

3.4: Graphing Lines Using Slope (continued)

2/12/2015

Note Title

Slope-intercept form of a line:

$y = mx + b$, where m is the slope and b is the y -intercept.

Example: Graph the equation $y = -2x + 4$ using the slope and y -intercept.

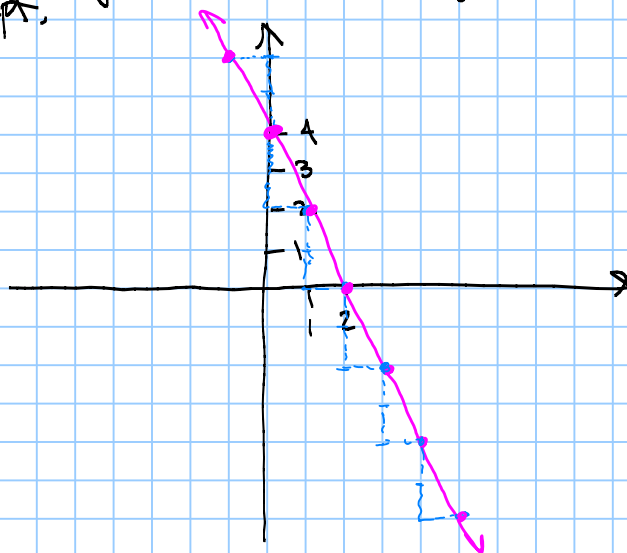
$$y = -2x + 4$$

$y = mx + b$

$$m = -2 = -\frac{2}{1}$$

vertical change = rise = 2
horizontal change = run = 1

$b = 4$
 y -intercept is 4
ordered pair $(0, 4)$



Homework Question:

3.3 #27) $y = -\frac{2}{3}x + 4$

Find y -intercept: Set $x = 0$:

$$y = -\frac{2}{3}(0) + 4$$

$$y = 0 + 4$$
$$y = 4 \Rightarrow (0, 4)$$

Find x -intercept: Set $y = 0$.

$$0 = -\frac{2}{3}x + 4$$

$$-4 = -\frac{2}{3}x$$

$$\frac{-4}{-\frac{2}{3}} = \frac{-\frac{2}{3}x}{-\frac{2}{3}}$$

$$\left(-\frac{3}{2}\right)\left(-\frac{4}{1}\right) = -\frac{2}{3}x\left(-\frac{3}{2}\right)$$

$$+ \frac{12}{2} = x$$

$$6 = x$$

so the point is $(6, 0)$.

Example: Graph the line $y = \frac{1}{3}x - 2$ using the slope and y-intercept!

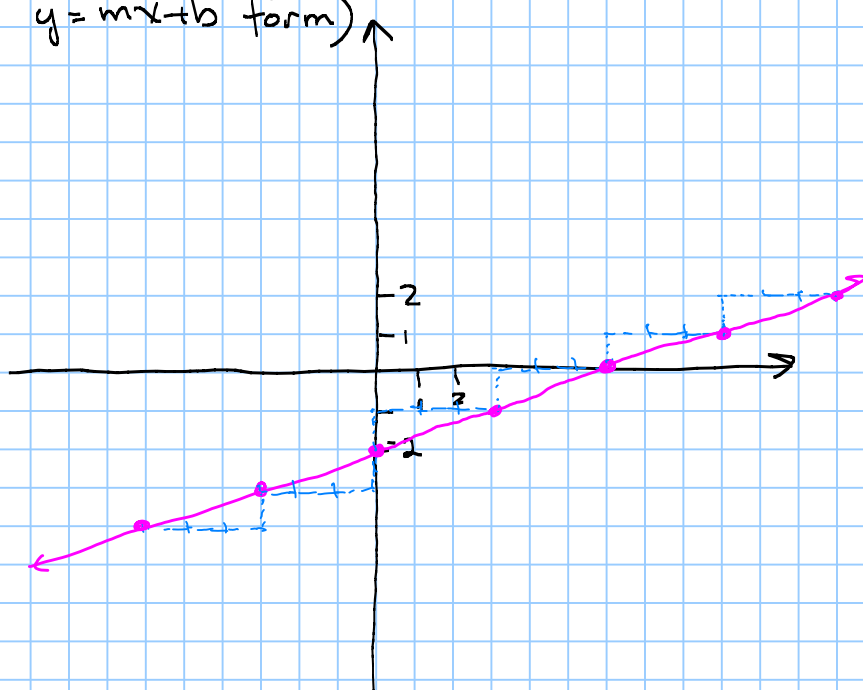
$y = \frac{1}{3}x - 2$ (already in $y = mx + b$ form)

$y = mx + b$

$m = +\frac{1}{3}$

vertical change = rise = 1
horizontal change = run = 3

y-intercept: $b = -2$
(ordered pair is $(0, -2)$)



Example: Graph $y = -\frac{4}{3}x$.

