Lesson 1.07 Average Rate of Change

Students will be able to:

- Content Objective: Calculate the average rate of change from a graph, table, and equation.
- Language Objective: Describe the relationship between linear functions and average rate of change.

Warm Up

Multiple Choice

1. If the point (-2,0) lies on the graph of $f(x)$, which point must lie on its inverse?

   (1) $(0, 2)$
   (2) $(-2, 0)$
   (3) $(2,0)$
   (4) $(0, -2)$

2. Which of the following is the inverse of the function $f(x) = \frac{2}{x+1}$?

   (1) $f^{-1}(x) = \frac{4}{x+2} + 1$
   (2) $f^{-1}(x) = \frac{2}{-x+2} - 2$
   (3) $f^{-1}(x) = \frac{2}{x-3} + 2$
   (4) $f^{-1}(x) = \frac{2}{x} - 1$

Vocabulary Review

___1. Domain	a. The change in y-values over the change in x-values. Also represents the steepness of a function.
___2. Slope	b. The set of all output values of a function.
___3. Range	c. The point on a graph that crosses the y-axis. Also, when $x = 0$.
___4. y-intercept	d. The set of all input values of a function.
___5. Inverse Function	e. Second function that technically undoes the work of the first.

Graphic Organizer

Average Rate of Change

Definition:

The Average Rate of Change is defined as the average rate at which one quantity is changing with respect to something else changing.

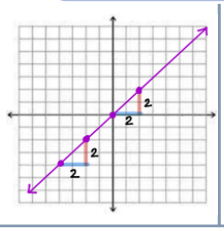
Formula:

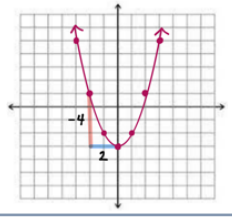
Average rate of change= $\frac{\Delta y}{\Delta x} = \frac{f(x_2)-f(x_1)}{x_2-x_1}$

(Slope formula)

The average rate of change over both intervals is $\frac{\Delta y}{\Delta x} = \frac{2}{2} = 1$

This is a constant rate of change since the function is linear





The average rate of change over this interval is $\frac{\Delta y}{\Delta x} = -\frac{4}{2} = -2$

This is not a constant rate of change since the function is not linear

Skill 1: Equations

Given the equation $f(x) = 2x + 4$, find the average rate of change over the following intervals.

a. $[-2, 4]$

b. $[0, 5]$

Exercise 1: Equations

Given the equation $h(x) = 4x^2 - 20$, find the average rate of change over the following intervals.

c. $[-3, 2]$

d. $1 \leq x \leq 4$

Write It Out

What do you notice about the rate of change over both intervals in skill 1 and exercise 1? Why do you think this is? Explain.

Skill 2: Tables

Use the table to find the average rate of change over the following interval. Round to the nearest tenth.

a. $[2,8]$

x	y
0	6.75
2	9.12
4	12.30
6	16.61
8	22.42
10	30.27

Exercise 2: Tables

Use the table to find the average rate of change over the following interval. Round to the nearest tenth.

b. $[0,10]$

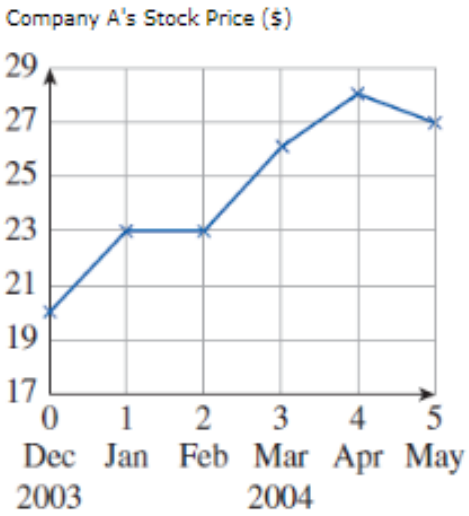
Do you think this function is linear? Why or why not?

Skill 3: Graphs

Use the graph on the right to calculate the average rate of change over the given interval.

a. $[0,1]$

b. $[3,4]$



Exercise 3: Graphs

Over which interval is the average rate of change for Company A's stock prices the greatest?

(1) $[0,1]$

(2) $[1,2]$

(3) $[3,4]$

(4) $[4,5]$

Check Point

Multiple Choice

Using the table below, which of the following represents the correct set up to determine the average rate of change over the interval $[0,4]$?

x	y
-3	7
0	-2
1	3
4	-8

(1) $\frac{-8-(-2)}{4-0}$

(2) $\frac{4-0}{-8-(-2)}$

(3) $\frac{4-0}{-8+(-2)}$

(4) $\frac{-8+(-2)}{4-0}$

1.07 Problem Set

Name:_____

1. A football is thrown upward with an initial velocity of 40 feet per second from a height of 100 feet. The height of the ball t seconds after it is thrown is given by the function $h(t) = 16t^2 + 40t + 100$. Determine the ball's average velocity from $t = 2$ to $t = 3$ seconds.

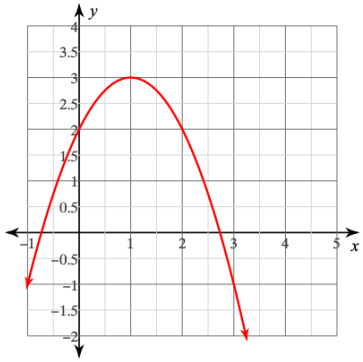
   (1) $120\ ft/s$

   (2) $40\ ft/s$

   (3) $-15.3\ ft/s$

   (4) $192\ ft/s$

2. Given the graph of the quadratic function $f(x) = -x^2 + 2x + 2$

   a. Use the graph to determine the average rate of change over the following interval $0 \leq x \leq 3$

   b. Use the equation to determine the average rate of change over the interval $[-2, 5]$

3. Michael bounces a tennis ball on the ground and the distance $d(t)$, in feet, that it travels after t seconds can be modeled by the function $d(t) = 0.73t^2$.

   a. What is the average rate of the bouncy ball between the first and fourth second?

   b. Explain what the average rate of change represents in terms of the context of the problem.