Finding Equations of Lines

Objective 1: Find the Equation of a Line Given Any Point and the Slope

Procedure: To find the equation of a line given any point and the slope of the line,

1. Call the given point (x_1, y_1)
2. Plug in values into Point Slope Form: $y - y_1 = m(x - x_1)$
3. Solve for y.

Example: Write the equation of the line with the given point and slope: $(3, 10)$ and slope $= \frac{1}{3}$

Example: Write the equation of the line with the given point and slope: $(0, -7)$ and slope $= -4$

Example: Write the equation of the line with the given point and slope: $(-2, -5)$ and an undefined slope.

Objective 2: Find the Equation of a Line Given Two Points

Procedure: To find the equation of a line given two points on that line,

1. Find the slope using the formula for slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$
2. Choose any point and plug in values of the point and slope into Point Slope Form: $y - y_1 = m(x - x_1)$
3. Solve for y.

Example: Find the equation of the line passing through the two points $(-4, 5)$ and $(-8, 8)$.

Example: Find the equation of the line passing through the two points $(5, -3)$ and $(2, -3)$.

Example: Find the equation of the line passing through the two points $(-1, -8)$ and $(2, 0)$.

Objective 3: Find the Equation of a Line Given a Point and a Line Parallel or Perpendicular to the Line

Procedure: To find the equation of a line given a point and given a line that the line is parallel or perpendicular to the line,

1. Determine the slope of the line:
    - Parallel lines have the same slope
    - Perpendicular lines have slopes that are opposite reciprocals
2. Plug in the values of the point and the slope into Point Slope Form: $y - y_1 = m(x - x_1)$
3. Solve for y.

Example: Find the equation of the line given that it is parallel to the line $y = \frac{1}{5}x + 3$ and passes through the point $(-10, 2)$.

Example: Find the equation of the line given that it is perpendicular to $y = -\frac{2}{3}x - 7$ and passes through the point $(-4, 0)$.

Example: Find the equation of the line that contains the point $(5, 1)$ and is parallel to the line $x = -6$.