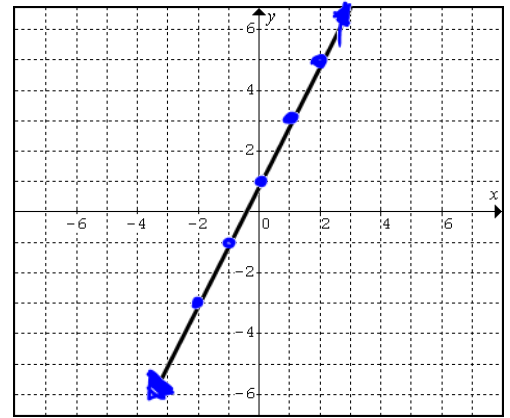


**WARM UP**

A line has a slope of 2 (or  $\frac{2}{1}$ ) and passes through the point (2,5) Find the equation of this line in  $y = mx + b$  form.

$m = \underline{2}$  (given)  
 $b = \underline{1}$   
 $y = \underline{2x + 1}$



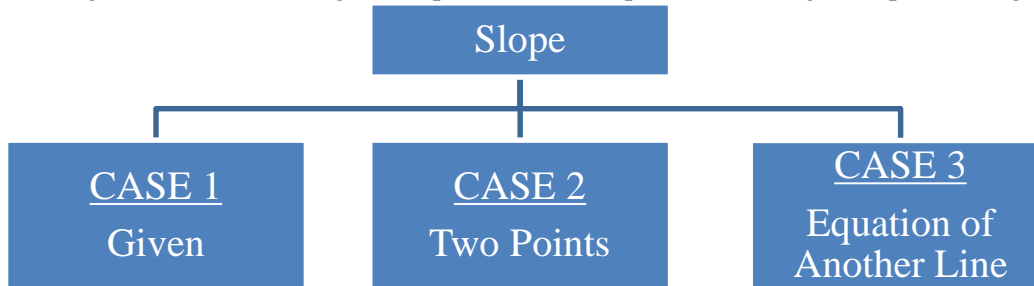
**DETERMINING THE EQUATION ALGEBRAICALLY**

As you saw above, to write an equation in  $y = mx + b$  (slope y-intercept) form, we need two parts:

- $m = \underline{\text{slope}}$
- $b = \underline{\text{y-int}}$

**STEP 1: FINDING THE SLOPE (m)**

Questions come in different versions (cases). Sometimes they will provide you the slope and y-intercept, but most of the times you will have to figure out both. Finding the slope is the first step in determining the equations algebraically.



<p>This one is rather easy because the slope is given to you.</p> <p><b>Ex:</b> State the slope of the line:</p> <p>Determine the equation of a line that has a slope of <math>\frac{2}{3}</math> and passes through the point (2, 3).</p> <p><math>m = \frac{2}{3}</math></p>	<p>We are given two points where we can calculate the slope using the formula.</p> <p><b>Ex:</b> State the slope of each line:</p> <p>1) Determine the equation of a line that goes through points (1, 4) and (2, 8).  <math>m = \frac{8-4}{2-1} = \frac{4}{1} = 4</math> <math>\underline{\underline{m=4}}</math></p> <p>2) Find the equation of the line with an x-intercept of -5 and a y-intercept of 6.  <math>(-5, 0)</math> <math>(0, 6)</math>  <math>m = \frac{6-0}{0-(-5)} = \frac{6}{5}</math></p> <p>3) with the same x-intercept as <math>3x - 7y + 12 = 0</math> and through the point <math>(-6, -1)</math>.  <math>3x - 7(0) + 12 = 0</math> <math>2x = -12</math> <math>x = -4</math> <math>m = \frac{-1-0}{-6-(-4)} = \frac{-1}{-2} = \frac{1}{2}</math></p> <p>4) with x-intercept -2 and intersecting the line <math>x - 3y + 2 = 0</math> when <math>x = -14</math>  <math>-14 - 3y + 2 = 0</math> <math>-12 - 3y = 0</math> <math>-3y = 12</math> <math>y = -4</math> <math>m = \frac{0-(-4)}{-2-(-14)} = \frac{4}{12} = \frac{1}{3}</math></p>	<p>We need to figure out the slope from another equation.</p> <p><b>Ex:</b> State the slope of each line:</p> <p>1) A line parallel to line <math>y = 2x + 3</math>.  <math>m_A = 2</math> <math>\textcircled{B}</math> </p> <p>2) A line perpendicular to line <math>y = 2x + 3</math>.  <math>m_A = -\frac{1}{2}</math></p> <p>3) A horizontal line through (7, 8).  <math>m = 0</math> <math>b = 8</math> </p> <p>4) A line parallel to line <math>y = -1</math> and through (12, 17).  <math>m = 0</math> <math>b = 17</math> </p>
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**STEP 2: FINDING THE Y-INTERCEPT (b)**

The second step is to figure out the y-intercept. You will use the coordinates (x and y) of a point on this line and plug into  $y = mx + b$  and solve for b.

**STEP 3: STATING THE EQUATION**

When you determine the slope (m) and the y intercept (b), using a therefore statement, you need to state the equation in  $y = mx + b$  form. Simply, keep y and x, then replace m and b with their numerical values.

