Find the line passing through

$(-2, 6)$ and $(-8, 3)$.

$x_1 \quad y_1 \qquad x_2 \quad y_2$

1. Need slope
2. Types of Linear Equations

standard $\quad Ax + By = C$

slope-intercept $\quad y = mx + b$

point-slope $\quad y = m(x - x_1) + y_1$

1. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{(3) - (6)}{(-8) - (-2)}$

$= \dfrac{-3}{-8 + 2}$

$= \dfrac{-3}{-6}$

$= \dfrac{1}{2}$

2. Find line

Point slope $\quad m = \frac{1}{2} \quad (-2, 6)$

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

$y = \frac{1}{2}(x - (-2)) + (6)$

$y = \frac{1}{2}(x + 2) + 6$

$m = \frac{1}{2} \quad (-8, 3)$

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

$y = \frac{1}{2}(x - (-8)) + (3)$

Slope Intercept

Option 1. Convert from point-slope to slope-intercept

a.) $y = \frac{1}{2}(x+2)+6$

$y = \frac{1}{2}x + \frac{2}{2} + 6$

$y = \frac{1}{2}x + 1 + 6$

$y = \frac{1}{2}x + 7$

b) $y = \frac{1}{2}(x-(-8))+3$

$y = \frac{1}{2}(x+8)+3$

$y = \frac{1}{2}x + \frac{8}{2} + 3$

$y = \frac{1}{2}x + 4 + 3$

$y = \frac{1}{2}x + 7$

Option 2. Find b.

$m = \frac{1}{2}$ $y = mx + b$

point on line $(-8,3)$ $(3) = \left(\frac{1}{2}\right)(-8) + b$

$3 = -4 + b$

$+4 \quad +4$

$7 = b$

Substitute m and b

$y = \frac{1}{2}x + 7$

* should result in same equation w/ $(-2,6)$

Convert Standard form $\to$ $y=mx+b$

$$Ax+By = C \to y=mx+b$$

e.g. $$\begin{array}{rcl} 3x+4y &=& 4 \\ -3x & & -3x \\ \hline \end{array}$$

Objective: solve for y in terms of x.

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

$$y = \frac{4-3x}{4} \longrightarrow \frac{1}{4}(4-3x)$$

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

$$y = 1 - \frac{3}{4}x \to \boxed{y = -\frac{3}{4}x + 1}$$

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

$$\begin{array}{rcl} 3x+4y &=& 4 \\ -3x & & -3x \\ \hline \end{array}$$

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

$$\boxed{y = -\frac{3}{4}x + 1}$$

Graphing Lines

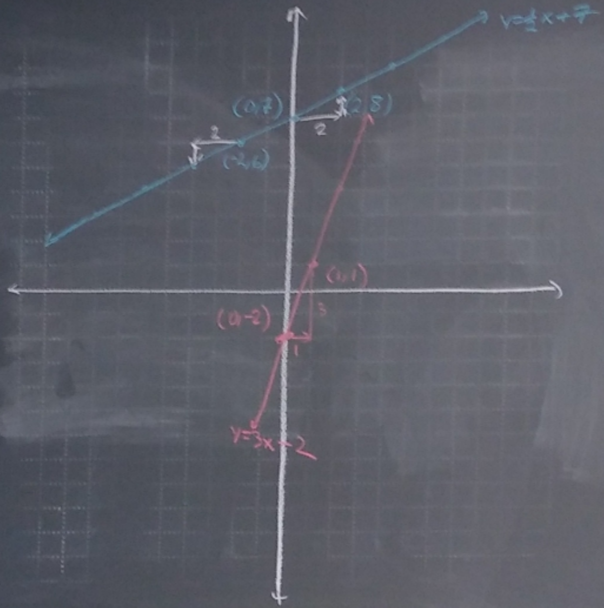
1. slope-intercept form

$y = mx + b$

$y = \frac{1}{2}x + 7$

$m = \frac{1}{2}$ (0,7)

↑1 2→



$y = 3x - 2$

$m = \frac{3}{1}$ (0,-2)

