Georgia Milestones
Assessment System

Assessment Guide

Analytic Geometry

Georgia Department of Education
October 2014

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 3–8 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 Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry 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 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.

Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry assessment is that students may use a graphing calculator in Part 1 of Section 1 and in all of Section 2.

Content Measured

The Analytic Geometry EOC assessment will assess the standards that are enumerated for the Analytic Geometry course as described on www.georgiastandards.org.

The content of the assessment is organized into four 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 Analytic Geometry are grouped into four domains: Geometry; Expressions, Equations, and Functions; Number and Quantity; and Statistics and Probability. Each domain was created by organizing standards that share similar content characteristics. The content standards describe the level of expertise that Analytic Geometry 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 Analytic Geometry EOC assessment. Educators should always use the content standards when planning instruction.

Analytic Geometry:
Domain Structures and Content Weights

Domain	Standard	Approximate Weight
Geometry	MCC9-12GCO6 MCC9-12GCO7 MCC9-12GCO8 MCC9-12GCO9 MCC9-12GCO10 MCC9-12GCO11 MCC9-12GCO12 MCC9-12GCO13 MCC9-12GSRT1 MCC9-12GSRT2 MCC9-12GSRT3 MCC9-12GSRT4 MCC9-12GSRT5 MCC9-12GSRT6 MCC9-12GSRT7 MCC9-12GSRT8 MCC9-12GC1 MCC9-12GC2 MCC9-12GC3 MCC9-12GC5 MCC9-12GGPE1 MCC9-12GGPE2 MCC9-12GGPE4 MCC9-12GGMD1 MCC9-12GGMD3	60%
Expressions, Equations, and Functions	MCC9-12ASSE1 (1a, 1b) MCC9-12ASSE2 MCC9-12ASSE3 (3a, 3b) MCC9-12AAPR1 MCC9-12ACED1 MCC9-12ACED2 MCC9-12ACED4 MCC9-12AREI4 (4a, 4b) MCC9-12AREI7 MCC9-12FIF4 MCC9-12FIF5 MCC9-12FIF6 MCC9-12FIF7 (7a)	18%

Analytic Geometry:
Domain Structures and Content Weights – continued

Domain	Standard	Approximate Weight
Expressions, Equations, and Functions – continued	MCC9-12FIF8 (8a) MCC9-12FIF9 MCC9-12FBF1 (1a, 1b) MCC9-12FBF3 MCC9-12FLE3	
Number and Quantity	MCC9-12NRN1 MCC9-12NRN2 MCC9-12NRN3 MCC9-12NCN1 MCC9-12NCN2 MCC9-12NCN7	11%
Statistics and Probability	MCC9-12SID6 (6a) MCC9-12SCP1 MCC9-12SCP2 MCC9-12SCP3 MCC9-12SCP4 MCC9-12SCP5 MCC9-12SCP6 MCC9-12SCP7	11%

Item Types

The Analytic Geometry 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 Analytic Geometry 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 Analytic Geometry 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.

<u>Level 1</u> (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.

<u>Level 2</u> (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
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 Analytic Geometry 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 Analytic Geometry 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

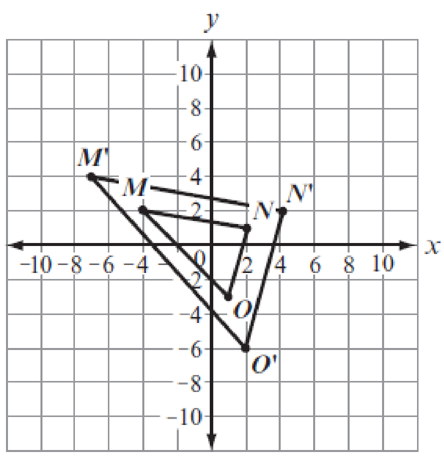
DOK Level: 1

Analytic Geometry Content Domain: Geometry

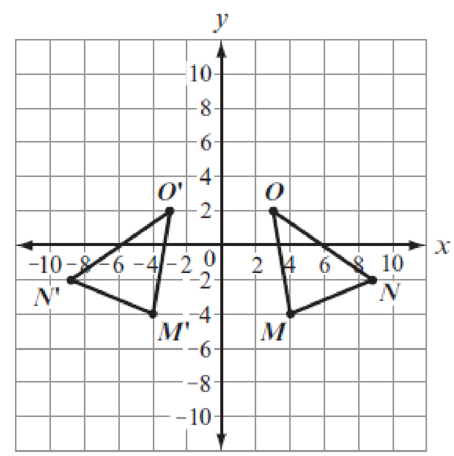
Standard: MCC9–12GCO6. The student will use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

Which transformation of *ΔMNO* results in a congruent triangle?

