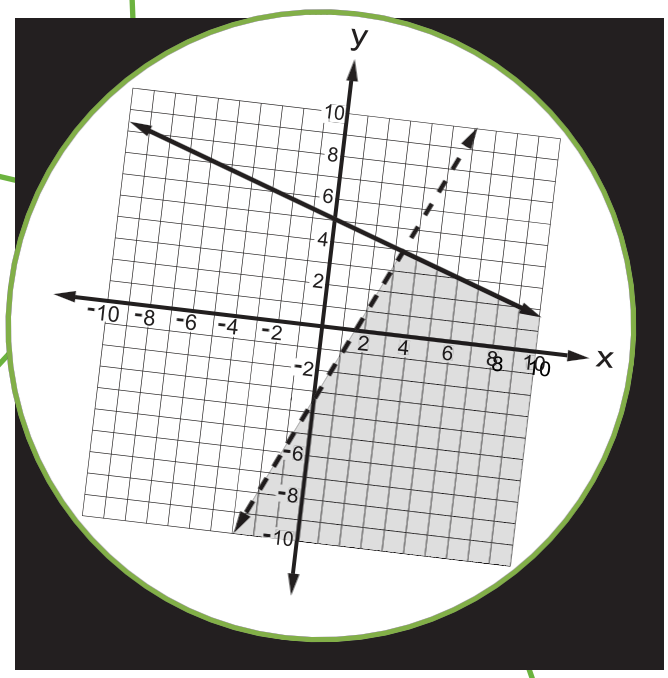
This document, originally published in 2013, contains information relating to a transition to PARCC testing; however, at this time, there is no plan to transition to PARCC. The sample items and student work reflect the current EOC Algebra I assessment; therefore, teachers are encouraged to use the samples provided in this document as additional resources, but should use the current Assessment Guidance Algebra I document for up-to-date EOC testing information.

SAMPLE TEST ITEMS

October 2013

Algebra I

END-OF-COURSE TESTS



DEPARTMENT of EDUCATION
Louisiana Believes

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Table of Contents

Introduction

Louisiana Believes embraces the principle that all children can achieve at high levels, as evidenced in Louisiana's adoption of the Common Core State Standards (CCSS). *Louisiana Believes* also promotes the idea that Louisiana's educators should be empowered to make decisions to support the success of their students. In keeping with these values, the Department has created documents with sample test items to help prepare teachers and students as they transition to the CCSS. These documents reflect the State's commitment to consistent and rigorous assessments and provide educators and families with clear information about expectations for student performance.

Purpose of This Document

Teachers are encouraged to use the sample items presented in this document in a variety of ways to gauge student learning and to guide instruction and development of classroom assessments and tasks. The document includes multiple-choice and constructed-response items that exemplify how the Common Core State Standards for Mathematics (CCSSM) will be assessed on the End-of-Course (EOC) tests. A discussion of each item highlights the knowledge and skills the item is intended to measure.

As Louisiana students and teachers transition to the CCSS and the Partnership for Assessment of Readiness for College and Careers (PARCC) assessments, the Algebra I EOC assessment will include only items aligned to the CCSS.

As you review the items, it is important to remember that the sample items included in this document represent only a portion of the body of knowledge and skills measured by the EOC test.

Algebra I Administration

The Algebra I EOC test is administered to students who have completed one of the following courses:

- Algebra I: course code 160321
- Algebra I, Part 2: course code 160338
- Algebra I, Middle School: course code 160380
- Applied Algebra I: course code 160331

Applied Algebra I Information

Applied Algebra I is an Algebra I course that includes problems and activities that show how algebra can be used in a variety of careers. The Applied Algebra I course covers the same Common Core State Standards (CCSS) as Algebra I.

Since the CCSSM requires many standards to be taught and assessed in real-world contexts, Applied Algebra I students will take the Algebra I form beginning with the December 2013 administration.

EOC Achievement Levels

Student scores for the Algebra I EOC test are reported at four achievement levels: *Excellent*, *Good*, *Fair*, and *Needs Improvement*. General definitions of the EOC achievement levels are shown below.

EOC Achievement-Level Definitions

Excellent: A student at this achievement level has demonstrated mastery of course content beyond *Good*.
Good: A student at this achievement level has demonstrated mastery of course content and is well prepared for the next level of coursework in the subject area.
Fair: A student at this achievement level has demonstrated only the fundamental knowledge and skills needed for the next level of coursework in the subject area.
Needs Improvement: A student at this achievement level has not demonstrated the fundamental knowledge and skills needed for the next level of coursework in the subject area.

Because of the shift from grade-level expectations to the CCSS, this document differs from the *Released Test Item Documents*. Many of the released items from past test administrations may not be indicative of the types of items on the upcoming December and May EOC transitional assessments. To better align the transitional test to the content of the CCSS, new items were developed. Therefore, this document includes sample items, rather than released items. These sample items reflect the way the CCSS will be assessed and represent the new items that students will encounter on the transitional EOC assessments. Because these are not released items, item-specific information about achievement levels is not included.

Algebra I

The Algebra I EOC test contains forty-six multiple-choice items and one constructed-response item. In addition, some field test items are embedded.

Multiple-choice items assess knowledge, conceptual understanding, and application of skills. They consist of an interrogatory stem followed by four answer options and are scored as correct or incorrect.

