Skill Check:

rewrite the equation in slope intercept form:

2y = 3x + 10

What is the slope?

What is the y-int?

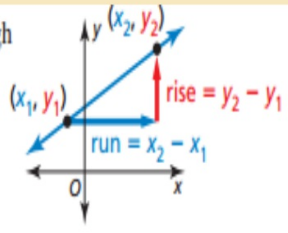
3-5 Notes
Graphing Linear Equations
(Slope-Intercept form)

Vocabulary:

1.) Slope: rate of change between any two points on a line. (steepness)

The **slope** m of a nonvertical line passing through two points (x_1, y_1) and (x_2, y_2) is the ratio of the **rise** (change in y) to the **run** (change in x).

$$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$



When the line rises from left to right, the slope is positive. When the line falls from left to right, the slope is negative.

vocabulary

2.) Slope int-form

$y = mx + b$

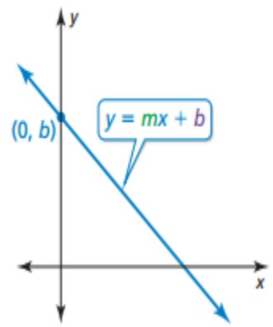
m = slope

b = y-int

Slope-Intercept Form

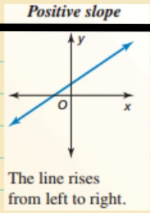
Words A linear equation written in the form $y = mx + b$ is in **slope-intercept form**. The slope of the line is m, and the y-intercept of the line is b.

Algebra $y = mx + b$ (slope: m; y-intercept: b)

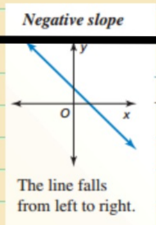


Different types of slopes

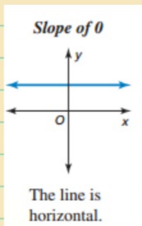
positive



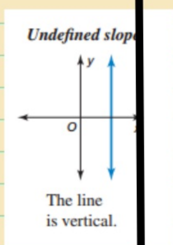
negative



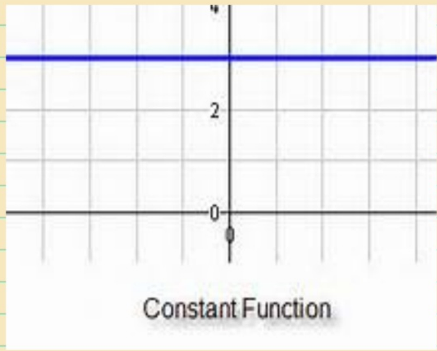
zero



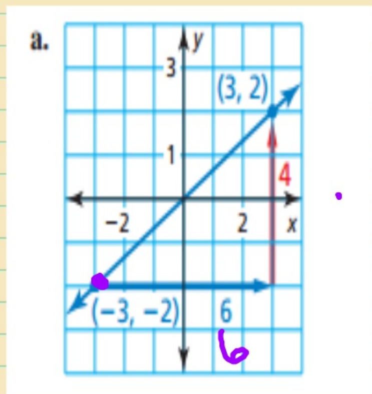
undefined

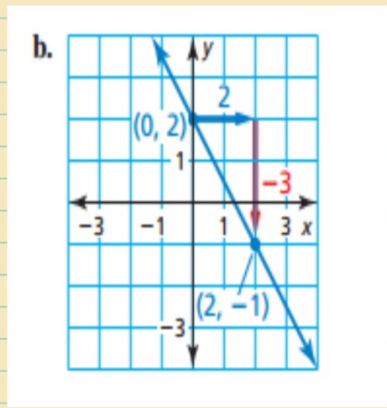


Vocabulary	
constant function	Creates a horizontal line y = b



Example 1 finding the slope of a line	
Steps: 1.) Find the Change in y (rise) 2.) Find the Change is x (run)	





m left to right.
ositive.
3, −2) and

$\frac{2-(-2)}{3-(-3)} = \frac{4}{6} = \frac{2}{3}$

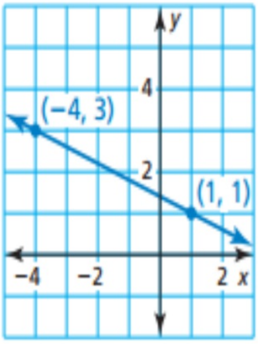
b. The line falls from left to right.
So, the slope is negative.
Let $(x_1, y_1) = (0, 2)$ and
$(x_2, y_2) = (2, -1)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1-2}{2-0} = \frac{-3}{2} = -\frac{3}{2}$

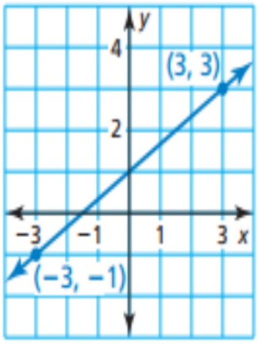
Practice:

Describe the slope of the line. Then find the slope.