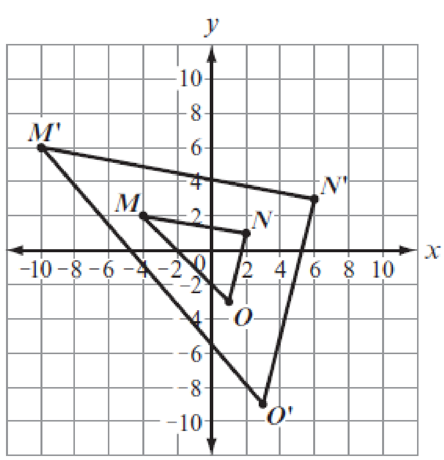
A



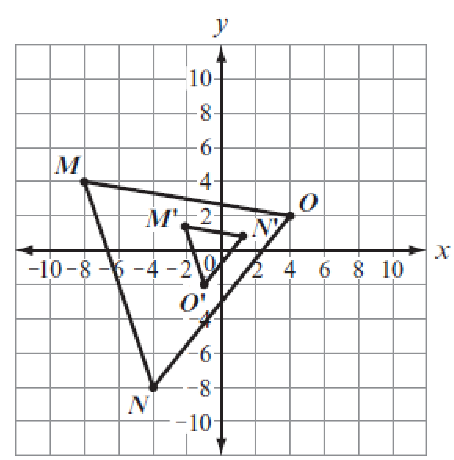
B



C



D



Correct Answer: B

Explanation of Correct Answer: The correct answer is choice (B). Choice (B) shows triangle MNO reflected across the y-axis, which is a rigid transformation that maintains congruency. Choices (A), (C), and (D) are incorrect because one of the triangles is contained entirely within the other triangle, so they cannot be congruent to each other.

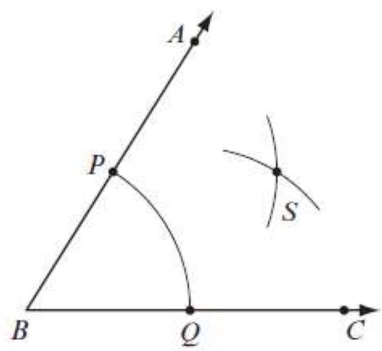
Example Item 2

DOK Level: 2

Analytic Geometry Content Domain: Geometry

Standard: MCC9-12GCO12: The student will make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

A student used a compass and a straightedge to bisect ∠*ABC* in this figure.



Which statement BEST describes point *S*?

A Point *S* is located such that *SC* = *PQ*.
B Point *S* is located such that *SA* = *PQ*.
C Point *S* is located such that *PS* = *BQ*.
D Point *S* is located such that *QS* = *PS*.

Correct Answer: D

Explanation of Correct Answer: The correct answer is choice (D) Point *S* is located such that *QS* = *PS*. Point *S* was constructed by placing a compass with a set radius at points *P* and *Q*. Therefore, *PS* and *QS* are both equal to the radius of the compass and equal to each other. Choices (A), (B), and (C) are incorrect because they identify incorrect line segments in the construction as congruent.

Example Item 3

DOK Level: 3

Analytic Geometry Content Domain: Geometry

Standard: MCC9-12GGPE2. Derive the equation of a parabola given a focus and directrix.

Parabola *M* has a focus of (2, 1) and a directrix of *y* = 7.

Parabola *Q* has the same focus as parabola *M*, but the directrix of parabola *Q* is a reflection of the directrix of parabola *M* across the *x*-axis. Which comparison of parabolas *M* and *Q* is TRUE?

A The focal length of both parabolas is the same.
B The *y*-coordinate of the vertex for both parabolas is the same.
C The value of $\frac{1}{4p}$ in the equation $y - k = \frac{1}{4p}(x - h)^2$ is the same for both parabolas.
D The value of *h* in the equation $y - k = \frac{1}{4p}(x - h)^2$ is the same for both parabolas.

