Review of Lines:

The general form for the equation of a line is $Ax + By = C$ where *A* and *B* aren't both zero. The graph of all the solution pairs of the equation form a line.

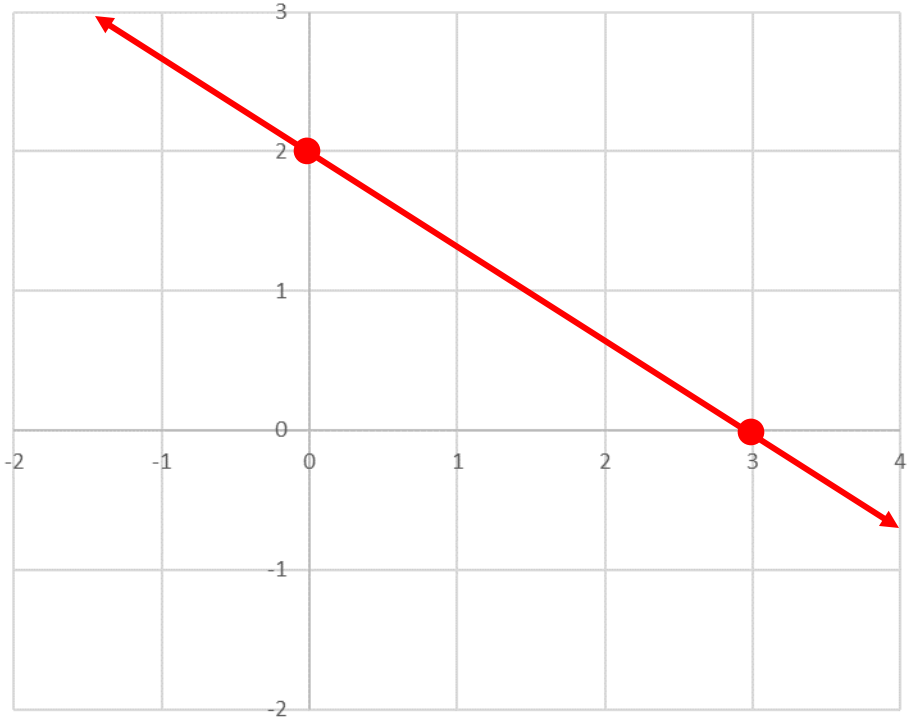
Examples:

1. $2x + 3y = 6$

To get the *x*-intercept, set *y* equal to zero and solve for *x*. $2x = 6 \Rightarrow$ *x*-intercept is 3.

To get the *y*-intercept, set *x* equal to zero and solve for *y*. $3y = 6 \Rightarrow$ *y*-intercept is 2.

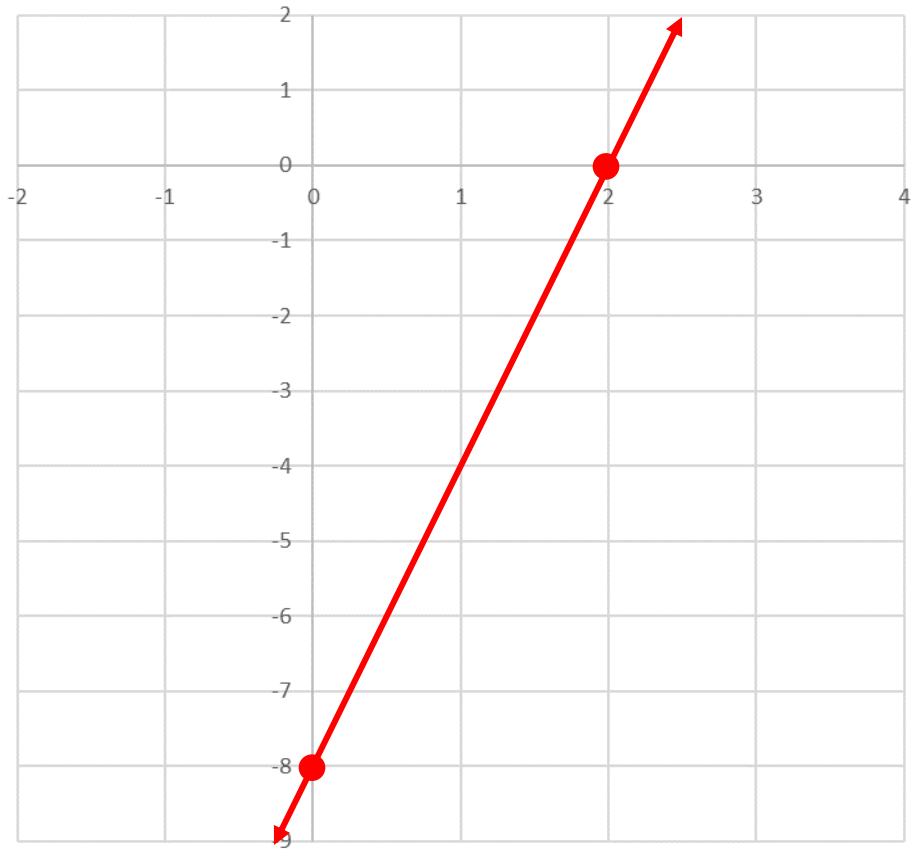
Plot the intercepts and connect the dots.



