Standard #: MAFS.912.A-REI.4.11

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Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

Grade: 912

Cluster: Represent and solve equations and inequalities graphically. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster) -
Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Date Adopted or Revised: 02/14

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - More Information

Date of Last Rating: 02/14

Status: State Board Approved

Assessed: Yes

TEST ITEM SPECIFICATIONS

Item Type(s): This benchmark may be assessed using: EE item(s)

Also assesses:
MAFS.912.A-REI.4.10

Assessment Limits :
In items where a function is represented by an equation, the function may be an exponential function with no more than one translation, a linear function, or a quadratic function.

In items where a function is represented by a graph or table, the function may be any continuous function.

Calculator :
Neutral

Clarification :
Students will find a solution or an approximate solution for f(x) = g(x) using a graph.

Students will find a solution or an approximate solution for f(x) = g(x) using a table of values.

Students will find a solution or an approximate solution for f(x) = g(x) using successive approximations that give the solution to a given place value.

Students will justify why the intersection of two functions is a solution to f(x) = g(x).

Students will verify if a set of ordered pairs is a solution of a function.

Stimulus Attributes :
Items may be set in a mathematical or real-world context.

Items may use function notation.

Items must designate the place value accuracy necessary for approximate solutions.

Response Attributes :
Items may require the student to complete a missing step in an algebraic justification of the solution of f(x) = g(x).

Items may require the student to explain the role of the x-coordinate and the y-coordinate in the intersection of f(x) = g(x).

Items may require the student to explain a process.

Items may require the student to record successive approximations used to find the solution of f(x) = g(x).

SAMPLE TEST ITEMS (1)

Test Item #: Sample Item 1
Question:
Cora is using successive approximations to estimate a positive solution to f(x)=g(x), where

$f(x)=x^2+13$ and $g(x)=3x+14$. The table shows her results for different input values of x.

x	f(x)	g(x)
0	13	14
1	14	17
2	17	20
3	22	23
4	29	26
3.5	25.25	24.5

Use Cora's process to find the positive solution, to the nearest tenth, of f(x)=g(x).

Difficulty: N/A
Type: EE: Equation Editor

Related Courses

Course Number	Course Title
1200310:	Algebra 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200320:	Algebra 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200330:	Algebra 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200340:	Algebra 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200370:	Algebra 1-A (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200410:	Mathematics for College Success (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200700:	Mathematics for College Readiness (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912070:	Access Liberal Arts Mathematics (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7912080:	Access Algebra 1A (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
1200315:	Algebra 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200335:	Algebra 2 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2019 (course terminated))
1200375:	Algebra 1-A for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912100:	Fundamental Algebraic Skills (Specifically in versions: 2013 - 2015, 2015 - 2017 (course terminated))
1207300:	Liberal Arts Mathematics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912075:	Access Algebra 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7912095:	Access Algebra 2 (Specifically in versions: 2016 - 2018, 2018 - 2019, 2019 and beyond (current))

Related Access Points

Independent

Access Points Number	Access Points Title
MAFS.912.A-REI.4.In.11a:	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically.

Access Point

Access Points Number	Access Points Title

MAFS.912.A-REI.4.AP.11a:	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically

Related Resources

Virtual Manipulative

Name	Description
Equation Grapher:	This interactive simulation investigates graphing linear and quadratic equations. Users are given the ability to define and change the coefficients and constants in order to observe resulting changes in the graph(s).

Formative Assessment

Name	Description
Graphs and Solutions - 2:	Students are asked to find the solution(s) of the equation $f(x) = g(x)$ given the graphs of f and g and explain their reasoning.
Graphs and Solutions -1:	Students are asked to explain why the x-coordinate of the intersection of two functions, f and g, is a solution of the equation $f(x) = g(x)$.
Using Tables:	Students are asked to find solutions of the equation $f(x) = g(x)$ for two given functions, f and g, by constructing a table of values.
Using Technology:	Students are asked to use technology (e.g., spreadsheet, graphing calculator, or dynamic geometry software) to estimate the solutions of the equation $f(x) = g(x)$ for given functions f and g.

