

derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .

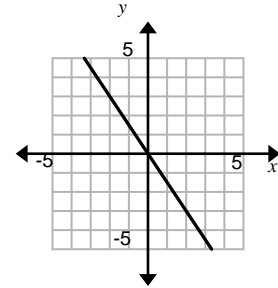
Given an equation in slope-intercept form, students graph the line represented.

Students write equations in the form $y = mx$ for lines going through the origin, recognizing that m represents the slope of the line.

Example 2:

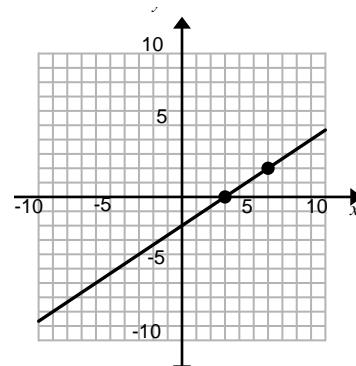
Write an equation to represent the graph to the right.

Solution: $y = -\frac{3}{2}x$



Students write equations in the form $y = mx + b$ for lines not passing through the origin, recognizing that m represents the slope and b represents the y-intercept.

Solution: $y = \frac{2}{3}x - 2$



8.F.2 Students compare two functions from different representations.

Example 1:

Compare the following functions to determine which has the greater rate of change.

Function 1: $y = 2x + 4$

Function 2:

x	y
-1	-6
0	-3
2	3

Solution: The rate of change for Function 1 is 2; the rate of change for Function 2 is 3. Function 2 has the greater rate of change.

8.F.A.2

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For*



example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Example 2:

Compare the two linear functions listed and determine which has a negative slope.

Function 1: Gift Card

Samantha starts with \$20 on a gift card for the bookstore. She spends \$3.50 per week to buy a magazine. Let y be the amount remaining as a function of the number of weeks, x .

x	y
0	20
1	16.50
2	13.00

Function 2: Calculator rental

The school bookstore rents graphing calculators for \$5 per month. It also collects a non-refundable fee of \$10.00 for the school year. Write the rule for the total cost (c) of renting a calculator as a function of the number of months (m).

$$c = 10 + 5m$$

Solution: Function 1 is an example of a function whose graph has a negative slope. Both functions have a positive starting amount; however, in function 1, the amount decreases 3.50 each week, while in function 2, the amount increases 5.00 each month.

NOTE: Functions could be expressed in standard form. However, the intent is not to change from standard form to slope-intercept form but to use the standard form to generate ordered pairs. Substituting a zero (0) for x and y will generate two ordered pairs. From these ordered pairs, the slope could be determined.

Example 3:

$$2x + 3y = 6$$

$$\text{Let } x = 0: \quad 2(0) + 3y = 6$$

$$3y = 6$$

$$\frac{3y}{3} = \frac{6}{3}$$

$$y = 2$$

Ordered pair: (0, 2)

$$\text{Let } y = 0: \quad 2x + 3(0) = 6$$

$$2x = 6$$

$$\frac{2x}{2} = \frac{6}{2}$$

$$x = 3$$

Ordered pair: (3, 0)

Using (0, 2) and (3, 0) students could find the slope and make comparisons with another function.

8.F.A.3 (part)

Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.3 Students understand that linear functions have a constant rate of change between any two points. Students use equations, graphs and tables to categorize functions as linear or non-linear.

Example 1:

Determine if the functions listed below are linear or non-linear. Explain your reasoning.

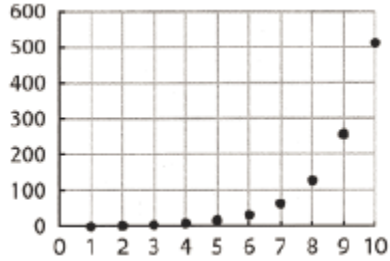
- $y = -2x^2 + 3$

- $y = 0.25 + 0.5(x - 2)$



3.

x	y
1	12
2	7
3	4
4	3
5	4
6	7

4. 

Solution:

1. Non-linear; there is not a constant rate of change
2. Linear; there is a constant rate of change
3. Non-linear; there is not a constant rate of change
4. Non-linear; the graph curves indicating the rate of change is not constant.

Approximate Time Frame: 3 – 4 weeks

Terms:

- constant of proportionality
- dependent variable
- direct variation
- independent variable
- intercept
- linear function
- proportional relationship
- rate of change
- rise/run
- similar triangles
- slope
- slope-intercept form
- unit rate
- $y = mx$
- $y = mx + b$

Resources

MGH – McGraw Hill, Glencoe Math (2015)
 ML – McDougal Littell, Pre-Algebra Book; Larson, 2005
 EX – Explorations in Core Math (Holt McDougal)
 IL – Illinois Model Math Curriculum

NY – Engage New York
 MAP – Math Assessment Project (MARS)
 MA – Massachusetts Model Curriculum Units - you will have to sign-up for 30 day permission

	<i>Suggested Topics for Lessons</i>	<i>Possible Resources</i>
Prep for unit	<p>Constant Rate of Change (proportional and non-proportional)</p> <p>Slope</p>	<ul style="list-style-type: none"> ➤ MGH 3-1 Constant Rate of Change (page 171) ➤ MGH 3-1 Inquiry Lab: <i>Graphing Technology – Rate of Change</i> (page 179) ➤ MGH 3-2 <i>Slope</i> (page 181) ➤ EX 8-1 <i>Graphing Linear Equations: Rates of Change</i> (page 295) ➤ Pearson Video: Finding Rate of Change Using a Table ➤ Learn Zillion Lesson: Determining the constant rate of change ➤ Pearson Video: Finding the Rate of Change Using a Graph