2. $4x - y = 8$

x-int: 2

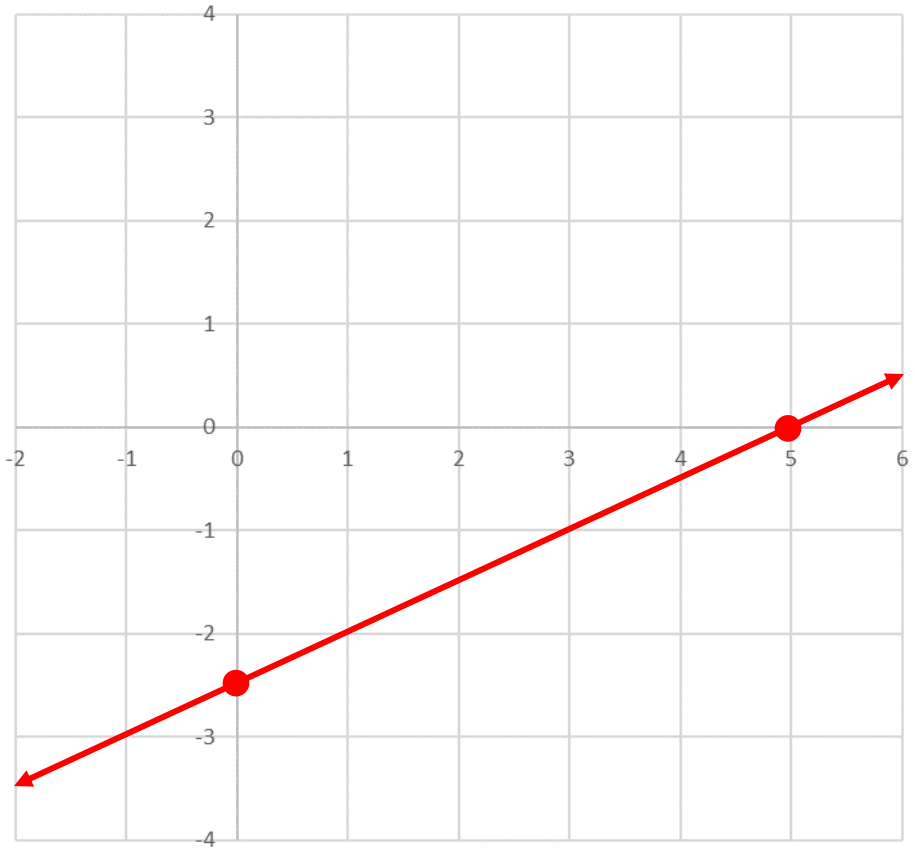
y-int: -8



3. $-2x+4y=-10$

x-int: 5

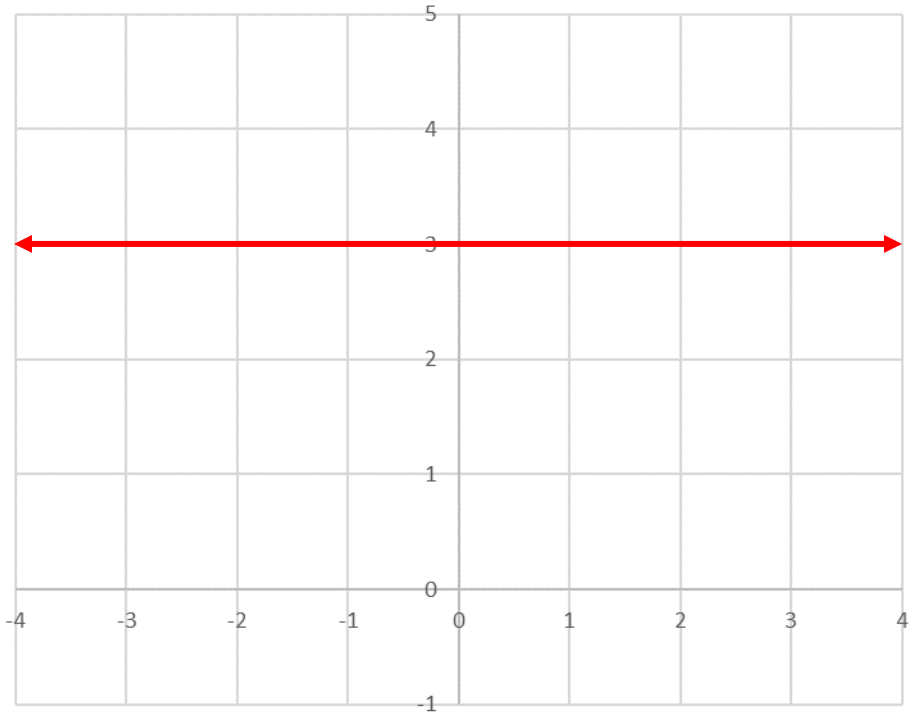
y-int: $-\frac{5}{2}$



4. $4y = 12$

When the *x* variable is missing, there is no *x*-intercept. The solution line is