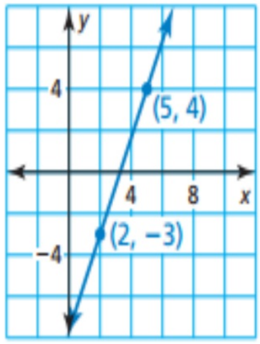
1.



2.



3.



Example 2: Find the slope from a Table

Steps:

1.) Choose any 2 points on a table

2.) Use the slope Formula
Change in y
Change in x

a.

x	y
4	20
7	14
10	8
13	2

a. Choose any two points from the table and use the slope formula. Use the points $(x_1, y_1) = (4, 20)$ and $(x_2, y_2) = (7, 14)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{14 - 20}{7 - 4} = \frac{-6}{3}, \text{ or } -2$$

▶ The slope is −2.

Practice

b.

x	y
−1	2
1	2
3	2
5	2

c.

x	y
−3	−3
−3	0
−3	6
−3	9

b. Note that there is no change in y. Choose any two points from the table and use the slope formula. Use the points $(x_1, y_1) = (-1, 2)$ and $(x_2, y_2) = (5, 2)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 2}{5 - (-1)} = \frac{0}{6}, \text{ or } 0$$

The change in y is 0.

▶ The slope is 0.

c. Note that there is no change in x. Choose any two points from the table and use the slope formula. Use the points $(x_1, y_1) = (-3, 0)$ and $(x_2, y_2) = (-3, 6)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 0}{-3 - (-3)} = \frac{6}{0} \text{ ✗}$$

The change in x is 0.

▶ Because division by zero is undefined, the slope of the line is undefined.

Example 3
Identifying slope and y - int

Steps:

1.) write equation in slope form.

2.) Find the m (slope)

3.) Find the b (y-int)

a.) $y = 3x - 4$

b.) $y = 6.5$

c.) $-5x - y = -2$

Find the slope and the y-intercept of the graph of the linear equation.

6. $y = -6x + 1$

7. $y = 8$

8. $x + 4y = -10$

Example 4: Using slope-Int Form to Graph

Steps:

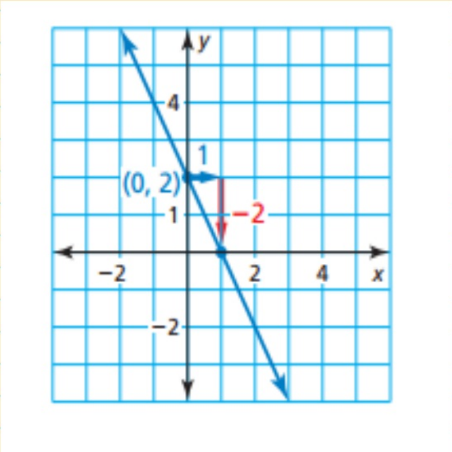
1.) rewrite equation in slope form

2.) Find slope & y-int

3.) Plot y - int

4.) use the slope to find next point on line

Graph: $2x + y = 2$



Example 5
Graphin from a Verbal Description

EXAMPLE 5 **Graphing from a Verbal Description**

A linear function g models a relationship in which the dependent variable increases 3 units for every 1 unit the independent variable increases. Graph g when $g(0) = 3$. Identify the slope, y-intercept, and x-intercept of the graph.

SOLUTION

Because the function g is linear, it has a constant rate of change. Let x represent the independent variable and y represent the dependent variable.