Problem-Solving Task

Name	Description
Population and Food Supply:	In this task students use verbal descriptions to construct and compare linear and exponential functions and to find where the two functions intersect (F-LE.2, F-LE.3, A-REI.11).
Two Squares are Equal:	This classroom task is meant to elicit a variety of different methods of solving a quadratic equation (A-REI.4). Some are straightforward (for example, expanding the square on the right and rearranging the equation so that we can use the quadratic formula); some are simple but clever (reasoning from the fact that x and (2x - 9) have the same square); some use tools (using a graphing calculator to graph the functions f(x) = x^2 and g(x) = (2x-90)^2 and looking for values of x at which the two functions intersect). Some solution methods will work on an arbitrary quadratic equation, while others (such as the last three) may have difficulty or fail if the quadratic equation is not given in a particular form, or if the solutions are not rational numbers.

Assessment

Name	Description
Sample 1 - High School Algebra 2 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 2 - High School Algebra 1 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 2 - High School Algebra 2 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 3 - High School Algebra 1 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.

Unit/Lesson Sequence

Name	Description
Sample Algebra 1 Curriculum	This sample Algebra 1 CMAP is a fully customizable resource and curriculum-planning tool that provides a framework for the Algebra 1 Course. The units and standards are customizable and the CMAP allows instructors to add lessons, worksheets, and other resources as needed. This CMAP also includes rows that automatically filter and display Math Formative Assessments System tasks, E-Learning Original Student Tutorials and Perspectives Videos that are aligned to the standards, available on CPALMS. Learn more about the sample Algebra 1 CMAP, its features and customizability by watching the following video:

Plan Using CMAP:	

Using this CMAP

To view an introduction on the CMAP tool, please click here.

To view the CMAP, click on the "Open Resource Page" button above; be sure you are logged in to your iCPALMS account.

To use this CMAP, click on the "Clone" button once the CMAP opens in the "Open Resource Page." Once the CMAP is cloned, you will be able to see it as a class inside your iCPALMS My Planner (CMAPs) app.

To access your My Planner App and the cloned CMAP, click on the iCPALMS tab in the top menu.

All CMAP tutorials can be found within the iCPALMS Planner App or at the following URL: http://www.cpalms.org/support/tutorials_and_informational_videos.aspx

Original Student Tutorial

Name	Description
Solving an Equation Using a Graph:	Explain why the x-coordinate of the point of intersection of two functions is the solution of the equation f(x) = g(x).

Lesson Plan

Name	Description
Steel vs. Wooden Roller Coaster Lab:	This lesson is a Follow Up Activity to the Algebra Institute and allows students to apply their skills on analyzing bivariate data. This STEM lesson allows students the opportunity to investigate if there is a linear relationship between a coaster's height and speed. Using technology the students can determine the line of best fit, correlation coefficient and use the line for interpolation. This lesson also uses prior knowledge and has students solve systems of equations graphically to determine which type of coaster is faster.

Student Resources

Name	Description
Equation Grapher:	This interactive simulation investigates graphing linear and quadratic equations. Users are given the ability to define and change the coefficients and constants in order to observe resulting changes in the graph(s).
Population and Food Supply:	In this task students use verbal descriptions to construct and compare linear and exponential functions and to find where the two functions intersect (F-LE.2, F-LE.3, A-REI.11).
Solving an Equation Using a Graph:	Explain why the x-coordinate of the point of intersection of two functions is the solution of the equation f(x) = g(x).
Two Squares are Equal:	This classroom task is meant to elicit a variety of different methods of solving a quadratic equation (A-REI.4). Some are straightforward (for example, expanding the square on the right and rearranging the equation so that we can use the quadratic formula); some are simple but clever (reasoning from the fact that x and (2x - 9) have the same square); some use tools (using a graphing calculator to graph the functions f(x) = x^2 and g(x) = (2x-90)^2 and looking for values of x at which the two functions intersect). Some solution methods will work on an arbitrary quadratic equation, while others (such as the last three) may have difficulty or fail if the quadratic equation is not given in a particular form, or if the solutions are not rational numbers.

Parent Resources

Name	Description
Population and Food Supply:	In this task students use verbal descriptions to construct and compare linear and exponential functions and to find where the two functions intersect (F-LE.2, F-LE.3, A-REI.11).
Two Squares are Equal:	This classroom task is meant to elicit a variety of different methods of solving a quadratic equation (A-REI.4). Some are straightforward (for example, expanding the square on the right and rearranging the equation so that we can use the quadratic formula); some are simple but clever (reasoning from the fact that x and (2x - 9) have the same square); some use tools (using a graphing calculator to graph the functions f(x) = x^2 and g(x) = (2x-90)^2 and looking for values of x at which the two functions intersect). Some solution methods will work on an arbitrary quadratic equation, while others (such as the last three) may have difficulty or fail if the quadratic equation is not given in a particular form, or if the solutions are not rational numbers.