horizontal, and it can be graphed by solving the equation for *y*.

$y = 3$



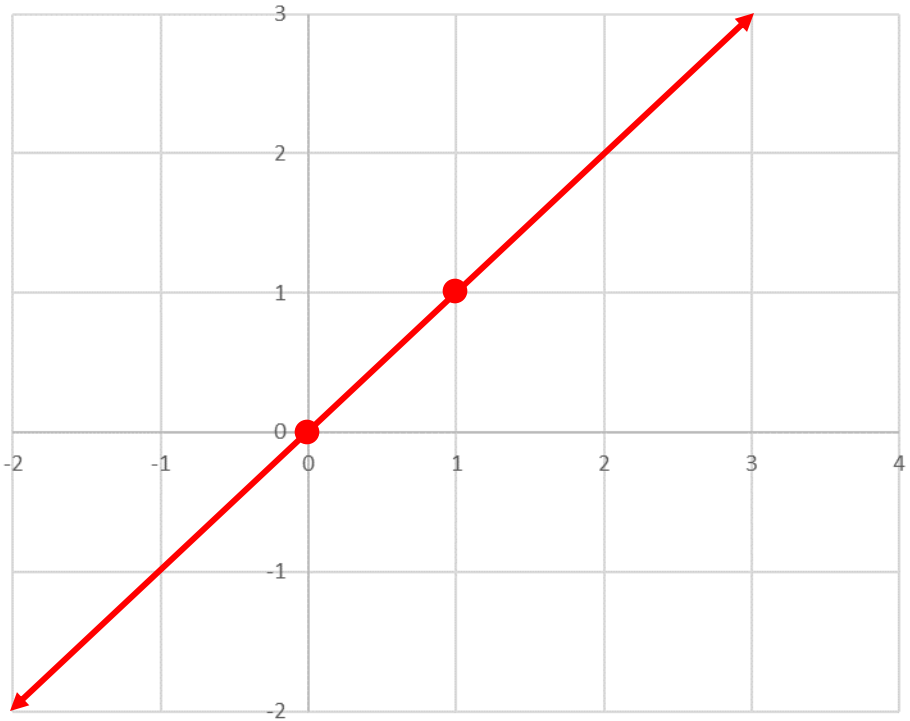
5. $-3x = 24$

When the *y* variable is missing, there is no *y*-intercept. The solution line is vertical, and it can be graphed by solving the equation for *x*.

