

# MATH 1314

Section 1.2

# Lines

In this section, we'll review slope and different equations of lines. We will also talk about x-intercept and y-intercept, parallel and perpendicular lines.

# Slope

Definition: The **slope** of a line measures the steepness of a line or the rate of change of the line.

To find the slope of a line you need two points. You can find the slope of a line between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  by using this formula.

$$\text{slope } (m) = \frac{y_2 - y_1}{x_2 - x_1}$$

**Note:**

- Lines with positive slope rise to the right.
- Line with negative slope fall to the right.
- Lines with slope equal to 0 are horizontal lines.
- Lines with undefined slope are vertical lines

Example 1: Find the slope of the line containing the following points

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

b.  $(-3, 1)$  and  $(-3, -2)$

# Finding the Equation of a Line

Three usual forms:

1. **Point-Slope Form**

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

where  $(x_1, y_1)$  is a point on the line and  $m$  is the slope.

2. **Slope-Intercept Form**

$$y = mx + b$$

where  $m$  is the slope and  $b$  is the  $y$ -intercept of the line.

3. **Standard Form**

$$Ax + By + C = 0$$

where  $A$  and  $B$  are not both equal to 0.

Example 2: Write the following equation in slope-intercept form and identify the slope and y-intercept.

$$2x - 4y = 5$$

Example 3: Write an equation of the line that satisfies the given conditions.

a.  $m = \frac{1}{2}$  and the  $y$ -intercept is 3.

b.  $m = -3$  and the line passes through  $(-2, 1)$ .

c. line passes through  $(-6, 10)$  and  $(-2, 2)$ .

# Parallel and Perpendicular Lines

Definition: Parallel lines are lines with slopes  $m_1$  and  $m_2$  such that they are equal, in other words

$$m_1 = m_2$$

Definition: Perpendicular lines are lines in which the product of the slopes equal -1.

$$m_1 m_2 = -1$$

Also known as the negative reciprocal.  $m_2 = \frac{-1}{m_1}$



Example 4: Write an equation of the line that passes through the points  $(-3, 8)$  and parallel to  $y = -2x + 4$

Example 5: Write an equation of the line that passes through the points  $(1, 2)$  and perpendicular to  $y = -2x + 4$ .

# x-intercept and y-intercept

When graphing an equation, it is usually very helpful to find the **x intercept(s)** and the **y -intercepts** of the graph. An **x intercept** is the first coordinate of the ordered pair of a point where the graph of the equation crosses the **x axis**. To find an **x intercept**, let  $y = 0$  and solve the equation for  $x$ .

The **y-intercept** is the second coordinate of the ordered pair of a point where the graph of the equation crosses the **y axis**. To find a **y intercept**, let  $x = 0$  and solve the equation for  $y$ .

Example 5: Find the  $x$  and  $y$  intercepts of the graph of the equation  $3x - 4y = 8$ .

Example 6: Find the  $x$  and  $y$  intercepts of the graph of the equation  $y = x^2 - 9$ .