Constructed-response items require students to compose an answer, and these items generally require higher-order thinking. A typical constructed-response item may require students to develop an idea, demonstrate a problem-solving strategy, or justify an answer based on reasoning or evidence. The Algebra I constructed-response item is scored on a scale of 0 to 4 points. The general constructed-response rubric, shown below, provides descriptors for each score point.

Constructed-Response Rubric

Score	Description
4	• The student's response demonstrates in-depth understanding of the relevant content and/or procedures. • The student completes all important components of the task accurately and communicates ideas effectively. • Where appropriate, the student offers insightful interpretations and/or extensions. • Where appropriate, the student uses more sophisticated reasoning and/or efficient procedures.
3	• The student completes the most important aspects of the task accurately and communicates clearly. • The student's response demonstrates an understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood. • The student's logic and reasoning may contain minor flaws.
2	• The student completes some parts of the task successfully. • The student's response demonstrates gaps in conceptual understanding.
1	• The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.
0	• The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Testing Materials and Online Tools

Students taking the Algebra I EOC test have access to a number of resources. Scratch paper, graph paper, and pencils are provided by test administrators and can be used by students during all three sessions of the Algebra I EOC test.

There are also buttons at the top of the screen that a student may click to open the online tools. The list below identifies the online tools available for each session.

Session 1

- inch ruler
- centimeter ruler
- protractor

Note: Students are NOT allowed to use calculators during session 1 unless students have the approved accommodation *Assistive Technology* and are allowed the use of a calculator.

Sessions 2 and 3

- calculator
- protractor
- inch ruler
- centimeter ruler

Also available in session 2, which contains the constructed-response item, is the Algebra I Typing Help (see page 36). This online tool describes how to enter special characters, symbols, and formatting into typed responses. The graph paper, Typing Help, and EOC Tests online calculator can be found on the EOC Tests homepage at www.louisianaeoc.org under Test Coordinator Materials: Testing Materials.

Multiple-Choice Items

This section presents ten multiple-choice items selected to illustrate the type of skills and knowledge students need in order to demonstrate understanding of the CCSS in the Algebra I course. These items also represent the skills students need in order to meet performance expectations for Math Practices. Information shown for each item includes

- conceptual category,
- domain,
- cluster,
- standard,
- Math Practices,
- the calculator designation (calculator allowed or calculator not allowed),
- the correct answer,
- commentary on the skills and knowledge associated with the standard measured by the item,
- commentary on the Math Practices linked with the item,
- commentary on why the correct answer is correct including, in some cases, how the answer is achieved, and
- commentary on each answer choice, explaining why it is correct or incorrect.

Conceptual Category:	A—Algebra
Domain:	SSE—Seeing Structure in Expressions Cluster:
	A—Interpret the structure of expressions
Standard:	2—Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*
Math Practices:	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 7. Look for and make use of structure.
Calculator:	Calculator allowed

Teresa is simplifying an expression.

step 1: $\sqrt{4x^2}$

step 2: **?**

step 3: $2x$

What should Teresa add at step 2 to best complete the process?

*A. $\sqrt{(2x)^2}$

B. $2\sqrt{2x^2}$

C. $x\sqrt{4x}$

D. $\sqrt{(2+2)(x+x)}$

*correct answer

This item requires students to evaluate a series of steps involved in simplifying a radical expression. Specifically, students must recognize the structure of the original expression and use this structure to determine an equivalent expression that is useful in simplifying the expression, as opposed to any equivalent expression that does not relate to simplifying. This item requires students to use the skills covered in the grade 8 Expressions and Equations domain, and apply those skills to determine a useful expression.

This item is linked to three of the Math Practices.

- Math Practice 1 (*Make sense of problems and persevere in solving them.*): Students must examine the given solution pathway in the problem and determine the missing information.
- Math Practice 2 (*Reason abstractly and quantitatively.*): Students must make sense of the given quantities and manipulate the symbols in order to provide the correct missing information.
- Math Practice 7 (*Look for and make use of structure.*): Students must recognize the pattern and understand which equivalent expression could best be used to simplify the original expression.

Option A: This is the correct answer. The student correctly identifies that the expression $4x^2$ is equivalent to $(2x)^2$. From there, the student can identify the square root of $(2x)^2$ as $2x$.

Option B: The student incorrectly brings a 2 outside the radical while leaving a 2 inside. This represents the misunderstanding that taking the square root of a number involves placing one factor inside the radical and one factor outside the radical.

Option C: The student incorrectly brings an x outside the radical while leaving an x inside. This represents the misunderstanding that taking the square root of a squared variable involves placing one factor inside the radical and one factor outside the radical.

Option D: The student incorrectly rewrites 4 using addition instead of multiplication. While 4 does equal 2 + 2, this is not helpful in simplifying the original expression, and x^2 is not equivalent to $x + x$.

Conceptual Category:	A—Algebra
Domain:	REI—Reasoning with Equations and Inequalities
Cluster:	B—Solve equations and inequalities in one variable
Standard:	4a—Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
Math Practices:	7. Look for and make use of structure.
Calculator:	Calculator allowed

Use the equation to answer the question.

$$2x^2 + 8x - 7 = 7$$

Natasha is completing the square to rewrite the equation.

Which equation could be her result?