Correct Answer: D

Explanation of Correct Answer: The correct answer is choice (D). The answer indicates the recognition that the variable *h* remains constant for both of these parabolas. The values indicated in (A), (B), and (C) all change between the two parabolas. As part of this, the student must either conceptualize the parabolas using entirely algebraic reasoning or translate into a visual representation (either mentally or using scratch paper) to interpret the situation. Choice (A) is incorrect because the focal length changes between the two parabolas. Choice (B) is incorrect because the *y*-coordinate of the vertex changes between the two parabolas. Choice (C) is incorrect because the value of 1/4*p* changes between the two parabolas.

ADDITIONAL SAMPLE ITEMS

This section has two parts. The first part is a set of 10 sample items for Analytic Geometry. 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

Analytic Geometry 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/Parallelogram $A = bh$

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

Circle $A = \pi r^2$

Circumference

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

$C = 2\pi r$

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

Sphere $SA = 4\pi r^2$

Trigonometric Relationships

$\sin(\theta) = \frac{\text{opp}}{\text{hyp}}$; $\cos(\theta) = \frac{\text{adj}}{\text{hyp}}$; $\tan(\theta) = \frac{\text{opp}}{\text{adj}}$

Quadratic Equations

Standard Form: $y = ax^2 + bx + c$

Vertex Form: $y = a(x-h)^2 + k$

Quadratic Formula

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

Conic Sections

Parabola: $y - k = \frac{1}{4p}(x-h)^2$

$x - h = \frac{1}{4p}(y-k)^2$

Circle: $(x-h)^2 + (y-k)^2 = r^2$

Distance Formula

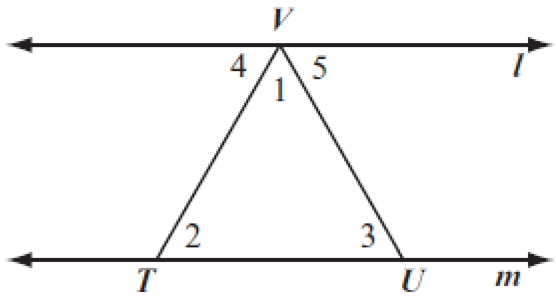
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Conditional Probability

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

Item 1

In this figure, $l || m$. Jessie listed the first two steps in a proof that $\angle 1 + \angle 2 + \angle 3 = 180°$.



	Step	Justification
1	$\angle 2 \cong \angle 4$	?
2	$\angle 3 \cong \angle 5$	?

Which justification can Jessie give for Steps 1 and 2?

A Alternate interior angles are congruent.
B Corresponding angles are congruent.
C Vertical angles are congruent.
D Alternate exterior angles are congruent.

Item 2

This table defines a function with *x*-values making up the domain and *y*-values making up the range.

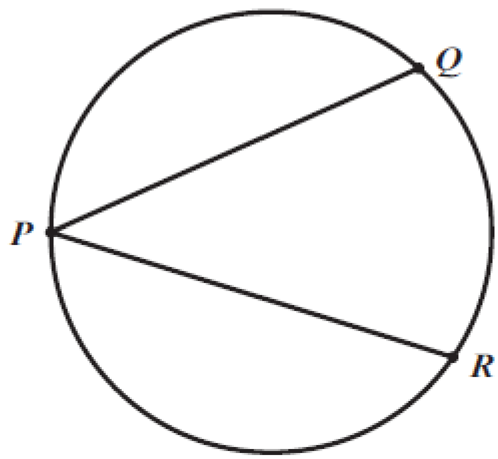
x	*y*
–2	0
0	4
3	–5
5	–21

Which equation describes the function?

A $y = -x^2 + 4$
B $y = -x^2 + 4x$
C $y = 4x^2 - 1$
D $y = 4x^2 - 4$

Item 3

In this circle, $m\widehat{QR} = 72°$.



What is $m\angle QPR$?

A 18°
B 24°
C 36°
D 72°

Item 4

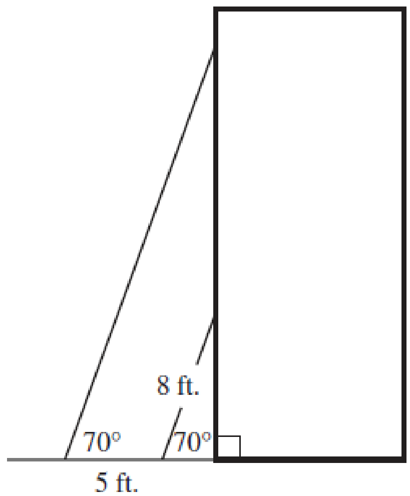
Which of these expressions has a real number value?

