rubric – continued

<table>
<tr><th>Points</th><th>Description</th></tr>
<tr><td>2 – continued</td><td>Note for Educators: Higher score levels reflect higher levels of precision and accuracy within the response. At lower score levels, incorrect responses which indicate partial understanding of the concepts under assessment may be awarded points. In this example, the two possible responses for Part B represent cases where the student is demonstrating a partial understanding of how to interpret the number 1.005 within this context, so students who commit these errors will receive partial credit in their responses at the 1- and 2-point levels.</td></tr>
<tr><td>1</td><td>The response achieves the following:
Student demonstrates minimal understanding of interpreting the parameters in a linear function in terms of a context. Award 1 point for a student response that contains any 2 of the following elements:
Part A: $2,000
Part B: 5% per month (See “Note for Educators” below)
Part B: 0.5% (with or without “rate” duration included)
Part B: 1.005% per month
Part C: $100
Part D: 18 months
Part E: $2,187.86
Scoring Note: If an error is made in one of these response elements, future response elements based on that should count as correct based upon the previous error. For example, if the student indicates 8 months as the response to Part D and computes a response to Part E that is correct for v(8), then the Part E element should be scored as correct.
Note for Educators: Higher score levels reflect higher levels of precision and accuracy within the response. At lower score levels, incorrect responses which indicate partial understanding of the concepts under assessment may be awarded points. In this example, the two possible responses for Part B represent cases where the student is demonstrating a partial understanding of how to interpret the number 1.005 within this context, so students who commit these errors will receive partial credit in their responses at the 1- and 2-point levels.</td></tr>
<tr><td>0</td><td>The response achieves the following:
The student demonstrates little to no understanding of interpreting the parameters in a linear function in terms of a context.</td></tr>
</table>

Item 10

Exemplar Response

Points Awarded	Response
4	Part A: \$2,000 Part B: 0.5% per month Part C: \$100 Part D: 18 months Part E: \$2,187.86
3	Part A: \$2,000 Part B: 5% per month Part C: \$100 Part D: 18 months Part E: \$2,187.86
2	Part A: \$2,000 Part B: 5% per month Part C: \$100 Part D: 20 months Part E: \$2,000
1	Part A: \$2,000 Part B: 5% Part C: \$100 Part D: 20 months Part E: \$4,000
0	Part A: \$250 Part B: 1.005% Part C: 1.005% Part D: 5 Part E: \$2,000