A. $(x + 2)^2 = 7$
B. $(x + 2)^2 = 9$
*C. $(x + 2)^2 = 11$
D. $(x + 2)^2 = 15$

*correct answer

This item requires students to use the method of completing the square as a first step in solving the given quadratic equation. The method of completing the square results in an equation that is easier to interpret or solve.

This item is linked to one of the Math Practices.

- Math Practice 7 (*Look for and make use of structure.*): Students must recognize the structure of the quadratic and use this to create another equation that is more useful.

Option C: This is the correct answer. One way to solve is by applying the following method.

Step 1	$2x^2 + 8x - 7 = 7$ $+7 \quad +7$ $2x^2 + 8x = 14$	Add 7 to both sides of the equation.
Step 2	$2(x^2 + 4x) = 14$	Factor 2 out of the left side of the equation.
Step 3	$\div 2 \quad \div 2$ $x^2 + 4x = 7$	Divide both sides of the equation by 2.
Step 4	$+4 \quad +4$ $x^2 + 4x + 4 = 11$	Complete the square by adding 4 to both sides because $\left(\frac{4}{2}\right)^2 = 4$.
Step 5	$(x + 2)^2 = 11$	Write in factored form.

Option A: This is an incorrect answer because, in step 4, the student did not add 4 to the right side of the equation.

Option B: This is an incorrect answer because the student inverted steps 3 and 4. The student added 4 to both sides, and then divided by 2.

Option D: This is an incorrect answer because the student skipped steps 1 and 3. The student also multiplied the coefficient 2 by 4 when completing the square, and then added 8 to the right side of the equation.

Conceptual Category:	A—Algebra
Domain:	CED—Creating Equations
Cluster:	A—Create equations that describe numbers or relationships
Standard:	2—Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
Math Practices:	4. Model with mathematics.
Calculator:	Calculator allowed

A construction company spends w weeks extending an existing road. The existing road is 5 miles long. Each week the company completes 0.2 miles of the extension.

Which equation models the **total** length (L) of the road over time?

*A. $L = 0.2w + 5$

B. $L = 0.2w - 5$

C. $w = 0.2L + 5$

D. $w = 0.2L - 5$

*correct answer

This item requires students to select an equation in two variables to model the relationship between two quantities in a given situation. This item aligns to the content of the standard, but not the full depth and rigor with which it should be taught.

This item is linked to one of the Math Practices.

- Math Practice 4 (*Model with mathematics.*): Students must examine each linear equation to determine which slope and y-intercept correspond to the rate of change and initial value in the given real-world context.

Option A: This is the correct answer. The length of the extension completed by the construction company, 0.2 miles each week, may be represented by the expression $0.2w$. This quantity must be added to the existing length of road, 5 miles, to model the total length, L.

Option B: The student incorrectly subtracts the length of the existing road instead of adding it to the length of the extension completed by the construction company over time.

Option C: This answer is a result of incorrectly transposing the variables that represent the number of weeks, w, the construction company spends extending the road and the total length of the road, L.

Option D: This answer represents incorrectly transposing the variables and also incorrectly subtracting the length of the existing road.

Conceptual Category:	A—Algebra
Domain:	APR—Arithmetic with Polynomials and Rational Expressions
Cluster:	A—Perform arithmetic operations on polynomials
Standard:	1—Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
Math Practices:	7. Look for and make use of structure.
Calculator:	Calculator not allowed

Ellen organizes concerts for a band. She knows that if she charges \$50 per ticket, about 400 people will buy tickets. For every \$1 she lowers the ticket price, an additional 15 people will buy tickets. Ellen wrote this expression to show the total income from tickets, where x is the number of dollars the ticket price has been reduced.

$$(50 - x)(400 + 15x)$$

Which expression is equivalent to Ellen's?

A. $14x + 450$

B. $-15x + 20{,}000$

C. $15x^2 - 400x + 20{,}000$

*D. $-15x^2 + 350x + 20{,}000$

*correct answer

This item requires students to multiply two binomials. Most items that assess this skill present the binomials with the x-terms first. Rearranging the terms, however, allows the expressions to align more naturally with the given context and more accurately assesses whether students understand the process of multiplying polynomials.

This item is linked to one of the Math Practices.

- Math Practice 7 (*Look for and make use of structure.*): Students must recognize that two binomials are being multiplied and apply the distributive property to find an equivalent expression.

Option D: This is the correct answer. One method to solving this problem is to use the distributive property, as shown in the following steps. Using the distributive property over other methods connects to prior knowledge and extends its application.

Step 1	$400(50 - x) + 15x(50 - x)$	distribute the first binomial to each term in the second binomial
Step 2	$20{,}000 - 400x + 750x - 15x^2$	distribute 400 into each term in $(50 - x)$ then distribute $15x$ to each term in $(50 - x)$
Step 3	$20{,}000 + 350x - 15x^2$	combine like terms
Step 4	$-15x^2 + 350x + 20{,}000$	reorder terms

Option A: This answer is the result of adding the binomials instead of multiplying them. The steps below show how the student may have arrived at the incorrect answer.

Step 1	$(50 + 400) + (-x + 15x)$	reorder to collect like terms (incorrect first step)
Step 2	$450 + 14x$	combine like terms
Step 3	$14x + 450$	reorder terms

Option B: The student incorrectly multiplies only the like terms instead of using the distributive property. The steps below show how the student may have arrived at the incorrect answer.