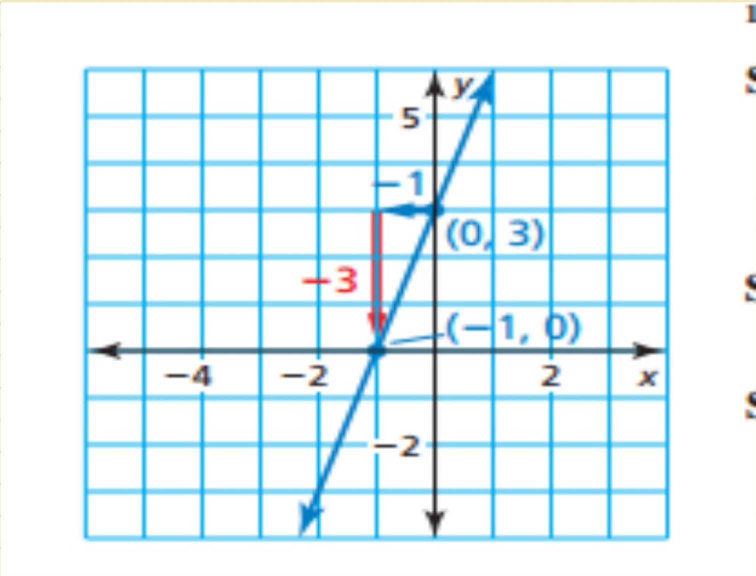
Step 1 **Find the slope.** When the dependent variable increases by 3, the change in y is $+3$. When the independent variable increases by 1, the change in x is $+1$.

So, the slope is $\frac{3}{1}$, or 3.

Step 2 **Find the y-intercept.** The statement $g(0) = 3$ indicates that when $x = 0$, $y = 3$. So, the y-intercept is 3. Plot (0, 3).

Step 3 **Use the slope to find another point on the line.** A slope of 3 can be written as $\frac{-3}{-1}$. Plot the point that is 1 unit left and 3 units down from (0, 3). Draw a line through the two points. The line crosses the x-axis at $(-1, 0)$. So, the x-intercept is -1.

▶ The slope is 3, the y-intercept is 3, and the x-intercept is -1.



Graph the linear equation. Identify the *x*-intercept.

9. $y = 4x - 4$ **10.** $3x + y = -3$ **11.** $x + 2y = 6$

12. A linear function h models a relationship in which the dependent variable decreases 2 units for every 5 units the independent variable increases. Graph h when $h(0) = 4$. Identify the slope, y-intercept, and x-intercept of the graph.

EXAMPLE 6 Modeling with Mathematics

A submersible that is exploring the ocean floor begins to ascend to the surface. The elevation h (in feet) of the submersible is modeled by the function $h(t) = 650t - 13{,}000$, where t is the time (in minutes) since the submersible began to ascend.

a. Graph the function and identify its domain and range.

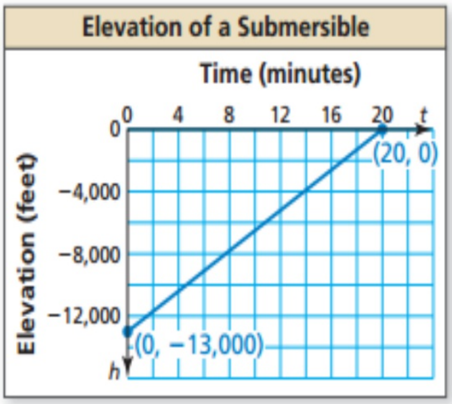
b. Interpret the slope and the intercepts of the graph.

1. **Understand the Problem** You know the function that models the elevation. You are asked to graph the function and identify its domain and range. Then you are asked to interpret the slope and intercepts of the graph.

2. **Make a Plan** Use the slope-intercept form of a linear equation to graph the function. Only graph values that make sense in the context of the problem. Examine the graph to interpret the slope and the intercepts.

3. Solve the Problem

a. The time t must be greater than or equal to 0. The elevation h is below sea level and must be less than or equal to 0. Use the slope of 650 and the h-intercept of $-13{,}000$ to graph the function in Quadrant IV.



▶ The domain is $0 \le t \le 20$, and the range is $-13{,}000 \le h \le 0$.

b. The slope is 650. So, the submersible ascends at a rate of 650 feet per minute. The h-intercept is $-13{,}000$. So, the elevation of the submersible after 0 minutes, or when the ascent begins, is $-13{,}000$ feet. The t-intercept is 20. So, the submersible takes 20 minutes to reach an elevation of 0 feet, or sea level.

4. Look Back You can check that your graph is correct by substituting the t-intercept for t in the function. If $h = 0$ when $t = 20$, the graph is correct.

$h = 650(20) - 13{,}000$	Substitute 20 for t in the original equation.
$h = 0$ ✓	Simplify.