A $\frac{1}{i}$
B $-i$
C $\sqrt{i}$
D i^2

Item 5

This diagram shows two ladders leaning against a building. Each ladder is leaning at an angle of 70 degrees.

- **The length of the short ladder is 8 feet.**
- **The base of the long ladder is 5 feet farther from the base of the building than the base of the short ladder is.**



What is the length, to the nearest foot, of the long ladder?

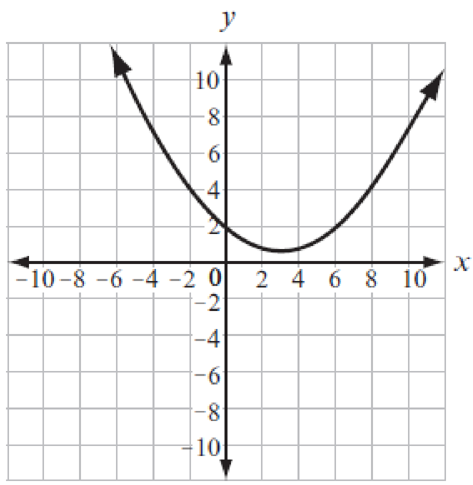
$$\begin{bmatrix} \sin 70^\circ = 0.9397 \\ \cos 70^\circ = 0.3420 \\ \tan 70^\circ = 2.7475 \end{bmatrix}$$

A 10 ft.
B 13 ft.
C 23 ft.
D 26 ft.

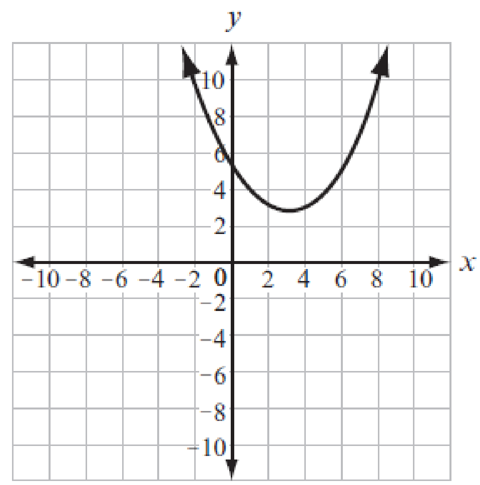
Item 6

Which coordinate plane shows the graph of a parabola that has a focus at (3, 3) and a directrix of *y*=–1?

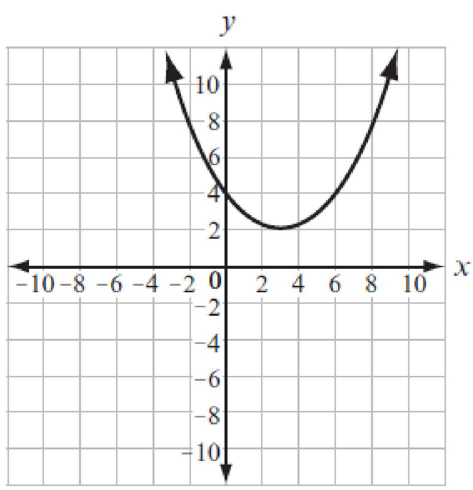
A



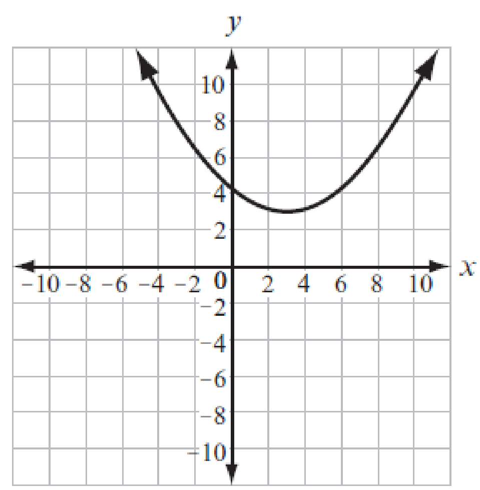
B



C



D



Item 7

Use these functions to answer this question.