Step 1	$(50 \times 400) + (-x \times 15x)$	collect like terms (incorrect first step)
Step 2	$20{,}000 - 15x^2$	multiply
Step 3	$-15x^2 + 20{,}000$	reorder terms

Option C: The student incorrectly applies the distributive property. The steps below show how the student may have arrived at the incorrect answer.

Step 1	$50(400 + 15x) - x(400 + 15x)$	distribute second binomial to each term of the first binomial
Step 2	$20{,}000 - 400x + 15x^2$	multiply 50 by 400 neglect to distribute 50 to $15x$ multiply $-x$ by 400 multiply x by $15x$ (sign error) (incorrect second step)
Step 3	$15x^2 - 400x + 20{,}000$	reorder terms

Conceptual Category: F—Functions

Domain: IF—Interpreting Functions

Cluster: B—Interpret functions that arise in applications in terms of the context

Standard: 6—Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Math Practices: 2. Reason abstractly and quantitatively.

Calculator: Calculator allowed

Use the table to answer the question.

Gulf Water Temperature, Gulfport
(data collected on the fifteenth of the month)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Water Temperature (°F)	63.9	64.4	66.8	73.1	78.1	82.4	85.2	86.7	84.5

A scientist measures the water temperature in the Gulf at Gulfport on the fifteenth of each month. Her data is shown in the table.

What is the average rate of change between March 15 and June 15?

A. 2.6°F per month

B. 3.9°F per month

*C. 5.2°F per month

D. 7.8°F per month

*correct answer

This item requires students to interpret data from a table and use it to calculate the average rate of change of a function. This standard is often misinterpreted as finding the slope of a linear function where the rate of change is constant. However, it is meant to also apply to functions in which the rate of change fluctuates over time. Determining the slope of a linear function is a skill that is covered by the grade 8 Functions domain. Page 9 of the progression document *Grade 8, High School, Functions* explains this further.

This item is linked to one of the Math Practices.

- Math Practice 2 (*Reason abstractly and quantitatively*.): Students must use familiar slope calculations to compute the average rate of change of the function given in the table. Then, they must contextualize their result to identify the average change in water temperature over time.

Option C: This is the correct answer. This is the result of dividing the change in temperature (82.4 – 66.8) by the number of months (3) that elapsed between the given dates.

Option A: This response represents finding the average rate of change for the entire data set instead of the specified range of dates.

Option B: This answer is a result of dividing the change in temperature (82.4 – 66.8) by the number of boxes represented by the specified range of dates (4), rather than the change in time.

Option D: The student incorrectly computes the change in time as 2 months instead of 3 months.

Conceptual Category:	F—Functions
Domain:	IF—Interpreting Functions
Cluster:	C—Analyze functions using different representations
Standard:	8a—Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
Math Practices:	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 7. Look for and make use of structure.
Calculator:	Calculator not allowed

A cliff diver's height above the water, in meters, is modeled by the function $h(d) = -d^2 + 2d + 24$, where d represents how far the diver is from the cliff.

How far from the cliff will the diver be when she reaches the water?

A. 0 meters

B. 4 meters

*C. 6 meters

D. 24 meters

*correct answer

This item requires students to find the zeros of a quadratic function and interpret the zeros in terms of the context. Factoring is the most likely method students will use to solve the problem. Most factoring items involve a positive leading coefficient. This item begins with a $-d^2$ term, which will more accurately assess whether students understand how to factor a trinomial without relying on memorized algorithms. The item also adds a real-world context to the quadratic function, which allows students to demonstrate their skills beyond simple factoring.

This item is linked to three of the Math Practices.

- Math Practice 1 (*Make sense of problems and persevere in solving them.*): Students must recognize that reaching the water is the same as the function intersecting the x-axis. Then, they must determine the appropriate course of action to calculate the zeros of the function.
- Math Practice 2 (*Reason abstractly and quantitatively.*): Students must reason quantitatively to find the zeros of the given quadratic function. Then, they must contextualize the meaning of the zeros.
- Math Practice 7 (*Look for and make use of structure*): Students must examine the structure of the function in order to determine the proper way to factor into a product of two binomials.

Option C: This is the correct answer. The student factors the given quadratic equation to determine the zeros of the function. Then, the student selects the zero with a positive value, as it is the only value that makes sense in the context described. The steps below show how the student arrived at the answer.

Step 1	$0 = -d^2 + 2d + 24$	set the equation equal to zero
Step 2	$0 = (-d + 6)(d + 4)$	factor the equation
Step 3	$0 = (-d + 6)$ $0 = (d + 4)$	set each binomial equal to zero (zero product property)
Step 4	$d = 6$ $d = -4$	solve each equation for d
Step 5	$d = 6$	select the result that makes sense in the context of the problem

Option A: The student recognizes that the diver's height above the water is 0 meters when the diver reaches the water. However, the student confuses the vertical distance and the horizontal distance in the context of the problem.