→1 ↑3

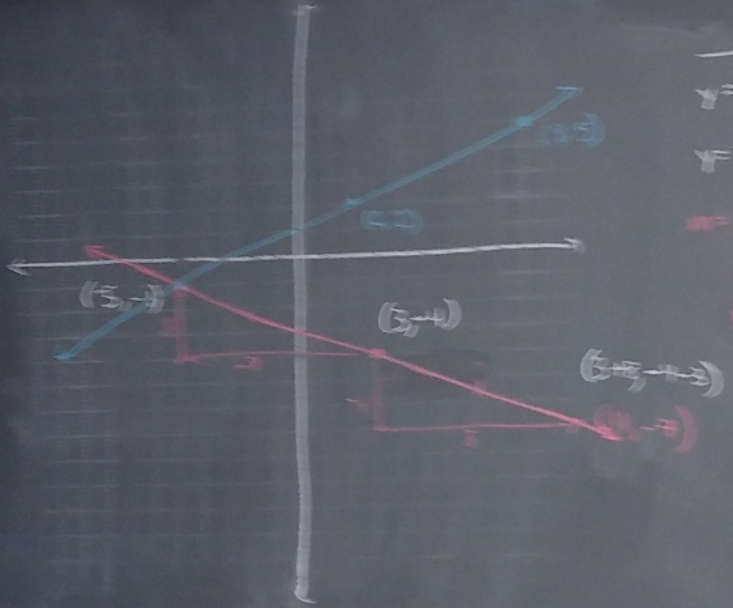
Graphing Lines

$y=\frac{3}{7}(x-11)+5$

$m=\frac{3}{7}$ $(11,5)$

$\rightarrow 7$ $\uparrow 3$

$\leftarrow 7$ $\downarrow 3$



Graphing w/ point slope form

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

$y=-\frac{3}{8}(x-3)-4$

$m=-\frac{3}{8}$ $(x_1,y_1)=(3,-4)$

$\downarrow 3$ $\rightarrow 8$

Graphing in standard form

$$2x - 5y = 20$$

* Observe that 20 is divisible by 2 and 5.

→ Look for x and y-intercepts

y-intercept. y-value when $x = 0$ → $2(0) - 5y = 20$

$0 - 5y = 20$

$\frac{-5y}{-5} = \frac{20}{-5}$

$y = -4$

$(0, -4)$

x-intercept: x when $y = 0$

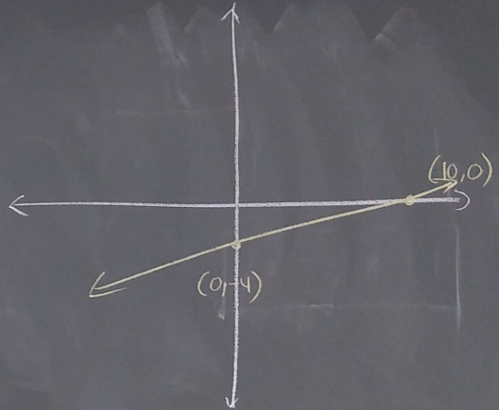
$2x - 5(0) = 20$

$2x - 0 = 20$

$\frac{2x}{2} = \frac{20}{2}$

$x = 10$

$(10, 0)$



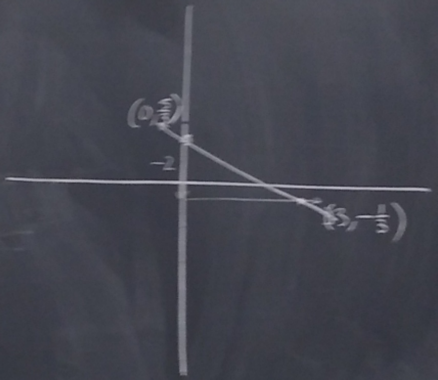
$$2x + 3y = 5$$

$$-2x \qquad\qquad -2x$$

$$\frac{3y}{3} = \frac{-2x}{3} + \frac{5}{3}$$

$$y = -\frac{2}{3}x + \frac{5}{3}$$

Graph this



parallel lines

lines if extended infinitely will never touch.

Playfair's Axiom Given a line and a point outside the line, then there exists only one line that can pass through the point that is parallel to the original line.

$$3x + 4y = 4 \quad \| \quad 6x + 8y = 5$$

$$\begin{aligned} 3x + 4y &= 4 \\ -3x \qquad &\;\; -3x \\ \hline \frac{4y}{4} &= \frac{-3x}{4} + \frac{4}{4} \end{aligned} \qquad \begin{aligned} 6x + 8y &= 5 \\ -6x \qquad &\;\; -6x \\ \hline \frac{8y}{8} &= \frac{-6x}{8} + \frac{5}{8} \end{aligned}$$

$\rightarrow m = -\frac{3}{4}$ $\qquad m = -\frac{6}{8} = -\frac{3}{4}$

$y = -\frac{5}{6}(x+8) + 1$, $y = -\frac{5}{6}x + 5$ $\quad (m = -\frac{5}{6})$

lines are parallel if they have the same slope.

$m_1 = m_2 \rightarrow l_1 \| l_2$

e.g. $y = 5$ and $y = 7$ (both horizontal, both $m = 0$)

$y = 2x + 3$ $\quad y = 2x + 5$ (slope $m = 2$)

$x = \frac{1}{2}$ $\quad x = \frac{5}{3}$ (both vertical)

perpendicular lines

are lines that intersect at 90° angle

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

$$m = \frac{\Delta y}{\Delta x} \rightarrow m_\perp = -\frac{\Delta x}{\Delta y}$$

$\perp$ slopes are negative reciprocals

Find lines that are parallel and perpendicular to $y = -\frac{5}{6}(x+8)+1$ that passes through $(-3,1)$

parallel

$\rightarrow m = -\frac{5}{6}$

$(-3,1)$

point slope: $y = m(x - x_1) + y_1$

$y = -\frac{5}{6}(x - (-3)) + (1)$

$\boxed{y = -\frac{5}{6}(x+3)+1}$

perpendicular

$\rightarrow m = -\left(-\frac{6}{5}\right) = \frac{6}{5}$

$(-3,1)$

$y = \frac{6}{5}(x - (-3)) + (1)$

$\boxed{y = \frac{6}{5}(x+3)+1}$