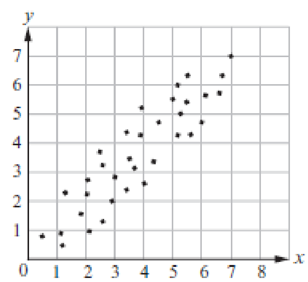
$P(x) = x^2 - x - 6$
$Q(x) = x - 3$

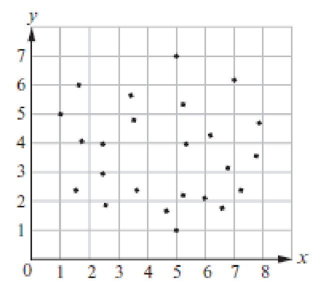
What is $P(x) - Q(x)$?

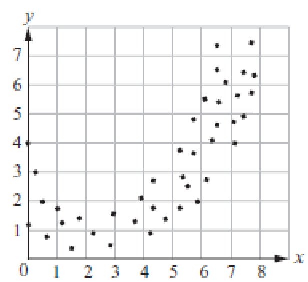
A $x^2 - 3$
B $x^2 - 9$
C $x^2 - 2x - 3$
D $x^2 - 2x - 9$

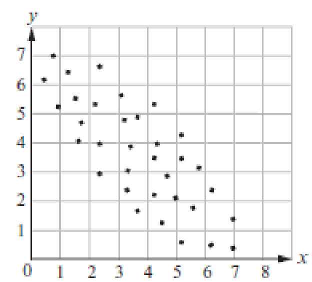
Item 8

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

A


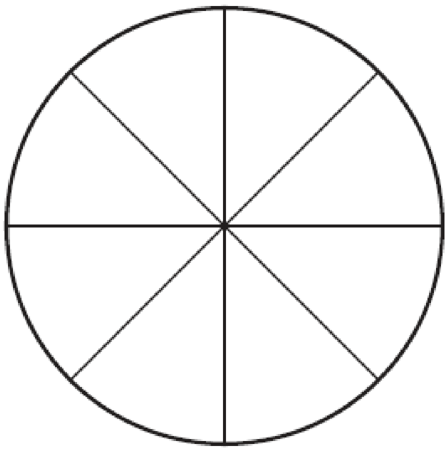
B


C


D


Item 9

Billy is creating a circular garden divided into 8 equal sections. The diameter of the garden is 12 feet.



What is the area of one section of the garden? Explain how you determined your answer.

Item 10

Jane and Mark each build ramps to jump their remote-controlled cars.

Both ramps are right triangles when viewed from the side. The incline of Jane's ramp makes a 30-degree angle with the ground, and the length of the inclined ramp is 14 inches. The incline of Mark's ramp makes a 45-degree angle with the ground, and the length of the inclined ramp is 10 inches.

Part A: What is the horizontal length of the base of Jane's ramp and the base of Mark's ramp? Show or explain your work.

Part B: Which car is launched from the highest point? Justify your answer by showing or explaining your work.

Additional Sample Item Keys

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
1	MCC9-12GCO10	2	A	The correct answer is (A) because each line is an example of alternate interior angles being congruent. Choice (B) is incorrect because the angles shown are not corresponding angles. Choice (C) is incorrect because the angles shown are not vertical angles. Choice (D) is incorrect because the angles shown are not alternate exterior angles.
2	MCC9-12FBF1a	2	A	The correct answer is choice (A) $y = -x^2 + 4$. Choice (A) is correct because the equation is true for all input-output pairs. Choices (B), (C), and (D) are incorrect because they are not true for all input-output pairs.
3	MCC9-12GC2	1	C	The correct answer is choice (C) because an inscribed angle is one-half the measure of the arc it creates. Choice (A) is incorrect because it is one-quarter the measure of the arc it creates. Choice (B) is incorrect because it is one-third the measure of the arc it creates. Choice (D) is incorrect because it is the full measure of the arc it creates.
4	MCC9-12NCN1	1	D	The correct answer is choice (D) i^2. This is correct because *i* is defined such that i^2 is –1, which is a real number. Choices (A), (B), and (C) are incorrect because they are all imaginary numbers.
5	MCC9-12GSRT8	3	C	The correct answer is choice (C) 23 ft. The ratio of the distance from the short ladder to the wall to the length of the short ladder is equal to the cosine of the angle the ladder forms with the ground. So, the short ladder is 8cos(70°) = 2.736 feet from the wall, and the long ladder is 7.736 feet from the wall. Similarly, the ratio of the distance from the long ladder to the wall to the length of the long ladder is equal to the cosine of the angle the ladder forms with the wall. So, the long ladder is 7.736/cos(70°) ≈ 22.62 feet. Choice (B) is incorrect because it is the sum of the lengths in the figure. Choices (A) and (D) are incorrect because they use incorrect trigonometric ratios.