$x = -8$

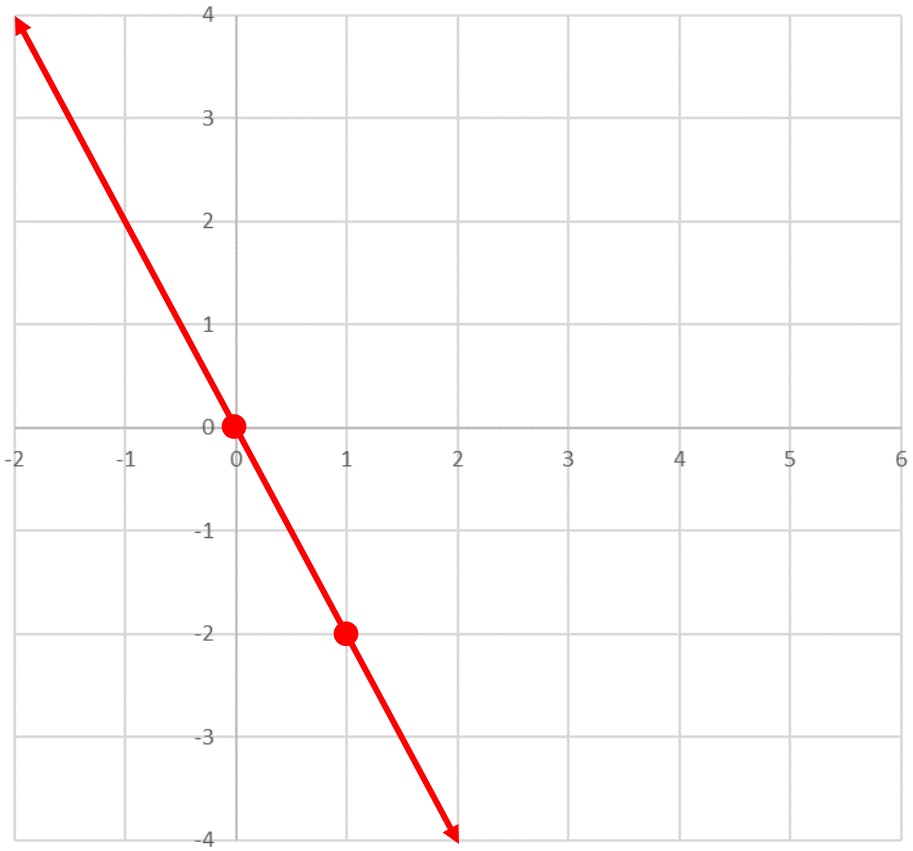
6. $x - y = 0$

When both x and y are present but the constant is zero, the x and y intercepts are both zero. These two intercepts only provide one point on the solution line-the origin, $(0,0)$. We'll have to find another point on the solution line in order to graph it. We'll do this by choosing a non-zero value for one of the variables and finding the corresponding value of the other variable. For example, if $x = 1$ then y must also be 1 to satisfy the equation, so our second point on the solution line is $(1,1)$.