Write as $y = mx + b$

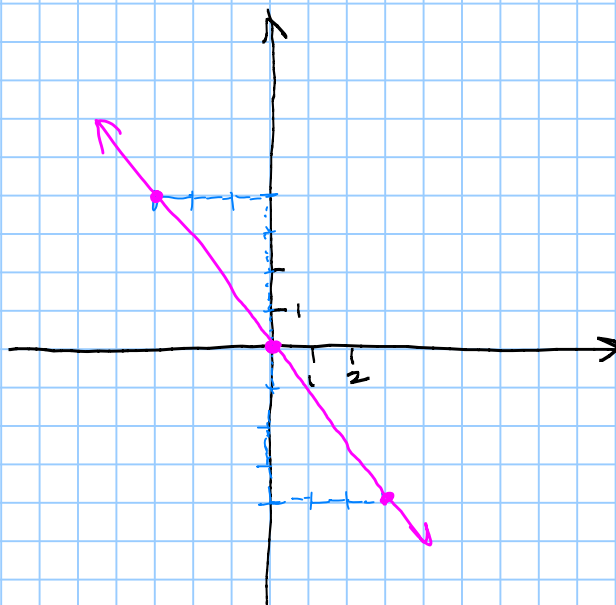
$y = -\frac{4}{3}x + 0$

Slope: $m = -\frac{4}{3}$

rise: 4
run: 3

y-intercept: $b = 0$

(goes through origin)



Example: Graph the line $2x - 3y = 9$ by first writing it in slope-intercept form.

$$2x - 3y = 9 \quad \text{Want to write as } y = mx + b.$$

Solve for y :

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

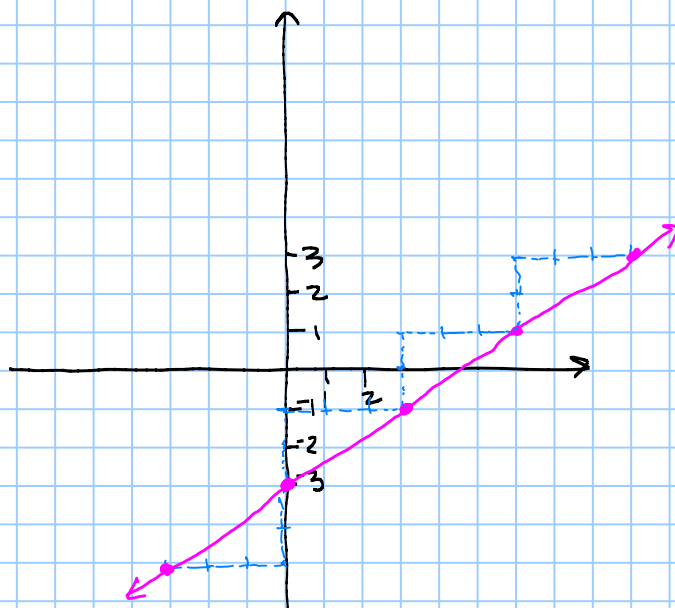
$$\frac{-3y}{-3} = \frac{-2x}{-3} + \frac{9}{-3}$$

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

Slope: $m = +\frac{2}{3}$

rise = 2
run = 3

y-intercept: $b = -3$



Recall: Slope = $m = \frac{y_2 - y_1}{x_2 - x_1}$

Example: Find the slope of the line containing the points $(-3, 2)$ and $(5, 8)$.

$$x_1 = -3$$

$$y_1 = 2$$

$$x_2 = 5$$

$$y_2 = 8$$

} $\Rightarrow$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 2}{5 - (-3)} = \frac{6}{5 + 3} = \frac{6}{8} = \frac{3}{4}$$

Slope is $m = \frac{3}{4}$.

If I put the points in the other order, I get the same answer.

$$x_1 = 5$$

$$x_2 = 8$$

$$x_2 = -3$$

$$y_2 = 2$$

} $\Rightarrow$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 8}{-3 - 5} = \frac{-6}{-8} = \frac{6}{8} = \frac{3}{4}$$

Example: Calculate the slope of the line containing the points $(4, -6)$ and $(-1, -3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - (-6)}{-1 - 4} = \frac{-3 + 6}{-1 - 4} = \frac{3}{-5} = -\frac{3}{5}$$

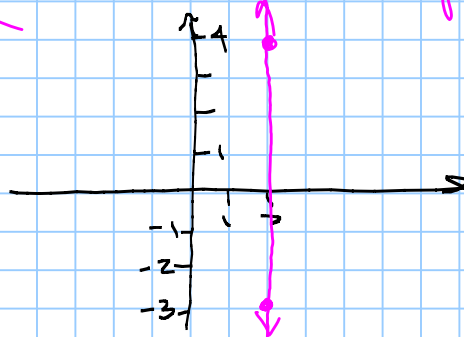
Other order: $m = \frac{-6 - (-3)}{4 - (-1)} = \frac{-6 + 3}{4 + 1} = \frac{-3}{5} = -\frac{3}{5}$

Example: Find the slope of the line containing the points $(2, 4)$ and $(2, -3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 4}{2 - 2} = \frac{-7}{0}$$

Slope is undefined.