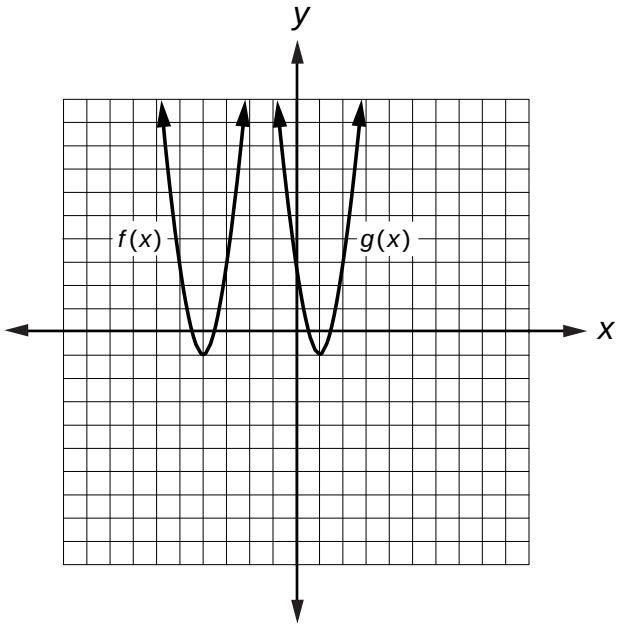
Option B: The student has a sign error when solving the equation for d or has a sign error when factoring. The steps below show one possible method the student used to reach the incorrect answer.

Step 1	$0 = -d^2 + 2d + 24$	set the equation equal to zero
Step 2	$0 = (-d + 6)(d + 4)$	factor the equation
Step 3	$0 = (-d + 6)$ $0 = (d + 4)$	set each binomial equal to zero (zero product property)
Step 4	$d = -6$ $d = 4$	solve each equation for d (sign error in solving)
Step 5	$d = 4$	select the result that makes sense in the context of the problem

Option D: The student confuses the y-intercept of the graph with the x-intercepts that represent the zeros of the given function.

Conceptual Category:	F—Functions
Domain:	BF—Building Functions
Cluster:	B—Build new functions from existing functions
Standard:	3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
Math Practices:	7. Look for and make use of structure.
Calculator:	Calculator not allowed

Use the graph to answer the question.



Which equation relates $f(x)$ with $g(x)$?

A. $g(x) = f(x) + 5$
B. $g(x) = f(x) – 5$
C. $g(x) = f(x + 5)$
*D. $g(x) = f(x – 5)$

*correct answer

This item requires students to identify the function $g(x)$ that correctly represents a transformation of the function $f(x)$. Students recognize that $g(x)$ is $f(x + k)$ and find the value of k, –5, from the graph.

This item is linked to one of the Math Practices.

- Math Practice 7 (*Look for and make use of structure.*): Students must use the structure of the function $f(x)$ as a single entity and determine how the structure changes with different placements of k. Specifically, students need to determine whether to add 5 to or subtract 5 from the value of x or the function, $f(x)$, to correctly represent the function $g(x)$.

Option D: This is the correct answer. Subtracting 5 from the value of x results in a horizontal translation of $f(x)$ to the right by 5 units.

Option A: The student incorrectly adds 5 to the function, $f(x)$. This represents a vertical translation of $f(x)$ up by 5 units.

Option B: The student incorrectly subtracts 5 from the function, $f(x)$. This represents a vertical translation of $f(x)$ down by 5 units.

Option C: The student incorrectly adds 5 to the value of x. This represents a horizontal translation of $f(x)$ to the left by 5 units.

Conceptual Category:	N—Number and Quantity
Domain:	Q—Quantities
Cluster:	A—Reason quantitatively and use units to solve problems
Standard:	2—Define appropriate quantities for the purpose of descriptive modeling.
Math Practices:	2. Reason abstractly and quantitatively.
Calculator:	Calculator allowed

Kianna is writing an equation to model the growth rate of a vine treated with fertilizer.

Which quantity is the **most** appropriate for modeling the growth rate?

*A. centimeters per day

B. centimeters per hour

C. feet per hour

D. feet per day

*correct answer

This item requires students to consider which units would be most appropriate for modeling the growth rate of a vine. Even students who are not familiar with the actual growth rate will understand that a vine grows relatively slow. This leaves only one clearly correct response.

This item is linked to one of the Math Practices.

- Math Practice 2 (*Reason abstractly and quantitatively.*): Using the context, students must reason about the most appropriate units of measure and time to form a rate.

Option A: This is the correct answer because a vine grows several centimeters each day. These units will generate a very usable equation that more closely models the growth.

Option B: This is not an appropriate unit to measure growth rate of a vine. If growth rate of a vine were measured in these units, it would be represented in fractions of a centimeter for each hour. Using these units would result in an equation that models the growth of the vine, but would not be usable in a realistic situation.

Option C: This is not an appropriate unit to measure the growth rate of a vine. If the growth rate of a vine were measured in these units, it would be measured in very small fractions of a foot for each hour. The quantity is not easily measurable and thus would result in a model that would not be practical to use.

Option D: This is not an appropriate unit to measure the growth rate of a vine. If the growth rate of a vine were measured in these units, it would be measured in fractions of a foot for each day. The quantities measured would generate a model that would be impractical to use in a realistic situation.

Conceptual Category:	S—Statistics and Probability
Domain:	ID—Interpreting Categorical and Quantitative Data
Cluster:	A—Summarize, represent, and interpret data on a single count or measurement variable
Standard:	3—Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
Math Practices:	2. Reason abstractly and quantitatively.
Calculator:	Calculator not allowed

Use the table to answer the question.