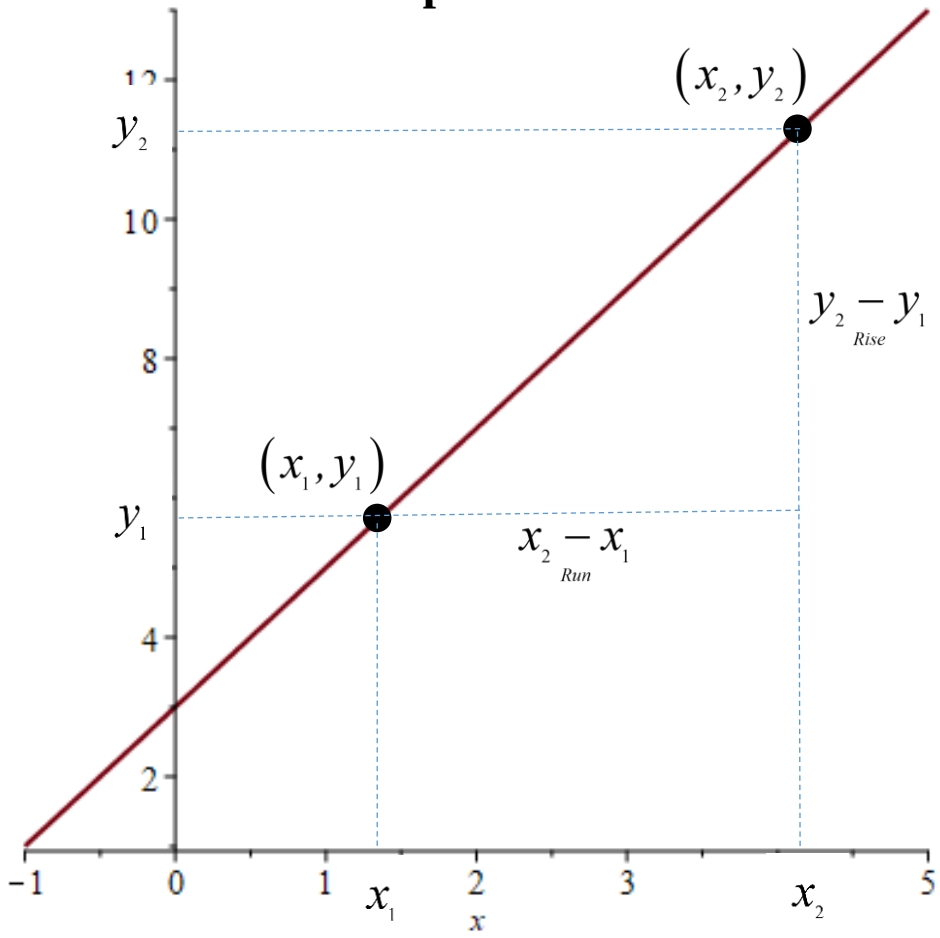
7. $2x + y = 0$

$(0,0)$ is a point on the solution line. If $x = 1$ then y must be -2 to satisfy the equation, so our second point on the solution line is $(1,-2)$.

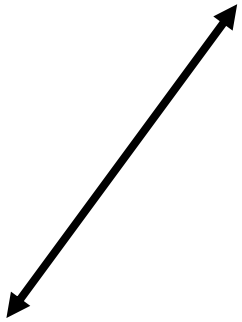


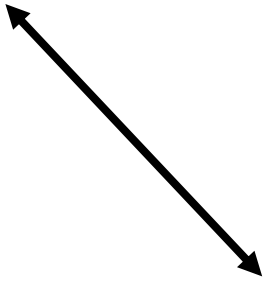
Slope:

The slope of a line is a measure of its steepness and direction.



