

Standard #: MAFS.912.F-IF.2.6

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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. ★

Subject Area: Mathematics	Grade: 912
Domain-Subdomain: Functions: Interpreting Functions	Cluster: Level 2: Basic Application of Skills & Concepts
Cluster: Interpret functions that arise in applications in terms of the context. (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: [MC](#) item(s)

Also assesses: MAFS.912.S-ID.3.7

Assessment Limits :

Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable.

Items should not require the student to find an equation of a line.

Items assessing S-ID.3.7 should include data sets. Data sets must contain at least six data pairs. The linear function given in the item should be the regression equation.

For items assessing S-ID.3.7, the rate of change and the y-intercept should have a value with at least a hundredths place value.

Items assessing F-IF.2.6 should not be linear.

Calculator :

Neutral

Clarification :

Students will calculate the average rate of change of a continuous function that is represented algebraically, in a table of values, on a graph, or as a set of data.

Students will interpret the average rate of change of a continuous function that is represented algebraically, in a table of values, on a graph, or as a set of data with a real-world context.

Students will interpret the y-intercept of a linear model that represents a set of data with a real-world context.

Stimulus Attributes :

Items may require the student to apply the basic modeling cycle.

Items should be set in a real-world context.

Items must use function notation.

Items may require the student to choose and interpret variables.

Response Attributes :

Items may require the student to choose an appropriate level of accuracy.

Items may require the student to choose and interpret the scale in a graph.

Items may require the student to choose and interpret units.

SAMPLE TEST ITEMS (1)

Test Item #: [Sample Item 1](#)

Question:

The graph shows the number of acres, in millions, of farmland in the United States from 1975 to 2008.



Which statement describes the average rate of change of the graph?

Difficulty: N/A

Type: [MC: Multiple Choice](#)

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))
1206330:	Analytic Geometry (Specifically in versions: 2014 - 2015 (course terminated))
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))
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))
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))
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))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.F-IF.2.AP.6b:	Describe the rate of change of a function using numbers.
MAFS.912.F-IF.2.AP.6c:	Pair the rate of change with its graph.

Related Resources

Name	Description
Acceleration:	<p>In this lesson students will learn to:</p> <ol style="list-style-type: none"> 1. Identify changes in motion that produce acceleration. 2. Describe examples of objects moving with constant acceleration. 3. Calculate the acceleration of an object, analytically, and graphically. 4. Interpret velocity-time graph, and explain the meaning of the slope. 5. Classify acceleration as positive, negative, and zero. 6. Describe instantaneous acceleration.
BIOSCOPEs Summer Institute 2013 - Motion:	<p>This lesson is the first in a sequence of grade 9-12 physical science lessons that are organized around the big ideas that frame motion, forces, and energy. It directly precedes resource # 52648 "BIOSCOPEs Summer Institute 2013 - Forces." This lesson is designed along the lines of an iterative 5-E learning cycle and employs a predict, observe, and explain (POE) activity at the beginning of the "Engage" phase in order to elicit student prior knowledge. The POE is followed by a sequence of inquiry-based activities and class discussions that are geared toward leading the students systematically through the exploration of 1-dimensional motion concepts. Included in this resource is a summative assessment as well as a teacher guide for each activity.</p>
Compacting Cardboard:	<p>Students will investigate the amount of space that could be saved by flattening cardboard boxes. The analysis includes linear graphs and regression analysis along with discussions of slope and a direct variation phenomenon.</p>
Cup-Activity: writing equations from data:	<p>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 then 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.</p>
Functions and Everyday Situations:	<p>This lesson unit is intended to help you assess how well students are able to articulate verbally the relationships between variables arising in everyday contexts, translate between everyday situations and sketch graphs of relationships between variables, interpret algebraic functions in terms of the contexts in which they arise and reflect on the domains of everyday functions and in particular whether they should be discrete or continuous.</p>
Slide, Slide Away :	<p>In this Engineering Design Challenge, student teams will design, calculate, build and then test a tower structure that can successfully hold a slide made from a pool tube. The slide will be placed at three different heights to determine which height is safe yet still fun. Students will be given supply restraints and guidelines as they work in teams to solve the problem.</p>

