Standard #: MAFS.912.F-BF.1.1

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Write a function that describes a relationship between two quantities. ★

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

Grade: 912

Cluster: Build a function that models a relationship between two quantities. (Algebra 1 - Supporting 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 3: Strategic Thinking & Complex Reasoning - 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)

Assessed with:

MAFS.912.F-LE.1.2

SAMPLE TEST ITEMS (1)

Test Item #: Sample Item 1
Question:
Chantel drew a picture of her dog on a piece of paper that is 12 centimeters long. She used a copy machine to enlarge her drawing. She used the 115% setting to make each new copy. She then used each new copy to generate the next copy, using the same copier setting.

Enter a recursive formula that will give the length of each new copy.

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))
1200380:	Algebra 1-B (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1202340:	Pre-Calculus (Specifically in versions: 2014 - 2015, 2015 and beyond (current))

1201300:	Mathematical Analysis Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1298310:	Advanced Topics in Mathematics (formerly 129830A) (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200500:	Advanced Algebra with Financial Applications (Specifically in versions: 2014 - 2015 (course terminated))
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))
7912080:	Access Algebra 1A (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7912090:	Access Algebra 1B (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))
1200385:	Algebra 1-B for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1201315:	Analysis of Functions Honors (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))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.F-BF.1.AP.1a:	Select a function that describes a relationship between two quantities (e.g., relationship between inches and centimeters, Celsius Fahrenheit, distance = rate x time, recipe for peanut butter and jelly- relationship of peanut butter to jelly f(x)=2x, where x is the quantity of jelly, and f(x) is peanut butter.

Related Resources

Problem-Solving Task

Name	Description
A Sum of Functions:	In this example, students are given the graph of two functions and are asked to sketch the graph of the function that is their sum. The intent is that students develop a conceptual understanding of function addition.
Compounding with a 100% Interest Rate:	This task provides an approximation, and definition, of *e*, in the context of more and more frequent compounding of interest in a bank account. The approach is computational.
Compounding with a 5% Interest Rate:	This task develops reasoning behind the general formula for balances under continuously compounded interest. While this task itself specifically address the standard (F-BF), building functions from a context, an auxiliary purpose is to introduce and motivate the number *e*, which plays a significant role in the (F-LE) domain of tasks.
Crude Oil and Gas Mileage:	This task asks students to write expressions for various problems involving distance per units of volume.
Drip, Drop, Drip, Drop:	Students design an experiment to model a leaky faucet and determine the amount of water wasted due to the leak. Using the data they gather in a table, students graph and write an equation for a line of best fit. Students then use their derived equation to make predictions about the amount of water that would be wasted from one leak over a long period of time or the amount wasted by several leaks during a specific time period.
Flu on Campus:	The context of this example is the spread of a flu virus on campus and the related sale of tissue boxes sold. Students interpret the composite function and determine values simply by using the tables of values.
Graphs of Compositions:	This task addresses an important issue about inverse functions. In this case the function *f* is the inverse of the function *g* but *g* is not the inverse of *f* unless the domain of *f* is restricted.
Lake Algae:	The purpose of this task is to introduce students to exponential growth. While the context presents a classic example of exponential growth, it approaches it from a non-standard point of view.
Skeleton Tower:	This problem is a quadratic function example. The other tasks in this set illustrate MAFS.912.F.BF.1.1.a in the context of linear, exponential, and rational functions.
Summer Intern:	This task asks students to use proportions of mass and volume to create ideal brine for saltwater fish tanks. It also asks students to compare graphs.
Susita's Account:	This task asks students to determine a recursive process from a context. Students who study computer programming will make regular use of recursive processes.
Temperature Conversions:	Unit conversion problems provide a rich source of examples both for composition of functions (when several successive conversions are required) and inverses (units can always be converted in either of two directions).
The Canoe Trip, Variation 1:	The purpose of this task is to give students practice constructing functions that represent a quantity of interest in a context, and then interpreting features of the function in the light of the context. It can be used as either an assessment or a teaching task.
The Canoe Trip, Variation 2:	The primary purpose of this task is to lead students to a numerical and graphical understanding of the behavior of a rational function near a vertical asymptote, in terms of the expression defining the function.

Video/Audio/Animation

Name	Description
Basic Linear Function:	This video demonstrates writing a function that represents a real-life scenario.

