Section 6.7

Graphing Linear Equations

Rectangular Coordinate System

- The horizontal line is called the $x$-axis.
- The vertical line is called the $y$-axis.
- The point of intersection is the origin.
Plotting Points

- Each point in the xy-plane corresponds to a unique ordered pair \((a, b)\).
- Plot the point \((2, 4)\). Starting from the origin:
  - Move 2 units right
  - Move 4 units up

Graphing Linear Equations

- Graph the equation \(y = 5x + 2\)

<table>
<thead>
<tr>
<th>(x)</th>
<th>(y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>(-2/5)</td>
<td>0</td>
</tr>
<tr>
<td>(-1)</td>
<td>(-3)</td>
</tr>
</tbody>
</table>
To Graph Equations by Plotting Points

- Solve the equation for \( y \).
- Select at least three values for \( x \) and find their corresponding values of \( y \).
- Plot the points.
- The points should be in a straight line. Draw a line through the set of points and place arrow tips at both ends of the line.

Graphing Using Intercepts

- The \( x \)-intercept is found by letting \( y = 0 \) and solving for \( x \).
  Example: \[ y = -3x + 6 \]
  \[ 0 = -3x + 6 \]
  \[ -6 = -3x \]
  \[ 2 = x \]

- The \( y \)-intercept is found by letting \( x = 0 \) and solving for \( y \).
  Example: \[ y = -3x + 6 \]
  \[ y = -3(0) + 6 \]
  \[ y = 6 \]
Example: Graph $3x + 2y = 6$

- Find the $x$-intercept.
  
  $3x + 2y = 6$
  $3x + 2(0) = 6$
  $3x = 6$
  $x = 2$

- Find the $y$-intercept.
  
  $3x + 2y = 6$
  $3(0) + 2y = 6$
  $2y = 6$
  $y = 3$

Slope

- The ratio of the vertical change to the horizontal change for any two points on the line.

\[
\text{Slope} = \frac{\text{vertical change}}{\text{horizontal change}}
\]

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

- Positive slope rises from left to right.
- Negative slope falls from left to right.
- The slope of a vertical line is undefined.
- The slope of a horizontal line is zero.

Example: Finding Slope

Find the slope of the line through the points (5, −3) and (−2, −3).

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

\[ m = \frac{-3 - (-3)}{-2 - 5} \]

\[ m = \frac{-3 + 3}{-7} \]

\[ m = \frac{0}{-7} = 0 \]
The Slope-Intercept Form of a Line

- Slope-Intercept Form of the Equation of the Line
  \[ y = mx + b \] where \( m \) is the slope of the line and \((0, b)\) is the \(y\)-intercept of the line.

Graphing Equations by Using the Slope and \(y\)-Intercept

- Solve the equation for \(y\) to place the equation in slope-intercept form.
- Determine the slope and \(y\)-intercept from the equation.
- Plot the \(y\)-intercept.
- Obtain a second point using the slope.
- Draw a straight line through the points.
Example

- Graph $2x - 3y = 9$.
- Write in slope-intercept form.

$$2x - 3y = 9$$

$$-3y = -2x + 9$$

$$\frac{-3y}{-3} = \frac{-2x}{-3} + \frac{9}{-3}$$

$$y = \frac{2}{3}x - 3$$

The $y$-intercept is $(0, -3)$ and the slope is $2/3$.

Example continued

- Plot a point at $(0, -3)$ on the $y$-axis, then move up 2 units and to the right 3 units.
**Horizontal Lines**

- Graph $y = -3$.
- $y$ is always equal to $-3$, the value of $y$ can never be 0.
- The graph is parallel to the $x$-axis.

**Vertical Lines**

- Graph $x = -3$.
- $x$ always equals $-3$, the value of $x$ can never be 0.
- The graph is parallel to the $y$-axis.