Slope is undefined
cannot divide by 0.



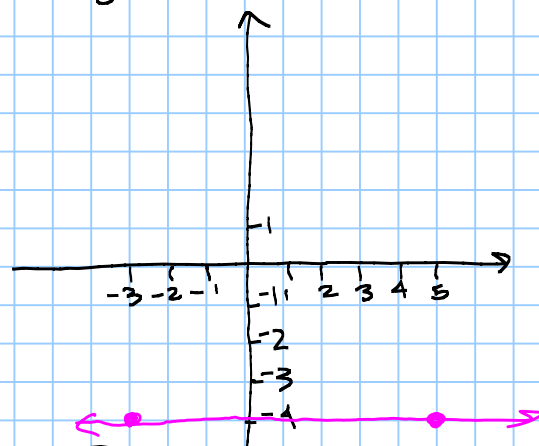
Vertical lines always have undefined slope.

Example: Find the slope of the line containing the points $(-3, -4)$ and $(5, -4)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - (-4)}{5 - (-3)} = \frac{-4 + 4}{5 + 3} = \frac{0}{8} = 0$$

The slope is 0.

Every horizontal line has slope 0.



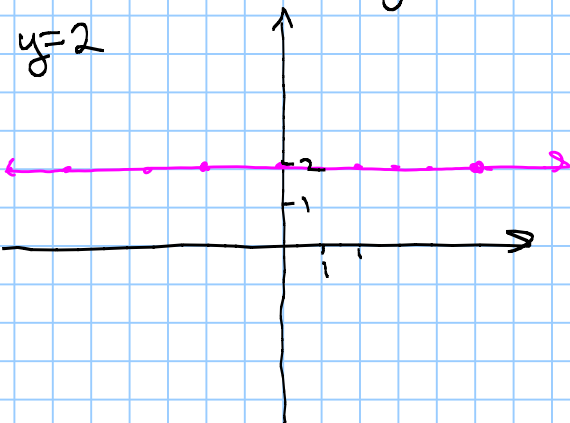
Slopes of horizontal and vertical lines

* Vertical lines have undefined slope.

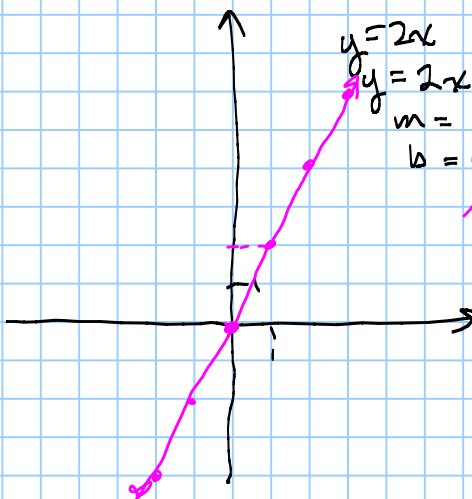
* Horizontal lines have slope 0.

Ex: Graph the equations.

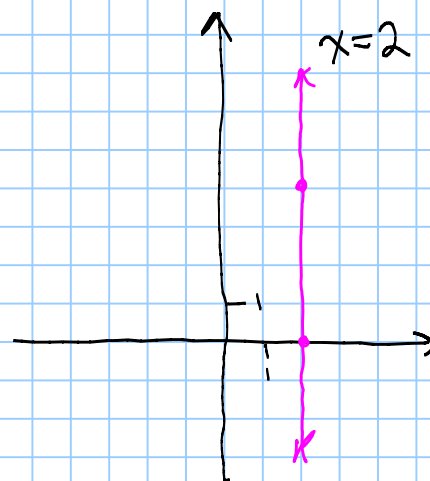
$$y = 2$$



$$\begin{aligned} y &= 2x \\ y &= 2x + 0 \\ m &= +2 \\ b &= 0 \end{aligned}$$



$$x = 2$$



3.5: Equations of Line

Finding the equation of a line given 2 points.

Example: Find the equation of the line containing the points $(-2, 4)$ and $(1, 7)$.

Find the slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 4}{1 - (-2)} = \frac{3}{1+2} = \frac{3}{3} = 1$$

$$y = mx + b$$

Put in $m=1$

$$y = 1x + b \quad \text{need to find } b.$$

Put in the coordinates of either of the given points for x and y .

$x = -2, y = 4$

$$y = 1x + b$$

$$4 = 1(-2) + b$$

$$4 = -2 + b$$

$$6 = b$$

The equation is $y = 1x + 6$ or just $\boxed{y = x + 6}$

Another method:

Point-Slope form of a line

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

where m is the slope,
and (x_1, y_1) is a
point on the line.

$$\left. \begin{array}{l} \text{Use } m=1 \\ x=-2 \\ y=4 \end{array} \right\} \Rightarrow$$

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

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

$$y - 4 = x + 2$$

$$\boxed{y = x + 6}$$