Lesson Plan

Name	Description
Cup-Activity: writing equations from data:	This is a great lab activity that allows students to develop a true understanding of slope as a rate of change. Students are active and involved and must use higher order thinking skills in order to answer questions. Students work through an activity, measuring heights of cups that are stacked. Students them determine a "rate of change - slope". Students are then asked to put this into slope-intercept form. The important part here is in their determining the y-intercept of the equation. Students then take this further and finally attempt to create a linear inequality to determine how many cups, stacked vertically, will fit under a table.
Generalizing Patterns: Table Tiles:	This lesson unit is intended to help you assess how well students are able to identify linear and quadratic relationships in a realistic context: the number of tiles of different types that are needed for a range of square tabletops. In particular, this unit aims to identify and help students who have difficulties with choosing an appropriate, systematic way to collect and organize data, examining the data and looking for patterns; finding invariance and covariance in the numbers of different types of tile, generalizing using numerical, geometrical or algebraic structure and describing and explaining findings clearly and effectively.
Modeling: Rolling Cups:	This lesson unit is intended to help you assess how well students are able to choose appropriate mathematics to solve a non-routine problem, generate useful data by systematically controlling variables and develop experimental and analytical models of a physical situation.
Movie Theater MEA:	This MEA deals with creating a business plan for a movie theater, based on provided data. Students will first determine the best film to show, and then based on that decision, will create a model of ideal sales. Students will need to create equations and graph them to visually represent relationships.
My first credit card!:	Students use information about credit card Annual Percentage Rate (APR), introductory APR, balance transfer fees and APR, and special offers such as frequent flyer miles or "cash back" to determine which card is the best to help a college student pay expenses and begin establishing a credit rating.
Plants versus Pollutants Model Eliciting Activity:	The Plants versus Pollutants MEA provides students with an open-ended problem in which they must work as a team to design a procedure to select the best plants to clean up certain toxins. This MEA requires students to formulate a phytoremediation-based solution to a problem involving cleaning of a contaminated land site. Students are provided the context of the problem, a request letter from a client asking them to provide a recommendation, and data relevant to the situation. Students utilize the data to create a defensible model solution to present to the client.
The Friendly Confines or The Nat - who has the best ballpark?:	Students will use basic arithmetic, simple functions, averages, and possibly weighted averages to rank 6 Major League Baseball Parks by home field advantage. Students will write a description of their process using correct terminology and appropriate tone.

Virtual Manipulative

Name	Description
Data Flyer:	Using this virtual manipulative, students are able to graph a function and a set of ordered pairs on the same coordinate plane. The constants, coefficients, and exponents can be adjusted using slider bars, so the student can explore the affect on the graph as the function parameters are changed. Students can also examine the deviation of the data from the function. This activity includes supplemental materials, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the java applet.
Number Cruncher:	In this activity, students enter inputs into a function machine. Then, by examining the outputs, they must determine what function the machine is performing. This activity allows students to explore functions and what inputs are most useful for determining the function rule. This activity includes supplemental materials, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the java applet.

Formative Assessment

Name	Description
Furniture Purchase:	Students are asked to write two explicit functions given verbal descriptions in a real-world context, compose the two functions, and explain the meaning in context.
Giveaway:	Students are asked to write an explicit function rule given a verbal description of a functional relationship in a real-world context and are then asked to use the function rule to answer a question.
How Much Bacteria?:	Students are asked to write and combine an exponential and a constant function from a verbal description to use when answering a related context question.
Saving for a Car:	Students are asked to write an explicit function rule given a verbal description of a functional relationship in a real-world context and are then asked to use the function rule to answer specific questions.

Professional Development

Name	Description
Mathematical Modeling: Insights into Algebra, Teaching for Learning:	This professional development resource provides a rich collection of information to help teachers engage students more effectively in mathematical modeling. It features videos of two complete lessons with commentary, background information on effective teaching, modeling, and lesson study, full lesson plans to teach both example lessons, examples of student work from the lessons, tips for effective teaching strategies, and list of helpful resources. • In Lesson 1 students use mathematical models (tables and equations) to represent the relationship between the number of revolutions made by a "driver" and a "follower" (two connected gears in a system), and they will explain the significance of the radii of the gears in regard to this relationship. • In Lesson 2 students mathematically model the growth of populations and use exponential functions to represent

	that growth.

Lesson Study Resource Kit

Name	Description
Motion and Forces:	This Lesson Study Resource Kit was adapted from a 2013 BioScopes physical science summer institute. It features a STEM-integrated unit plan that consists of resources and activities aligned to a unit of instruction on that employs Vernier LabQuest probeware in an investigation of Newton's Laws that complies with the Florida Standards for mathematics and the NGSSS for science for grades 9-12.

Assessment

Name	Description
Sample 1 - High School Algebra 1 State Interim Assessment:	This is the State Interim Assessment for high school.
Sample 1 - High School Algebra 2 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.
Sample 3 - High School Algebra 2 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 4 - High School Algebra 1 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 4 - High School Algebra 2 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.

Unit/Lesson Sequence

Name	Description
Sample Algebra 1 Curriculum Plan Using CMAP:	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: **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

Teaching Idea

Name	Description
Writing Linear Functions with Tickets:	This classroom activity allows students to use teacher made and assigned traffic tickets to create linear functions. Students may also use a graphing calculator to use the table and graph features.

Student Resources

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Parent Resources

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