1.2 Lines and Slopes

**Definition 1: Slope of a Line**

If \((x_1, y_1)\) and \((x_2, y_2)\) are two distinct points, then the slope \(m\) is

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

**Definition 2: Different Forms for a Line**

**Point-Slope Form**

**NEED** (1) POINT (2) SLOPE

\[y - y_1 = m(x - x_1)\]

**Slope-Intercept Form**

**NEED**: (1) SLOPE (2) Y-INT \((0, b)\)

\[y = mx + b\]
Example 1
Find the slope of the line that passes through the points \((-2, 2)\) and \((3, -1)\), the equation of the line, and then sketch.

**Slope:** \[ m = \frac{-1 - 2}{3 - (-2)} = \frac{-3}{5} \]

**Point-Slope:** \[ y - y_1 = m(x - x_1) \]
\[ y - 2 = \frac{-3}{5}(x + 2) \]
\[ y - 2 = \frac{-3}{5}x - \frac{6}{5} + 2 \]

**Slope-Intercept** \[ y = \frac{-3}{5}x + \frac{4}{5} \]
**Definition 3: Perpendicular and Parallel Lines**

Suppose you have two lines $L_1$ and $L_2$ with slopes $m_1$ and $m_2$.

- **Parallel**
  
  \[ \begin{align*}
  L_1 & \parallel L_2 \\
  m_1 &= m_2
  \end{align*} \]

- **Perpendicular**
  
  \[ \begin{align*}
  L_1 & \perp L_2 \\
  m_1 &= -\frac{1}{m_2}
  \end{align*} \]

**Example 2**

Find an equation of the line that passes through the point $(-1, 3)$ that is perpendicular to $y = -\frac{2}{3}x + 4$.

**NEED**

1. **Point**: $(-1, 3)$
2. **Slope**: $m = \frac{3}{2}$

**Point-Slope**

\[ y - 3 = \frac{3}{2} (x - (-1)) \]
\[ y - 3 = \frac{3}{2} x + \frac{3}{2} \]
\[ y = \frac{3}{2} x + \frac{9}{2} \]
Definition 4: General Equation of a Line

\[ Ax + By = C \]

OR

\[ A x + B y + C = 0 \]

Example 3

Consider the line \( 2x - 5y + 10 = 0 \).

\[ \rightarrow 2x - 5y = -10 \]

1. Find the slope

\[ m = \frac{-A}{B} = \frac{-2}{-5} = \frac{2}{5} \]

\[ -5y = -2x - 10 \]

\[ y = \frac{2}{5} x + 2 \]

2. Find the \( x \) and \( y \) intercepts.

\[ y \text{-INT: LET } x = 0 \rightarrow 2(0) - 5y = -10 \]

\[ \Rightarrow -5y = -10 \]

\[ y = 2 \]

\[ (0, 2) \]

\[ x \text{-INT: LET } y = 0 \]

\[ 2x - 5(0) = -10 \]

\[ 2x = -10 \]

\[ x = -5 \]

\[ (-5, 0) \]

3. Sketch the line