T-shirt Price Statistics for Two Stores

Store	Median	Mean	Interquartile Range
Cool Clothes	$13.99	$18.53	$8.24
Ben's Shirts	$14.99	$14.63	$4.60

Which conclusion about T-shirt prices at Cool Clothes and Ben's Shirts is **best** supported by the data?

*A. Some high-priced T-shirts at Cool Clothes make the mean higher than the median.

B. The fact that the mean and median are very similar at Ben's Shirts shows that all of the shirts cost under $15.

C. Comparing the mean prices shows that most shirts are cheaper at Ben's Shirts than at Cool Clothes.

D. Comparing the interquartile ranges shows that T-shirts at Cool Clothes are about twice as expensive as T-shirts at Ben's Shirts.

*correct answer

This item requires students to interpret data from a table and analyze how the statistical measures compare the prices of T-shirts for two stores. Students must select the description that accurately expresses the meaning of the data. The item requires more analysis of the statistical measures than the skills covered by the grade 7 Statistics and Probability domain.

This item is linked to one of the Math Practices.

- Math Practice 2 (*Reason abstractly and quantitatively.*): Students must reason about what the numerical statistical measures signify relative to the context of the given real-world situation.

Option A: This is the correct answer. High-priced shirts at Cool Clothes cause the mean to be significantly greater than the median.

Option B: The student does not use the interquartile range, which shows that there is a range of prices at Ben's Shirts that goes above $15.

Option C: This answer is the result of incorrectly interpreting the mean, which does not provide evidence about the number of shirts that are priced for less at Ben's Shirts than at Cool Clothes.

Option D: The student incorrectly interprets the interquartile range, which quantifies spread and is not a measure of center. The interquartile range does not provide details about specific values that would allow the student to state that shirts are "about twice as expensive."

Conceptual Category:	S—Statistics and Probability
Domain:	ID—Interpreting Categorical and Quantitative Data
Cluster:	C—Interpret linear models
Standard:	8—Compute (using technology) and interpret the correlation coefficient of a linear fit.
Math Practices:	2. Reason abstractly and quantitatively.
Calculator:	Calculator allowed

Deany collects data for a market research company on the number of dollars men and women spend on video games per year as a function of their age. She then models the data using linear functions.

- The correlation coefficient for the function for men is 0.30.
- The correlation coefficient for the function for women is 0.15.

Which statement correctly describes the meaning of the correlation coefficients?

A. Men spend approximately twice as much as women on video games.

*B. The function for men represents the amount they spend on video games better than the function for women.

C. Men spend the most on video games at age 30, and women spend the most on video games at age 15.

D. Men increase the amount they spend on video games by 30% each year, and women increase the amount they spend by 15%.

*correct answer

This item requires students to select the description that accurately expresses a correct comparison of the given correlation coefficients. It is difficult to assess computing correlation coefficients using technology on a standardized test, but asking students to interpret correlation coefficients accurately measures whether students understand the statistical definition.

This item is linked to one of the Math Practices.

- Math Practice 2 (*Reason abstractly and quantitatively.*): Students must reason about what the correlation coefficients mean in the context of the given real-world situation. Then, they must translate these statistical measures into everyday language.

Option B: This is the correct answer. A higher correlation coefficient represents a greater linear dependence between age and the amount of money spent on video games each year.

Option A: The student incorrectly confuses the correlation coefficient with the relative amount of money men spend on video games versus women.

Option C: The student incorrectly interprets the correlation coefficients as representing the age at which men and women spend the most amount of money on video games.

Option D: The student incorrectly interprets the correlation coefficient as the percentage increase in the amount of money men and women spend on video games each year.

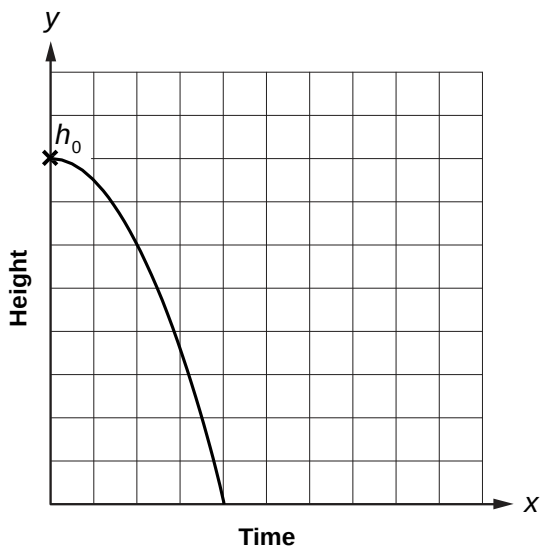
Constructed-Response Item

This section presents a constructed-response item and samples of student responses that received scores of 4, 3, 2, 1, 1 for minimal understanding, and 0. This section also includes information used to score this constructed-response item: an exemplary response, an explanation of how points are assigned, and a specific scoring rubric. In addition to the online resources available for all test questions, students have access to the Algebra I Typing Help (page 36), which describes how to enter special characters, symbols, and formatting into typed responses.