Formative Assessment

Name	Description
Air Cannon:	<p>Students are given a graph of an exponential function and are asked to calculate and compare the average rate of change over two different intervals of time.</p>
Estimating the Average Rate of Change:	<p>Students are asked to estimate the average rate of change of a nonlinear function over two different intervals given its graph.</p>
Identifying Rate of Change:	<p>Students are asked to calculate and interpret the rate of change of a linear function given its graph.</p>
Pizza Palace:	<p>Students are given a table of functional values in context and are asked to find the average rate of change over a specific interval.</p>

Original Student Tutorial

Name	Description
Changing Rates:	<p>Learn how to calculate and interpret an average rate of change over a specific interval on a graph.</p>

Virtual Manipulative

Name	Description
Equation Grapher:	<p>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).</p>
Function Flyer:	<p>In this online tool, students input a function to create a graph where the constants, coefficients, and exponents can be adjusted by slider bars. This tool allows students to explore graphs of functions and how adjusting the numbers in the function affect the graph. Using tabs at the top of the page you can also access 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.</p>
Graphing Lines:	<p>Allows students access to a Cartesian Coordinate System where linear equations can be graphed and details of the line and the slope can be observed.</p>

Perspectives Video: Expert

Name	Description
Improving Hurricane Scales:	<p>Meteorologist, Michael Kozar, discusses the limitations to existing hurricane scales and how he is helping to develop an improved scale.</p>

Name	Description
Linear Functions and Slope:	This session on linear function and slope contains five parts, multiple problems and videos, and interactive activities geared to help students recognize and understand linear relationships, explore slope and dependent and independent variables in graphs of linear relationships, and develop an understanding of rates and how they are related to slopes and equations. Throughout the session, students use spreadsheets to complete the work, and are encouraged to think about the ways technology can aid in teaching and understanding. The solutions for all problems are given, and many allow students to have a hint or tip as they solve. There is even a homework assignment with four problems for students after they have finished all five parts of the session.
Sample Algebra 1 Curriculum Plan Using CMAP:	<p>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.</p> <p>Learn more about the sample Algebra 1 CMAP, its features and customizability by watching the following video:</p> <p>Sample Algebra 1 Curriculum Plan Using CMAP:</p> <h3>Using this CMAP</h3> <p>To view an introduction on the CMAP tool, please click here.</p> <p>To view the CMAP, click on the "Open Resource Page" button above; be sure you are logged in to your iCPALMS account.</p> <p>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.</p> <p>To access your My Planner App and the cloned CMAP, click on the iCPALMS tab in the top menu.</p> <p>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</p>

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 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.

Video/Audio/Animation

Name	Description
Slope:	"Slope" is a fundamental concept in mathematics. Slope is often defined as " the rise over the run"....but why?

Problem-Solving Task

Name	Description
The High School Gym:	This task asks students to consider functions in regard to temperatures in a high school gym.

Name	Description
The Motion of Objects:	This 9-12 Lesson study resource kit is designed to engage teachers of physical science and physics in the planning and design of an instructional unit and research lesson pertaining to the motion of objects. Included in this resource kit are unit plans, concept progressions, formative and summative assessments, complex informational texts, and etc. that align to relevant NGSSS science, and the new Florida standards for mathematics and English language arts.

Student Resources

Name	Description
Changing Rates:	Learn how to calculate and interpret an average rate of change over a specific interval on a graph.
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).
Function Flyer:	In this online tool, students input a function to create a graph where the constants, coefficients, and exponents can be adjusted by slider bars. This tool allows students to explore graphs of functions and how adjusting the numbers in the function affect the graph. Using tabs at the top of the page you can also access 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.
Graphing Lines:	Allows students access to a Cartesian Coordinate System where linear equations can be graphed and details of the line and the slope can be observed.
Slope:	"Slope" is a fundamental concept in mathematics. Slope is often defined as " the rise over the run"....but why?
The High School Gym:	This task asks students to consider functions in regard to temperatures in a high school gym.

Parent Resources

Name	Description
Graphing Lines:	Allows students access to a Cartesian Coordinate System where linear equations can be graphed and details of the line and the slope can be observed.
The High School Gym:	This task asks students to consider functions in regard to temperatures in a high school gym.