MATH 020 Support 4: Graphs of Linear Equations

Linear Equation in Two Variables

\[ Ax + By = C \] Standard Form of a Line
\[ y = mx + b \] Slope-Intercept Form

The Slope of a Line

\[ \text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} \]

The slope of a line passing through two points \((x_1, y_1)\) and \((x_2, y_2)\) is

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

- The slope of a horizontal line: \( m = 0 \)
- The slope of a vertical line: \( m = \text{undefined} \)

"Uphill" "Downhill" Horizontal Slope = 0 Vertical Slope is Undefined

Positive Slope Negative Slope Slope = 0 Slope is Undefined

Intercepts

The \( x \)-intercept is the point where the graph intersects the \( x \)-axis. The \( y \)-intercept is the point where the graph intersects the \( y \)-axis.

To find the \( x \)-intercept, let \( y = 0 \) and solve for \( x \).

To find the \( y \)-intercept, let \( x = 0 \) and solve for \( y \).

\[ y = -2x + 8 \]

To find \( x \)-intercept, let \( y = 0 \), \( 0 = -2x + 8 \Rightarrow 2x = 8 \Rightarrow x = 4 \) \((4,0)\) int

To find \( y \)-intercept, let \( x = 0 \), \( y = -2(0) + 8 = y = 8 \) \((0,8)\) int

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Problems

Find the slope and y-intercept of the line and then graph.

1. $y = 2x - 8$  slope = 2  
   y-intercept $(0, -8)$

2. $y = \frac{1}{2}x - 2$  slope = $\frac{1}{4}$  
   y-intercept $(0, -2)$

3. $y = 8x - 9$

   - No y-intercept
   - Slope = undefined
   - x-intercept $(-3, 0)$

4. $y = 7$
   - No x-intercept
   - y-intercept $(0, 7)$

Graph the equation by first finding the x and y intercepts.

5. $3x + 4y = 12$

   - To find y-intercept let $x = 0$ & solve for $y$
     $3(0) + 4y = 12 \Rightarrow 4y = 12 \Rightarrow y = 3$; $(0, 3)$

   - To find x-intercept, let $y = 0$  & solve for $x$
     $3x + 4(0) = 12 \Rightarrow 3x = 12 \Rightarrow x = 4$; $(4, 0)$

   - Rise  = $\frac{-3}{4}$
   - Run

   - $M = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 3}{4 - 0} = \frac{-3}{4}$
7. \(3x - 2y = 6\)

To find \(x\)-intercept, let \(y = 0\) & solve for \(x\)

\[3x - 2(0) = 6\]
\[3x = 6\]
\[x = 2\]

\(x\)-intercept is \((2, 0)\)

To find \(y\)-intercept, let \(x = 0\) & solve for \(y\)

\[3(0) - 2y = 6\]
\[-2y = 6\]
\[y = -3\]

\((0, -3)\) is \(y\)-intercept

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8. \(y = 1.2x - 3.5\)

To find \(x\)-intercept, let \(y = 0\) & solve for \(x\)

\[0 = 1.2x - 3.5\]
\[3.5 = 1.2x\]
\[x = \frac{3.5}{1.2} \approx 2.92\]

\(x\)-intercept is \((2.92, 0)\)

To find \(y\)-intercept, let \(x = 0\) & solve for \(y\)

\[y = 1.2(0) - 3.5\]
\[y = -3.5\]

\((0, -3.5)\) is \(y\)-intercept

\[\text{slope} = \frac{3.5}{2.92} \approx 1.2\]