$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{Rise}}{\text{Run}}$$

$m > 0$:  **up to the right**

$m < 0$:  **down to the right**

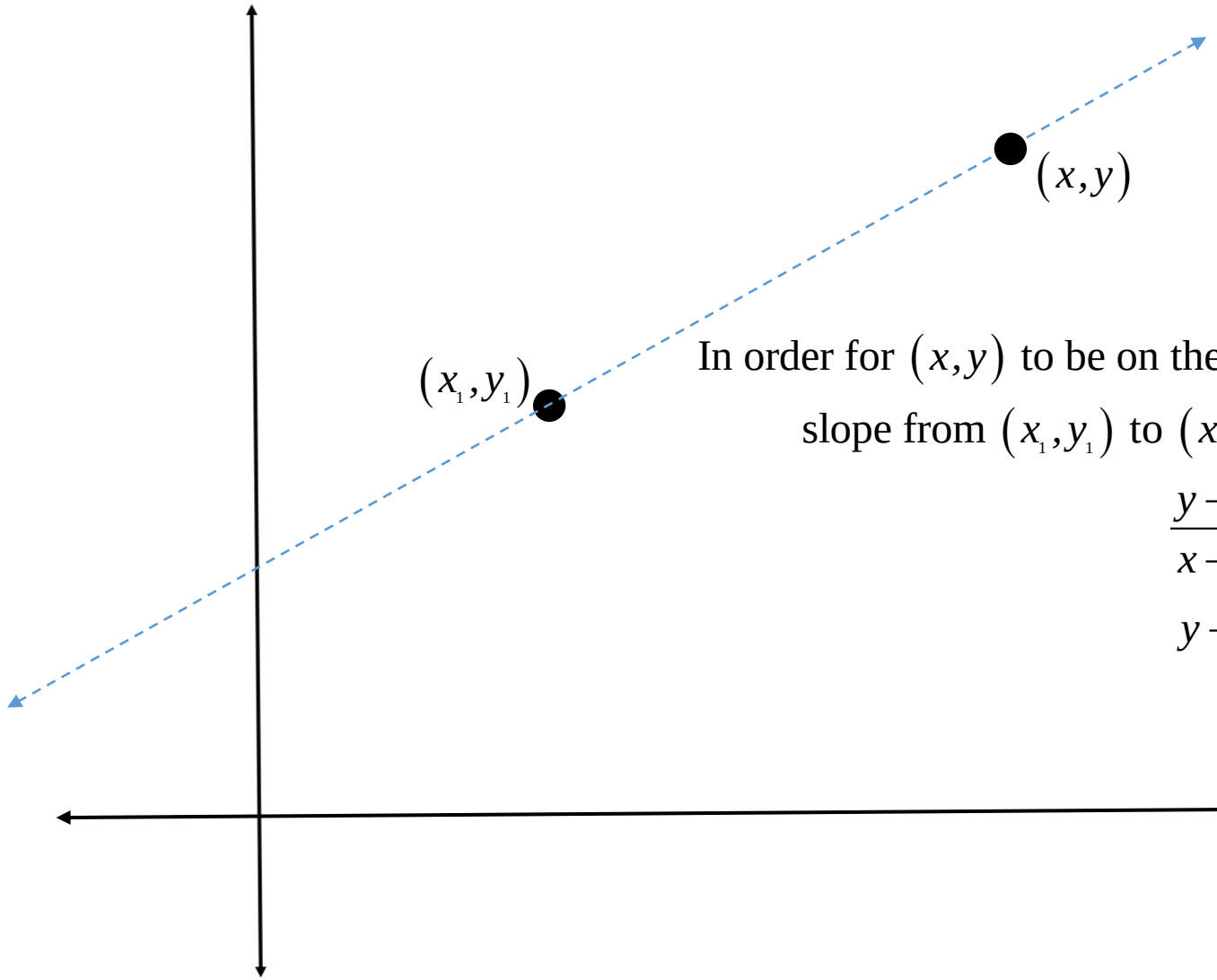
$m = 0$:  **horizontal**

m undefined:  **vertical**

Finding Equations of Lines from their descriptions:

Point-Slope Form/Formula:

You are given a point on the line, (x_1, y_1), and the slope of the line, *m*.



In order for (x, y) to be on the line:

slope from (x_1, y_1) to $(x, y) = m$

$$\frac{y - y_1}{x - x_1} = m$$

$$y - y_1 = m(x - x_1)$$

Examples:

