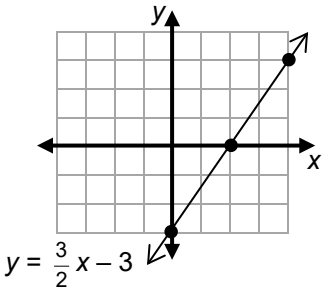
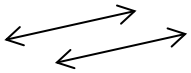
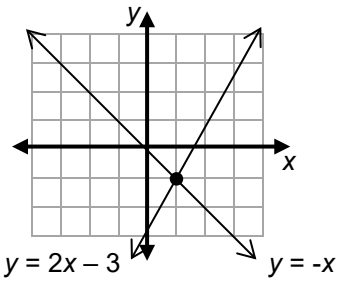
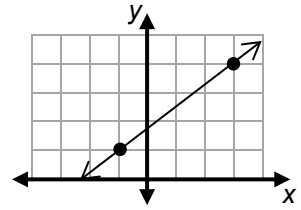
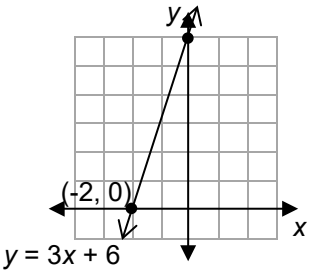
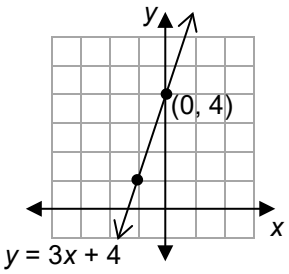
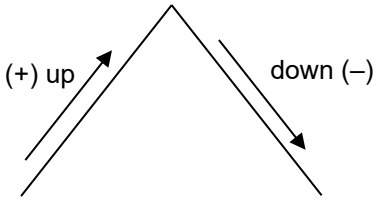
STUDENT RESOURCES

Word or Phrase	Definition
linear function	A <u>linear function</u> (in variables x and y) is a function that can be expressed in the form $y = mx + b$. The graph of $y = mx + b$ is a straight line with slope m and y-intercept b. The graph of the linear function $y = \frac{3}{2}x - 3$ is a straight line with slope $m = \frac{3}{2}$ and y-intercept $b = -3$. 
parallel	Two lines in a plane are <u>parallel</u> if they do not meet. 
point of intersection	A <u>point of intersection</u> of two lines is a point where the lines meet. The two straight lines in the plane with equations $y = -x$ and $y = 2x - 3$ have point of intersection (1, -1). 
slope-intercept form	The <u>slope-intercept form</u> of the equation of a line is the equation $y = mx + b$, where m is the slope of the line, and b is the y-intercept of the line. The equation $y = 2x + 3$ determines a line with slope 2 and y-intercept 3.
slope of a line	The <u>slope of a line</u> is the vertical change (change in the y-value) per unit of horizontal change (change in the x-value). If the difference in x is 0, we consider the slope to be undefined, a graphical representation of this situation is a vertical line. The slope of the line through (-1, 1) and (3, 4) is $\frac{3}{4}$: $\text{slope} = \frac{(\text{difference in } y)}{(\text{difference in } x)} = \frac{4-1}{3-(-1)} = \frac{3}{4}$ 

Word or Phrase	Definition
x-intercept	The <u>*x*-intercept</u> of a line is the *x*-coordinate of the point at which the line crosses the *x*-axis. It is the value of x that corresponds to $y = 0$. The *x*-intercept of the line $y = 3x + 6$ is -2. If $y = 0$, then $x = -2$. 
y-intercept	The <u>*y*-intercept</u> of a line is the *y*-coordinate of the point at which the line crosses the *y*-axis. It is the value of y that corresponds to $x = 0$. For the line $y = 3x + 4$, the *y*-intercept is 4. If $x = 0$, then $y = 4$. 

Slope

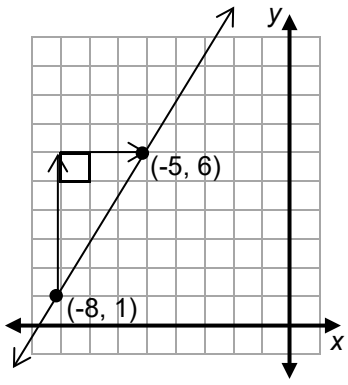
One way to think about slope (*m*) is to imagine that the line is a portion of a mountain. Just as we read from left to right, we will move up and down the mountain from left to right. When moving up the mountain, the slope is positive. When moving down the mountain, the slope is negative. The steeper the mountain, the greater (in absolute value) the slope.



The slope (m) of a line is computed as: $\frac{\text{vertical change}}{\text{horizontal change}}$ as you move from one point to another on the same line, or $\frac{\text{difference in } y \text{ coordinates}}{\text{difference in } x \text{ coordinates}}$ as you move from one point to another on the same line.

To use counting to determine slope, first move in a vertical direction and find the directed distance, and then move in a horizontal direction and find the directed distance.

If A (-8, 1) and B (-5, 6) are points on a line, then count 5 units up and then 3 units to the right. $m = \frac{5}{3}$



To use coordinates to determine slope (m), find the quotient of the difference in the *y*-coordinates and the difference in the *x*-coordinates.

If A (-8, 1) and B (-5, 6) are points on a line, then

$$m = \frac{\text{difference in } y}{\text{difference in } x} = \frac{6-1}{-5-(-8)} = \frac{5}{3}.$$

If (a, b) and (c, d) are points on a line, then

$m = \frac{\text{difference in } y}{\text{difference in } x} = \frac{d-b}{c-a}$. This formula is the definition of the slope of a line.

Horizontal and Vertical Lines

The slope (m) of a line is computed as:

$$\frac{\text{difference in } y \text{ coordinates}}{\text{difference in } x \text{ coordinates}}$$ as you move from one point to another on the same line.

Horizontal Lines

A horizontal line is a line parallel to the x-axis. Every point on a horizontal line has the same y-coordinate, and the vertical change between any two positions on the line is zero. Hence,

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{0}{\text{horizontal change}} = 0.$$

horizontal 

The slope of a horizontal line is zero.

Vertical Lines

vertical 

A vertical line is a line parallel to the y-axis. Every point on a vertical line has the same x-coordinate, and the horizontal change between any two points on the line is zero. Hence,

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{vertical change}}{0}$$ is undefined,

since division by zero is undefined.

The slope of a vertical line is undefined.

The Slope-Intercept Form of Linear Equations

Slope-intercept form of a linear equation is $y = mx + b$, where m = slope of the line and b = the y-intercept.

Find the equation of a line with a slope of $-\frac{1}{3}$ and the y-intercept is -5.

Since $y = mx + b$, then $y = -\frac{1}{3}x - 5$.

Find the equation of the line that passes through the points (0, 4) and (-2, 0).

First plot the points on a graph.
Notice that the y-intercept is 4.
Count or compute to find the slope,

$$m = \frac{4-0}{0-(-2)} = 2$$

Therefore, the equation of the line is $y = 2x + 4$.