**Example:** Determine the equation of a line in  $y = mx + b$  form that has a slope of 2 and passes through the point (2, 5) algebraically.

Step 1:  $m = 2$

Step 2: Finding "b"

$$y = mx + b \quad m = 2 \quad (2, 5)$$

$\downarrow$     $\downarrow$   
 x   y

$$5 = 2(2) + b$$

$$5 = 4 + b$$

$$\boxed{b = 1}$$

$$m \rightarrow b \rightarrow$$

$$\therefore y = 2x + 1$$

**PRACTICE**

Determine the equation of each line without graphing.

a) Slope is 5, passes through the point (1, 6)

$$y = mx + b \quad \boxed{m = 5} \quad (1, 6)$$

$\downarrow$     $\downarrow$   
 x   y

$$6 = 5(1) + b$$

$$\boxed{1 = b}$$

$$\therefore y = 5x + 1$$

b) Slope is -3, passes through the point (-1, -2)

$$y = mx + b \quad m = -3 \quad (-1, -2)$$

$\downarrow$     $\downarrow$   
 x   y

$$-2 = -3(-1) + b$$

$$-2 = 3 + b$$

$$\boxed{-5 = b}$$

$$\therefore y = -3x - 5$$

c) Slope is  $\frac{1}{2}$ , passes through the point (4, 4)

$$y = mx + b \quad m = \frac{1}{2} \quad (4, 4)$$

$\downarrow$     $\downarrow$   
 x   y

$$4 = \frac{1}{2}(4) + b$$

$$4 = 2 + b$$

$$\boxed{b = 2}$$

$$m \rightarrow b \rightarrow$$

$$\therefore y = \frac{1}{2}x + 2$$

d) Slope is  $-\frac{2}{5}$ , passes through the point (10, 1)

$$y = mx + b \quad m = -\frac{2}{5} \quad (10, 1)$$

$\downarrow$     $\downarrow$   
 x   y

$$1 = -\frac{2}{5}(10) + b$$

$$1 = -4 + b$$

$$\boxed{b = 5}$$

$$\therefore y = -\frac{2}{5}x + 5$$

<p>e) Slope is 1.5, passes through the point (5, 8)</p> $y = mx + b \quad m = 1.5 \quad (5, 8)$ $8 = 1.5(5) + b$ $8 = 7.5 + b$ $\boxed{b = 0.5}$ $\therefore y = 1.5x + 0.5$	<p>f) Determine the equation of the line perpendicular to <math>y = 2x - 5</math> passing through the point <math>(-3, 4)</math>.</p> <p>Step 1: Find slope (m)</p> $m = -\frac{1}{2} \text{ b/c it's } \perp \text{ to } y = 2x - 5$ <p>Step 2: Find b</p> $y = mx + b \quad m = -\frac{1}{2} \quad (-3, 4)$ $4 = -\frac{1}{2}(-3) + b$ $4 = 1.5 + b$ $\boxed{b = 2.5}$ $\therefore y = -0.5x + 2.5$
<p>g) Determine the equation of the line parallel to <math>y = \frac{3}{4}x - 5</math> passing through the point <math>(2, -6)</math>.</p> <p>Step 1: Finding m</p> $m = \frac{3}{4} \text{ b/c it's } \parallel \text{ to } y = \frac{3}{4}x - 5$ <p>Step 2: Finding b</p> $y = mx + b \quad m = \frac{3}{4} \quad (2, -6)$ $-6 = \frac{3}{4}(2) + b$ $-6 = 1.5 + b$ $\boxed{b = -7.5}$ $\therefore y = 0.75x - 7.5$ <p style="text-align: center;">OR</p> $y = \frac{3}{4}x - \frac{15}{2}$	<p>h) Margo's pizza parlour charges \$1.75 per topping. Sandra's pizza had 6 toppings and cost \$22.50. Find the equation that represents the cost of a pizza.</p> <p>Step 1: <math>m = 1.75</math></p> <p>Step 2: Finding b</p> $y = mx + b \quad m = 1.75 \quad (6, 22.50)$ $22.50 = 1.75(6) + b$ $22.50 = 10.50 + b$ $\boxed{12.50 = b}$ $\therefore y = 1.75x + 12.50$
<p>i) through <math>(1, 1)</math> and perpendicular to the line <math>y = -\frac{4}{3}x + 9</math>.</p> <p>Step 1: Finding m</p> $m = \frac{3}{4} \text{ b/c it's } \perp \text{ to } y = -\frac{4}{3}x + 9$ <p>Step 2: Finding b</p> $y = mx + b \quad m = \frac{3}{4} \quad (1, 1)$ $1 = \frac{3}{4}(1) + b$ $\frac{1}{4} = b$ $\therefore y = \frac{3}{4}x + \frac{1}{4}$	<p>j) parallel to the line <math>y = -x - 1</math> with an x-intercept of 4.</p> <p>Step 1: <math>m = -1</math> b/c it's <math>\parallel</math> to <math>y = -x - 1</math></p> <p>Step 2: <math>y = mx + b \quad m = -1 \quad (-4, 0)</math></p> $0 = -1(-4) + b$ $0 = 4 + b$ $\boxed{b = -4}$ $\therefore y = -x - 4$