1. Through $(1,2)$ with a slope of 3.

$$y-2=3(x-1)$$

2. Through $(1,-2)$ with a slope of $\frac{1}{2}$.

$$y-(-2)=\tfrac{1}{2}(x-1)\Rightarrow \boxed{y+2=\tfrac{1}{2}(x-1)}$$

3. Through $(-1,0)$ with a slope of $-\frac{2}{3}$.

$$y-0=-\tfrac{2}{3}(x-(-1))\Rightarrow \boxed{y=-\tfrac{2}{3}(x+1)}$$

4. Through $\left(2,-\frac{1}{2}\right)$ with a slope of 0.

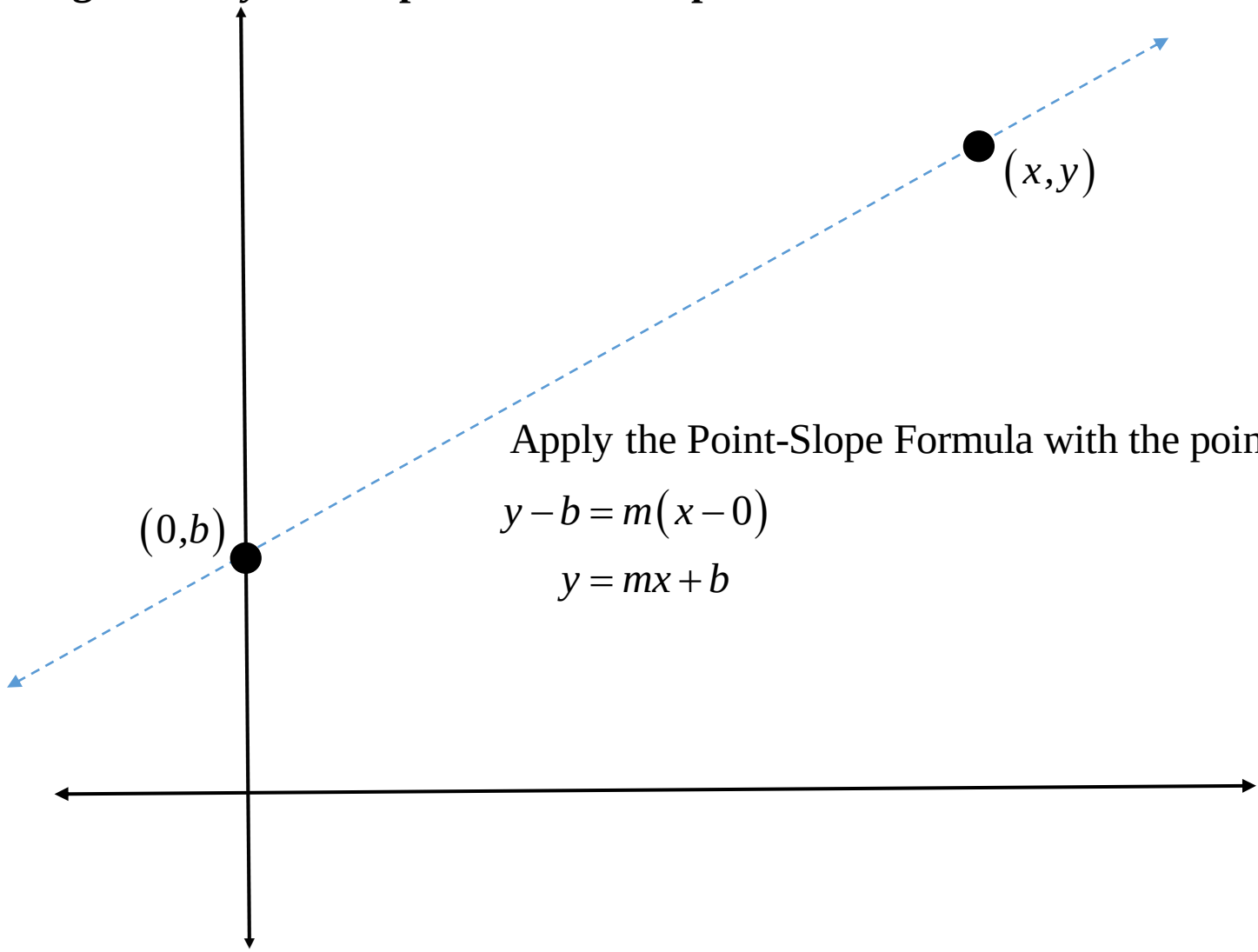
$$y-(-\tfrac{1}{2})=0(x-2)\Rightarrow \boxed{y+\tfrac{1}{2}=0}$$

5. Through $(5,-8)$ with undefined slope.

$$x=5$$

Slope-Intercept Form/Formula:

You are given the *y*-intercept, *b*, and the slope of the line, *m*.



Apply the Point-Slope Formula with the point $(0,b)$:

$$y-b=m(x-0)$$

$$y=mx+b$$

Examples:

1. *y*-intercept of 2 with a slope of 3.

$y = 3x + 2$

2. *y*-intercept of -3 with a slope of $\frac{1}{2}$.

$y = \frac{1}{2}x - 3$

3. *y*-intercept of 0 with a slope of $-\frac{2}{3}$.

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

4. *y*-intercept of $\frac{1}{2}$ with a slope of 0.

$y = 0x + \frac{1}{2} \Rightarrow \boxed{y = \frac{1}{2}}$

Determine the slope and *y*-intercept of the following lines.

1. $y = 2x + 3$

slope is 2

y-intercept is 3

2. $3y = 6 \Rightarrow y = 2 = 0x + 2$

slope is 0

y-intercept is 2

3. $9x + 3y = 6 \Rightarrow 3y = -9x + 6 \Rightarrow y = -3x + 2$

slope is -3

y-intercept is 2

4. $4x = -8 \Rightarrow x = -2$

slope is undefined

There is no *y*-intercept.

Two lines are parallel if their slopes are the ___same____.

1. Find an equation of the line that passes through the point $(1,-2)$ and is parallel to the line with equation $y=-4x+5$.

$$y+2=-4(x-1)$$

2. Find an equation of the line that passes through the point $(1,-2)$ and is parallel to the line with equation $x=5$.

$$x=1$$

Two non-vertical lines are perpendicular if the product of their slopes is__-1__.

Every vertical line is perpendicular to every horizontal line.

1. Find an equation of the line that passes through the point $(1,-2)$ and is perpendicular to the line with equation $y=-4x+5$.

$$y+2=\tfrac{1}{4}(x-1)$$

2. Find an equation of the line that passes through the point $(1,-2)$ and is perpendicular to the line with equation $x=5$.

$$y=-2$$