Constructed-Response Item

Conceptual Category:	F—Functions
Domain:	IF—Interpreting Functions
Cluster:	A—Understand the concept of a function and use function notation
Standard:	2—Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
Math Practices:	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 6. Attend to precision.
Calculator:	Calculator allowed

The height, in meters, of a rock as it falls at a given time (x), in seconds, can be found using the expression $-5x^2 + h_0$, where h_0 is the starting height where the rock falls.



Part A

A rock falls from a starting height of 80 meters. Write a function, $f(x)$, that models the height of the rock as it falls. Make sure to use proper function notation.

(*student enters response in text box*)

Part B

Using the function from part A, what is the value of $f(3)$?

(*student enters response in text box*)

Part C

Ahmed states that the domain for this function in the given context is $x \leq 4$. Explain why Ahmed is incorrect, **and** provide a correct domain.

(*student enters response in text box*)

This item requires students to use proper function notation to model a situation presented as a graph. To further test the standard, students must also evaluate their function for a given value for x. The student must provide a correct domain for the situation and explain why the given domain is incorrect.

This item is linked to five of the Math Practices.

- Math Practice 1 (*Make sense of problems and persevere in solving them.*): Students must examine and make sense of all of the given information in the problem and develop a solution pathway in order to provide the requested information.
- Math Practice 2 (*Reason abstractly and quantitatively.*): Students must use the given information and symbolic representations to contextualize their results and provide meaning for the quantities.
- Math Practice 3 (*Construct viable arguments and critique the reasoning of others.*): Students must critique the given domain and clearly explain why it is wrong.
- Math Practice 4 (*Model with mathematics.*): Students must write a mathematical function that models the given situation.
- Math Practice 6 (*Attend to precision.*): Students must accurately use function notation to communicate their response.

Scoring Information

Scoring Rubric

Score	Description
4	The student's response earns 4 points.
3	The student's response earns 3 points.
2	The student's response earns 2 points.
1	The student's response earns 1 point or demonstrates minimal understanding of functions.
0	The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Exemplary Response

Part A
f(x) = -5x^2 + 80

Part B
35 meters

Part C
Ahmed is incorrect because the time has to start at 0. You cannot have a negative time. The correct domain is 0 <= x <= 4.

Points Assigned

Part A: 1 point for correct function

Part B: 1 point for correct height for $f(3)$ from equation in part A

Part C: 1 point for correctly explaining why Ahmed is incorrect

Part C: 1 point for providing correct domain

Sample Student Responses

Score Point 4

The following authentic student responses show the work of two students who each earned a score of 4. A score of 4 is received when a student completes all required components of the task and communicates his or her ideas effectively. The response should demonstrate in-depth understanding of the content objectives, and all required components of the task should be complete.

Score Point 4, Student 1

Part A
f(x)= -5x^2 + 80

Part B
35 meters

Part C
Ahmed is incorrect because his answer is too vague. If anything less than zero is plugged into the equation it will not be a solution because the strating height was 80 meters. The correct domain would be 0<=x<=4

This student response is correct and well-reasoned. The student writes the correct function using proper function notation and evaluates the function to determine the correct value for $f(3)$. The student clearly explains why Ahmed's domain is incorrect and provides the correct domain for the given function situation.

Score Point 4, Student 2

Part A
f(x)= -5x^2 + 80

Part B
35 meters

Part C
Ahmed is incorrect, because his domain (all x values) goes into the negatives; in this function, the x values won't go into the negatives. The correct domain is 0<=x<=4.

This response receives full credit. The student provides the correct function using proper function notation and gives the correct value for $f(3)$. The student provides a clear explanation of why Ahmed is incorrect and provides the correct domain.

Score Point 3

The following authentic student responses show the work of two students who each earned a score of 3. A score of 3 is received when a student completes three of the four required components of the task. There may be simple errors in calculations or some confusion with communicating his or her ideas effectively.

Score Point 3, Student 1

Part A
f(x)=-5x^2+80

Part B
35 meters

Part C
The domain is wrong because the smallest x value on the graph where the rock starts is 0, not just any number less than 4. The rock does not go into negative x.

This student response provides the correct function using proper function notation and also gives the correct value for $f(3)$. The student explains that the lowest value on the graph is 0, which means that the left bound of infinity for Ahmed's domain is incorrect. However, the student does not provide the correct domain.

Score Point 3, Student 2

Part A
f(x)=-5x^2+80

Part B
f(3)=-5(3)^2+80 f(3)=35

Part C
It is incorrect because there has to be two numbers and the x in the inside of the two numbers. The correct answer would be 0<=x<=4.

In this response, the student provides the correct function using proper notation and the correct value for $f(3)$ in the response. The student incorrectly explains why Ahmed is incorrect. Not all domains require x to be between two numbers. The student provides the correct domain for the function.

Score Point 2

The following authentic student responses show the work of two students who each earned a score of 2. A score of 2 is received when a student completes two of the four required components of the task. There may be simple errors in calculations, one or two missing responses, or unclear or incorrect communications of his or her ideas.

Score Point 2, Student 1

Part A
f(x)=-5x^2+80

Part B
35 meters

Part C
Ahmed is incorrect because if x equals 4 the solution would be undefined. The solution can not be undefined because if the solution is undefined the function is higher then the starting point. A correct domain would be x <= 3.

