

1.1 Lines in the Plane

08/26/15

Slope of a line

$$\frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Ex 1.

Find the slope of the line passing through a point.

a) $(-2, 0)$ and $(3, 1)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 0}{3 - (-2)} = \frac{1}{5} = m$$

Slope intercept form

$$y = m \cdot x + b \quad \leftarrow \begin{array}{l} \text{slope} \\ \text{y-int} \end{array}$$

Ex. 2

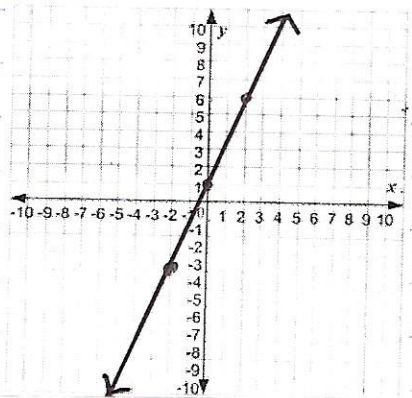
graph

$$\begin{array}{r} 2y - 5x = 2 \\ +5x \quad +5x \\ \hline 2y = 5x + 2 \\ \frac{2y}{2} = \frac{5x + 2}{2} \end{array}$$

$$m = \frac{5}{2}$$

$$b = 1$$

$$y = \frac{5}{2}x + 1$$



$$m = \frac{\text{rise}}{\text{run}}$$

Point-Slope form

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

Ex. 3

Find an equation of the line that passes through the point $(1, -2)$ and has a slope of 3.

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

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

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

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

$$y = 3x - 5$$

plugin pt. + m
simplify
solve for y

Standard form

$Ax + By + C$

- * Cannot have fractions
- * A has to be positive

Ex.4

Write $y = \frac{2}{3}x + 1$ in standard form

$$-\frac{2x}{3} \quad -\frac{2}{3}x$$

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

$$2x - 3y = -3$$

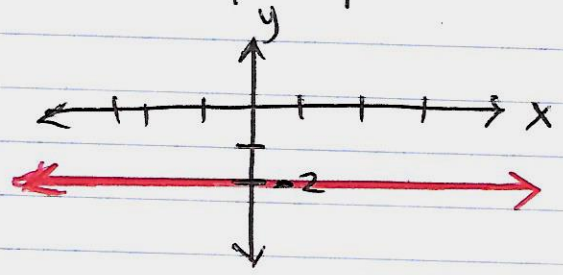
Horizontal line

A line that has a slope of 0

Ex.5

$y = -2$

$y = b$



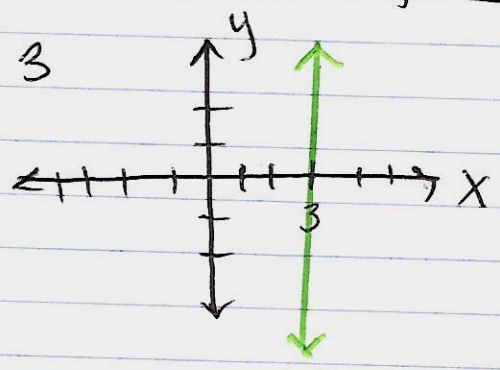
Vertical line

A line that has a slope of undefined

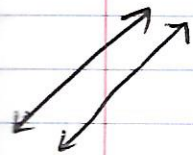
Ex.6

$x = a$

$x = 3$



Parallel lines



Ex 7

lines with the same slope.

Given $y = 2x + 1$, find a parallel line that passes through $(-1, 3)$

$$y = 2x + 1$$

↑ Same slope

$$m = 2$$

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

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

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

$$\begin{array}{r} +3 \\ \hline y = 2x + 5 \end{array}$$

Perpendicular line



Slopes are opposite reciprocals

(Flip signs, Flip fractions)

$$m_1 = -\frac{1}{m_2}$$

Ex 8

Given $2x - 3y = 5$, find the perpendicular line that passes through $(2, -1)$.

$$\begin{array}{r} 2x - 3y = 5 \\ -2x \quad \quad \quad -2x \\ \hline -3y = -2x + 5 \\ -3 \quad \quad \quad -3 \quad \quad -3 \\ \hline y = \frac{2}{3}x - \frac{5}{3} \end{array}$$

$$m_1 = \frac{2}{3}$$

$$m_2 = -\frac{3}{2}$$

Write in slope-int form to find "m"

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

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

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

$$\begin{array}{r} -1 \quad \quad \quad -1 \\ \hline y = -\frac{3}{2}x + 2 \end{array}$$

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