		<ul style="list-style-type: none"> ➤ Khan Academy: Slope and Rate of Change ➤ EX 8-2 Slope of a Line (page 299) ➤ ML 8.4 The Slope of a Line (page 404) ➤ Khan Academy: What does the slope represent? ➤ YouTube Video Song: Slope of a Line ➤ YouTube Video Song: Slope Music Rap
8.EE.B.6	<p>Use similar triangles to explain why the slope m is the same between any two distinct points on a line</p> <p>SBAC Evidence:</p> <ul style="list-style-type: none"> ➤ The student uses similar triangles to determine that the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. 	<ul style="list-style-type: none"> ➤ MGH 3.4 Inquiry Lab Slope Triangles (page 207) ➤ Learn Zillion Video Lesson: Make Lines from Right Triangles ➤ Khan Academy Video Lesson: Slope and Triangle Similarity 2 ➤ Slide Share Lesson: Similar Triangles and Slope ➤ NYCDOE Series of tasks: Slippery Slopes ➤ PBS Learning Media: Understanding Slope with Similar Triangles ➤ NY Module 4, Lesson 16: The Computation of the Slope of a Non-Vertical Line ➤ MA Lesson 4: Analyzing Rates of Change Visually and Numerically
8.EE.B.5 8.EE.B.6	<p>Proportional Relationships $y = mx$ Interpreting Unit Rate as Slope</p> <p>SBAC Evidence:</p> <ul style="list-style-type: none"> ➤ The student graphs proportional relationships. ➤ The student interprets the unit rate as the slope of the graph of a proportional relationship. ➤ The student finds the equation $y = mx$ for a line. 	<ul style="list-style-type: none"> ➤ MGH 3-3 Equations in $y = mx$ Form (page 189) ➤ Learn Zillion Lesson Plan: Graphing Proportional Relationships ➤ Learn Zillion Video Lesson: Display all possibilities in proportional relationship ➤ Khan Academy Video & Problems: Graphing and analyzing proportional relationships ➤ ML 8.6 Direct Variation (page 423) ➤ EX 8-5 Direct Variation (page 317) ➤ Learn Zillion Lesson Plan: Interpret Unit Rate as Slope ➤ Learn Zillion Video Lesson: Find a Unit Rate Using a Graph ➤ Learn Zillion Video Lesson: Find a Fractional Unit Rate by using a Graph ➤ Learn Zillion Video Lesson: Derive $y = mx$ Using Similar Triangles ➤ Illustrative Math Problems: Click here ➤ 8.EE.5 Lesson Strickler—Look at Student Crazy Rates: Click here



<p>8.EE.B.5</p>	<p>Compare proportional relationships in different formats</p> <p>SBAC Evidence:</p> <ul style="list-style-type: none"> ➤ The student compares two different proportional relationships represented in different formats. 	<ul style="list-style-type: none"> ➤ MGH 4-5 Compare Properties of Functions (page 309) ➤ YouTube Lesson: Compare Rates (Slopes) in Different Forms ➤ Learn Zillion Video Lessons: Understand Proportional Relationships by Relating Graphs and Equations ➤ Learn Zillion Lesson Plan: Compare Proportional Relationships
<p>8.EE.B.6 8.F.A.3</p>	<p>Proportional relationships vs non-proportional relationships</p> <p>$y = mx + b$</p> <p>Slope-Intercept Form</p> <p>SBAC Evidence:</p> <ul style="list-style-type: none"> ➤ The student finds/derives the equation $y = mx + b$ for a line. ➤ The student interprets the equation $y = mx + b$ as defining a linear function with a graph that is a straight line 	<ul style="list-style-type: none"> ➤ MGH 3-4 Slope-Intercept Form (page 199) ➤ MGH 3-5 Graphing a Line Using Intercepts (page 209) ➤ ML 8.5 Slope-Intercept Form (page 412) ➤ EX 8-3 Using Slopes and Intercepts (page 305) ➤ Learn Zillion Video Lessons: Interpret the Equation $y = mx + b$ ➤ Learn Zillion Video Lessons: Interpret the Equation $y = mx + b$ as defining a linear Function ➤ Illustrative Math Task: Introduction to Linear Functions ➤ Video Notes: Proportional vs Non-proportional Relationships ➤ YouTube: Introducing Desmos Online Graphing Calculator ➤ Learn Zillion Video Lesson: Derive $y = mx + b$ Using Similar Triangles ➤ MAP: Lines, Slopes and Linear Equations ➤ YouTube Video Song: $y = mx + b$ math remix
<p>8.F.A.2</p>	<p>Compare functions represented four ways: equation, graph, table, description</p> <p>SBAC Evidence:</p> <ul style="list-style-type: none"> ➤ The student recognizes the same function written in different functional forms (algebraic, graphic, tabular, or verbal). ➤ The student compares properties of two functions represented in a different way (algebraic, graphic, tabular, or verbal). 	<ul style="list-style-type: none"> ➤ EX 9-4 Comparing Multiple Representations (page 361) ➤ IL Unit 4, Lesson 4: Comparing Functions ➤ NY Module 5, Lesson 7: Comparing Linear Functions and Graphs ➤ Tufts Lesson/Activity: Who Shares my Function—Linear with All Representations ➤ Learn Zillion Video Lesson: Compare two functions by analyzing an equation and a graph ➤ Learn Zillion Video Lesson: Compare two functions by analyzing an equation and a table ➤ Learn Zillion Video Lesson: Compare two functions by analyzing an equation and a verbal description ➤ Illustrative Math: 8.F.2 Battery Charging