The student provides the correct function using proper function notation and provides the correct value for $f(3)$. The student does not understand how the domain connects to the context and does not provide the correct domain.

Score Point 2, Student 2

Part A
f(x)= -5x^2+80

Part B
f(x)=-145

Part C
Ahmed is incorrect because the line does not cross the x-axis at only 4. The domain should be 0<=x<=4

The student provides the correct function using proper function notation. The value for $f(3)$ is incorrect. The student incorrectly confuses the x-intercepts with the domain. Although the concepts are related in this context, they are different. The student provides the correct domain.

Score Point 1

The following authentic student responses show the work of two students who each earned a score of 1 for their responses, and two students who each earned a score of 1 for demonstrating minimal understanding. A score of 1 is received when a student correctly addresses one of the four required components, or demonstrates at least minimal understanding of the key concepts.

Score Point 1, Student 1

Part A
-5x^2+80

Part B
45m

Part C
The domain is NOT <=4 because the rock starts to fall at 0 and lands at 4. The correct domain is 0>=x<=4.

This student response provides the correct expression that relates to the situation, but does not use proper function notation. The value given for $f(3)$ is incorrect. The student provides a clear reason for why Ahmed is incorrect; however, there is a sign error in the corrected domain.

Score Point 1, Student 2

Part A
-5x^2 + 80 = f(x)

Part B
35 seconds

Part C
Ahmed is incorrect because when the rock falls it could fall greater than 4. A correct domain is x >= 4

This response uses proper function notation and provides the correct function. The value for $f(3)$ is correct; however, the units are incorrect. The student does not understand that the domain represents the possible x-values in the situation and does not provide the correct domain.

Score Point 1, Student 3

Part A
y=-5x^2+80

Part B
-5x3^2+80=125 m.

Part C
Ahmed is incorrect because the value of f(3) is 125m. which is greater than 4.

The student does not use proper function notation, but does provide the correct equation. The value for $f(3)$ is incorrect. The student confuses domain with range in the explanation, and there is no corrected domain. The student does not earn any points; however, a single point is awarded for demonstrating minimal understanding of functions. The student provides a correct equation, but does not know how to use proper function notation. In order to earn minimal understanding, the student MUST write an equation; expressions will not earn minimal understanding. This is the case because an equation demonstrates understanding of input/output relationships (relating to functions), whereas an expression does not.

Score Point 1, Student 4

Part A
-5x^2+80

Part B
35 feet

Part C
Because 35 is more than 4 not less.

The student provides the correct expression for the situation, but does not use function notation. The value for $f(3)$ is correct, but the units are incorrect. The student thinks the output for the function must be in the domain. All outputs make up the range. The response does not include a correct domain. The student demonstrates how to find specific values for functions, but does not read the context close enough to determine the correct units to use. The student does not earn any points based on the Points Assigned section of the rubric; however, one point is awarded for minimal understanding for providing the correct value for $f(3)$ with the wrong units.

Score Point 0

The following samples show the work of two students who each earned a score of 0. A score of 0 is received when a student response is incorrect, irrelevant, too brief to evaluate, or blank.

Score Point 0, Student 1

Part A
-5x^2+80

Part B
-5*3^2+8 the value is -37

Part C
Ahmed is incorrect because the domain is not less than or equal to 4. the correct answer would be x>= -5

This student response provides the correct expression for the situation, but does not use function notation. The value for $f(3)$ is incorrect. The student does not provide any reasoning for why Ahmed is incorrect—he or she simply restates that the domain is not what was given. The student provides an incorrect domain.

Score Point 0, Student 2

Part A
f(x)=80m

Part B
f(3)=80m

Part C
Ashmed is incorrect ,because he didn't show the starting height of the rock falling which was 80 .

The student attempts to use proper notation, but does not use the expression given to represent the situation. The value for $f(3)$ is incorrect. The student confuses the domain with the y-intercept.

Algebra I Typing Help

As of July 2014, the Algebra I Typing Help has been updated to include complex roots. A current version can be found at https://www.louisianaeoc.org/Documents/AlgebraITypingHelp.pdf

Use these keyboard shortcuts to enter special characters, symbols, or formatting into your responses:

1. If the Response Includes:	2. Type This Instead:	3. Example:
× multiplication symbol	x letter x **OR** * asterisk (SHIFT + 8)	3 x 4 = 12 3 * 4 = 12
÷ division symbol	/ forward slash	12 / 3 = 4
$\frac{12-7}{3-1}$ fraction or ratio	/ forward slash	(12 – 7)/(3 – 1) Note: Parentheses are required.
$2\frac{3}{4}$ mixed number	space between whole number and fraction; forward slash to separate numerator and denominator of fraction	2 3/4
3^2 exponent	^ "caret" (SHIFT + 6)	3^2 = 9
π pi symbol	(pi)	Area = 9(pi) square inches
≥ "greater than or equal to"	>= greater than sign, followed by equals sign	y >= 13
≤ "less than or equal to"	<= less than sign, followed by equals sign	y <= 13
$\sqrt{4}$ square root	sqrt() the letters sqrt, with the radicand in parentheses	sqrt(4) = 2
≈ about equal to	=* equals sign, followed by asterisk (SHIFT + 8)	(pi) =* 3.14

END-OF-COURSE TESTS

October 2013

Louisiana Department of Education
Office of Assessments