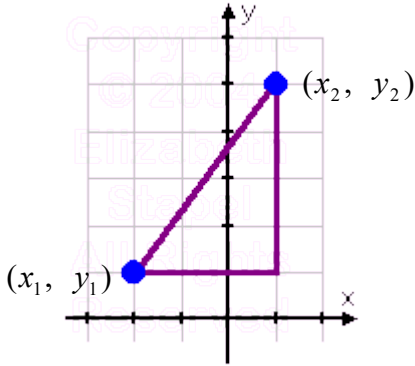


1.3 Lines

Slope Formula

The slope formula is used to find the slope between two points (x_1, y_1) and (x_2, y_2) .



The slope is the vertical change divided by the horizontal change. From our picture, the vertical change is $y_2 - y_1$ and the horizontal change is $x_2 - x_1$.

From this we get the formula for slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$.

- Positive slopes will increase as you move from left to right.
- Negative slopes will decrease as you move from left to right.
- A slope of zero is a horizontal line.
- An undefined or infinity slope is a vertical line.

EXAMPLE: Find the slope of a line passing through the following points. Indicate whether the line increases, decreases, is horizontal or vertical.

a.) $(-1, 3)$ and $(2, 4)$

b.) $(4, -1)$ and $(3, -1)$

c.) $(3, -2)$ and $(3, -5)$

Slope-Intercept Formula– this is the standard form of a line which allows you to easily identify the slope and y-intercept.

$$y = mx + b \quad \text{Here the slope is } m \text{ and the y-intercept is } (0, b).$$

Linear Function– this is the same as the slope-intercept form, except with function notation. In general, a linear function begins with $f(x)$ and contains an x with a power of 0 or 1.

$$f(x) = mx + b$$

Point-Slope Formula – this is used when you want to find the equation of a line when you are given a slope and another point on the line. This other point does not need to be the y-intercept.

$$y - y_1 = m(x - x_1)$$

EXAMPLE: Use the information and given conditions to write an equation for each line in slope-intercept form as well as the point-slope form.

a.) Slope = 8, passing through (4, -1).

b.) Slope = $-\frac{3}{5}$, passing through (10, -4).

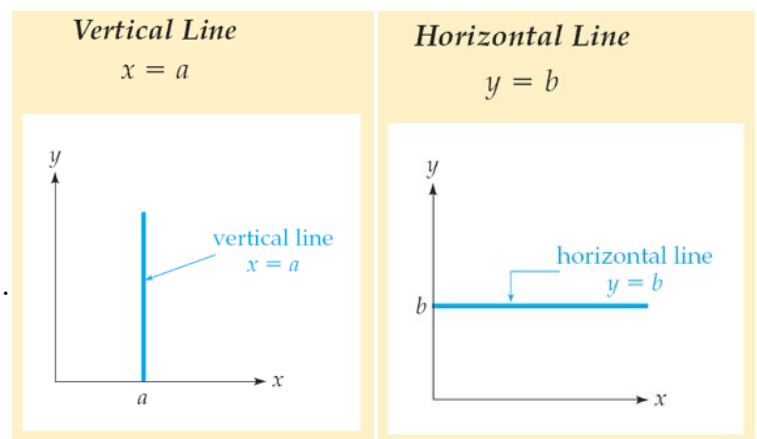
c.) Passing through (-3, 6) and (3, -2)

d.) x-intercept = $-\frac{1}{2}$, y-intercept = 4

Horizontal and Vertical lines

$x = a$ is a vertical line crossing the x -axis at $x = a$.

$y = b$ is a horizontal line crossing the y -axis at $y = b$.

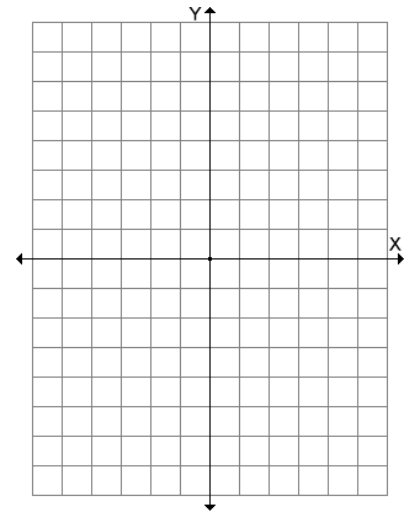


EXAMPLE: Write the equation of a vertical line containing the point $(-2,3)$.

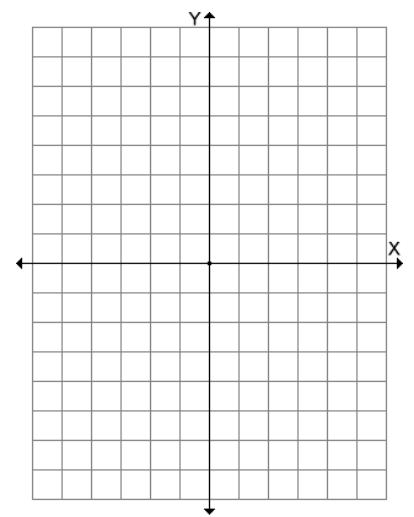
EXAMPLE: Write the equation of a horizontal line containing the point $(5,4)$.

EXAMPLE: Write the following in slope-intercept form and identify the slope and y-intercept. Use this information to graph the equation.

a.) $f(x) = \frac{3}{4}x - 3$



b.) $4x + 6y = -12$



Parallel lines have the same slope. These lines do not cross.

Perpendicular lines have opposite reciprocal slopes (opposite sign and one fraction is flipped over).

EXAMPLE: Find the slope of a line that is perpendicular to $y = -4x - 3$.

EXAMPLE: Determine whether the following lines are parallel, perpendicular, or neither.

$$3x - 4y = 12$$

$$8y - 6x = 16$$

EXAMPLE: Use the given conditions to write an equation for each line in point-slope form and slope-intercept form.

a.) Passing through $(-2, -7)$ and parallel to the line whose equation is $y = -5x + 4$

b.) Passing through $(-4, 2)$ and perpendicular to the line whose equation is $y = \frac{1}{3}x + 7$

c.) Passing through $(5, -9)$ and perpendicular to the line whose equation is $x + 7y - 12 = 0$

EXAMPLE: The cost of renting a truck is \$20 a day plus 50 cents per mile. Write a linear equation that relates the cost C , in dollars, of renting the truck to the number of x miles driven. What is the total cost if you drive 160 miles?

EXAMPLE: A manufacturer buys a new machine costing \$120,000. It is estimated that the machine has a useful lifetime of 10 years, and a salvage value of \$4000 at that time. Find a linear function for the value, V , of the machine after t years.

EXAMPLE: A company is planning to manufacture a certain product. The fixed costs will be \$500000 and it will cost \$400 to produce each product. Each will be sold for \$600. What is the profit equation and how many units must be sold in order to break even?