4.5 Graph Using Slope-Intercept Form

**Goal:** Graph linear equations using slope-intercept form.

### VOCABULARY

**Slope-intercept form**
\[ y = mx + b \]

**Linear Equation**

**Parallel lines:** are lines that never intersect.
* THE SYMBOL \( \parallel \) lines
* \( \parallel \) lines have the same slope

### FINDING THE SLOPE AND Y-INTERCEPT OF A LINE

**Words**
A linear equation of the form \( y = mx + b \) is written in **SLOPE INTERCEPT FORM**.

**Symbols**
\[ y = mx + b \]

**Example:** \( y = \frac{2}{3}x + 5 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>( -3 )</th>
<th>( 0 )</th>
<th>( 3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>( \frac{5}{3} )</td>
<td>( 5 )</td>
<td>( \frac{11}{3} )</td>
</tr>
</tbody>
</table>

**Slope:** \( m = \frac{2}{3} \)

**Y-intercept:** \( b = 5 \)

**Graph**

**STEP I:** Plot the y-intercept \( (0, b) \)

**STEP II:** Use slope to find other points
\( m = \frac{\text{Rise}}{\text{Run}} \)
Example 1  Identify slope and y-intercept
Identify the slope and y-intercept of the line with the given equation.

\[ a. \ y = x + 3 \]

**Solution**

\[ a. \ The \ equation \ is \ in \ the \ form \ \text{Slope Intercept}. \ So, \ the \ slope \ of \ the \ line \ is \ 1, \ and \ the \ y-intercept \ is \ 3. \]

\[ b. \ -2x + y = 5 \]

**Solution**

\[ b. \ Rewrite \ the \ equation \ in \ slope-intercept \ form \ by \ solving \ for \ y. \ ISOLATE \ y! \]

\[ -2x + y = 5 \]

\[ \begin{align*}
   +2x & \quad +2x \\
   \underline{y} & = 2x + 5
\end{align*} \]

The line has a slope of \(_2\) and a y-intercept of \(_5\).

**Checkpoint** Identify the slope and y-intercept of the line with the given equation.

\[ Y = \text{m}x + b \]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1. ( y = 4x - 1 )</td>
<td>2. ( 4x - 2y = 8 )</td>
</tr>
<tr>
<td>[ M = 4 ]</td>
<td>[ M = 2 ]</td>
</tr>
<tr>
<td>[ b = -1 ]</td>
<td>[ b = -4 ]</td>
</tr>
</tbody>
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<tbody>
<tr>
<td>3. ( 4y = 3x + 16 )</td>
<td>4. ( 6x + 3y = -21 )</td>
</tr>
<tr>
<td>[ M = \frac{3}{4} ]</td>
<td>[ M = -2 ]</td>
</tr>
<tr>
<td>[ b = 4 ]</td>
<td>[ b = -7 ]</td>
</tr>
</tbody>
</table>
**Example 2**  
**Graph an equation using slope-intercept form**

Graph the equation $4x + y = 2$.

**Solution**

Step 1  
Rewrite the equation in slope-intercept form.

\[
y = -4x + 2
\]

Step 2  
**Identify** the slope and the $y$-intercept.

\[
m = \frac{-4}{1} = \frac{\text{rise}}{\text{run}} \quad b = 2
\]

Step 3  
**Plot** the point that corresponds to the $y$-intercept, $(0, 2)$.

Step 4  
**Use** the slope to locate a second point on the line.

Draw a line through the two points.

\[
M = \frac{\text{rise}}{\text{run}} = \frac{-4}{1} = -4
\]

**Checkpoint** Complete the following exercise.

5. Graph the equation $-\frac{1}{2}x + y = 1$. 

\[
y = \frac{1}{2}x + 1
\]

\[
m = \frac{1}{2} \\
B = 1
\]
Example 3: Identify parallel lines

Determine which of the lines are parallel.

Line A: through $(-2, -3); (4, 3)$
Line B: through $(-4, -2); (2, 4)$
Line C: through $(-3, -5); (6, 2)$

Solution

Find the slope of each line.

Line $a$: $m = \frac{\Delta y}{\Delta x} = \frac{-3 - 3}{-2 - 4} = \frac{-6}{-6} = 1$

Line $b$: $m = \frac{-2 - 4}{-4 - 2} = \frac{-6}{-6} = 1$

Line $c$: $m = \frac{5 - (-2)}{-3 - 6} = \frac{-7}{-9} = \frac{7}{9}$

$\text{Lines } a \text{ and } b \text{ have the same slope. They are parallel.}$

Checkpoint: Complete the following exercise.

6. Determine which lines are parallel. Explain!

Line $a$: through $(2, 5)$ and $(-2, 2)$
Line $b$: through $(4, 1)$ and $(-3, -4)$
Line $c$: through $(2, 3)$ and $(-2, 0)$

$\text{a) } m = \frac{5 - 2}{2 - (-2)} = \frac{3}{4} \quad (m = \frac{3}{4})$

$\text{b) } m = \frac{1 - (-4)}{4 - (-3)} = \frac{5}{7} \quad (m = \frac{5}{7})$

$\text{Lines } a \text{ and } c \text{ are } \parallel$