Item	Standard/ Element	DOK Level	Correct Answer	Explanation
6	MCC9-12GGPE2	2	A	The correct answer is choice (A) because the vertex must lie halfway between the focus and directrix. The distance between focus and directrix in this case is $p = 4$, which means the vertex must be at (3, 1). Choice (B) is incorrect because its vertex is at the point (3, 3). Choice (C) is incorrect because its vertex is at point (3, 2). Choice (D) is incorrect because its vertex is at point (3, 3).
7	MCC9-12AAPR1	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.
8	MCC9-12SID6a	2	C	The correct answer is choice (C). The data in the graph represents 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.
9	MCC9-12GC5	2	N/A	See scoring rubric and exemplar responses on page 29.
10	MCC9-12GSRT8	3	N/A	See scoring rubric and exemplar responses beginning on page 30.

Example Scoring Rubrics and Exemplar Responses

Item 9

Scoring Rubric

Points	Description
2	The response achieves the following: • Student demonstrates full understanding of deriving the area of a sector of a circle. Award 2 points for a student response that contains both the following elements: ○ An explanation of a valid process for determining the area of one section of the garden. ○ A final answer of 4.5 π or 14.13 feet^2
1	The response achieves the following: • Student shows partial understanding of deriving the area of a sector of a circle. Award 1 point for a student response that contains only one of the following elements: ○ An explanation of a valid process for determining the area of one section of the garden. ○ A final answer of 4.5 π or 14.13 feet^2
0	The response achieves the following: • Student demonstrates little to no understanding of deriving the area of a sector of a circle.

Exemplar Response

Points Awarded	Response
2	I can find the area of the entire circle and divide by 8. This equals 4.5π.
1	4.5π feet^2
0	*Student does not produce a correct response or a correct process.*

Item 10

Scoring Rubric

Points	Description
4	The response achieves the following: • Response demonstrates a complete understanding of using trigonometric ratios and the Pythagorean Theorem to solve real-world problems. Give 4 points for correct responses to both Part A and Part B with valid work shown. **Scoring Note**: There are other valid ways of solving. Accept any valid method.
3	The response achieves the following: • Response demonstrates a nearly complete understanding of using trigonometric ratios and the Pythagorean Theorem to solve real-world problems. Give 3 points for correct responses to both Part A and Part B with valid work shown for only 1 part. **Scoring Note**: There are other valid ways of solving. Accept any valid method.

2	The response achieves the following:
	• Response demonstrates a partial understanding of using trigonometric ratios and the Pythagorean Theorem to solve real-world problems. Give 2 points for any of the following response types:
	  • Correct responses to both Part A and Part B with no valid work shown.
	  • Correct response for Part A with valid work shown with no correct work in Part B.
	  • Correct response for Part B with valid work shown with no correct work in Part A. (Incorrect results in Part A can be used in a correct method in Part B.)
	
	Scoring Note: There are other valid ways of solving. Accept any valid method.

1	The response achieves the following:
	• Response demonstrates a minimal understanding of using trigonometric ratios and the Pythagorean Theorem to solve real-world problems. Give 1 point for either of the following:
	  • Correct response to either Part A or Part B with no valid work shown for either.
	  • Correct method to one part shown, but it contains a computational error that results in an incorrect solution.
	
	Scoring Note: There are other valid ways of solving. Accept any valid method.

0	The response achieves the following: • Response demonstrates no understanding of using trigonometric ratios and the Pythagorean Theorem to solve real-world problems.

Item 10

Exemplar Response

Points Awarded	Response
4	Part A Jane's ramp's horizontal length: 14cos(30) = 12.12 inches. Mark's ramp's horizontal length: 10cos(45) = 7.1 inches. Part B Jane's car is launched from 14sin(30) = 7 Mark's car is launched from 10 sin(45) = 7.1 inches So, Mark's car is launched from a higher point.
3	Part A - Jane's ramp's horizontal length = 14cos(30) = 12.1 inches and Mark's ramp = 10cos(45) = 7.1 inches. Part B - Mark's car is launched from a higher point.
2	Part A - Jane's ramp's horizontal length = 12.1 inches and Mark's ramp = 7.1 inches. Part B - Mark's car is launched from a higher point.
1	Part A - Jane's ramp's horizontal length = 12.1 inches and Mark's ramp = 7.1 inches.
0	*Student does not produce a correct response or a correct process.*