Unit 1: Determining the equation of a line

- lines
- ⊥ // lines } today

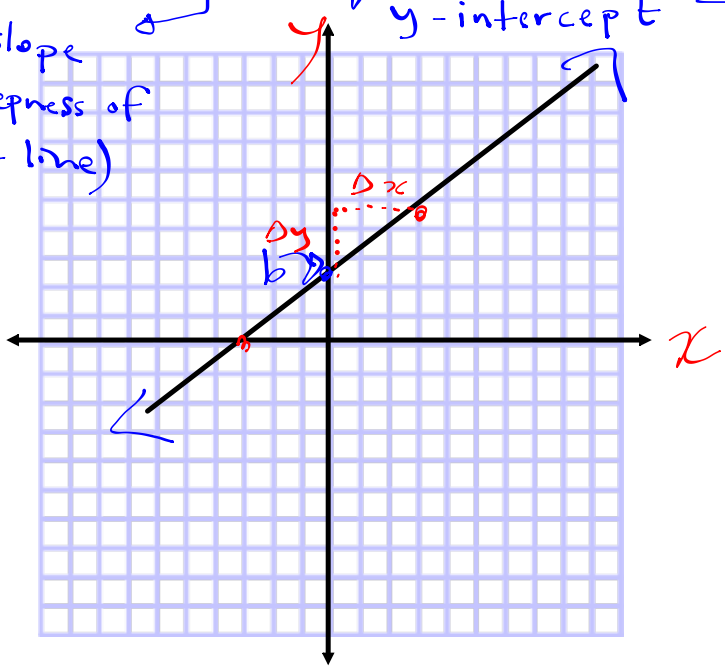
- points on lines
  - ↳ midpoint
  - ↳ point of division

- word questions

↳ $y = mx + b$ (first degree function relation)

m - slope (steepness of the line)

↳ y-intercept



Slope:

One way to calculate the slope of a line is by identifying two points and use:

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

LABEL!

x_1 y_1
$(6, 3)$

x_2 y_2
$(-7, -5)$

$$m = \frac{-5 - 3}{-7 - 6}$$

$$m = \frac{-8}{-13}$$

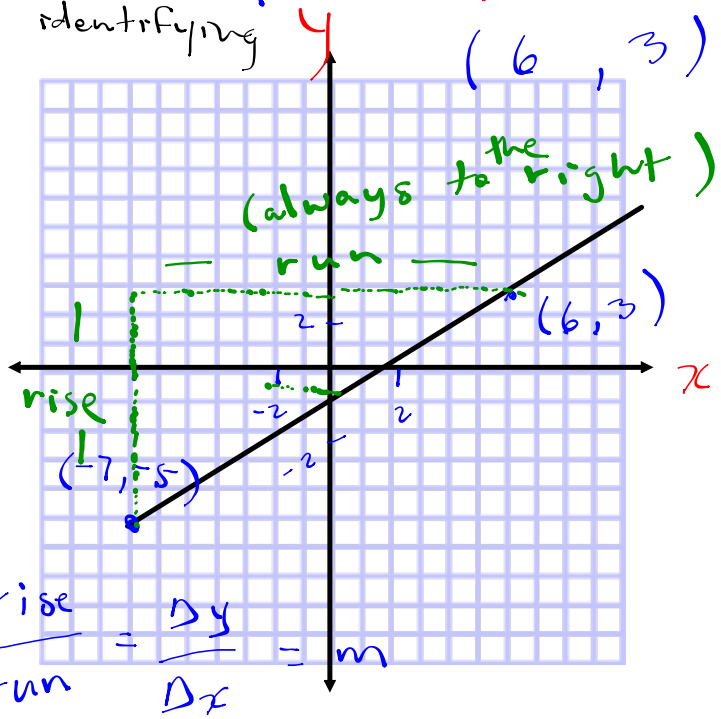
$$m = \frac{8}{13}$$

$$= \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = m$$

Point (ordered pair)

$(-7, -5)$

$(6, 3)$

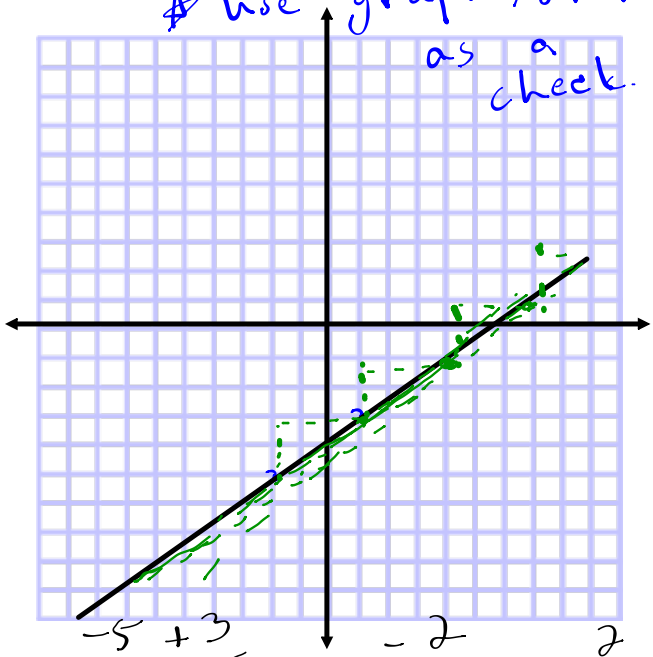


e.x. What's the slope of a line that passes through the points $P_1(\overset{x_1}{1}, \overset{y_1}{-3})$ $P_2(\overset{x_2}{-2}, \overset{y_2}{-5})$

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

$$m = \frac{-5 - (-3)}{-2 - 1} = \frac{-5 + 3}{-3} = \frac{-2}{-3} = \frac{2}{3}$$

* use graph/sketch as a check.



To find the value of 'b', use modified slope formula.

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

Sub in the value of 'm' and one point. Then cross multiply.

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

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

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

$$3y = 2x - 11$$

$$y = \frac{2}{3}x - \frac{11}{3}$$

ex. $(1, -3)$ (x_1, y_1)

$(-2, -5)$ (x_2, y_2)

Find the equation of the line.

$y = mx + b$

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

★ Finally, evaluate and isolate y, by performing the opposite operation to both sides.

$b = -\frac{11}{3}$

★ Recall what an equation is then used for

Determine equation $(-3, 2)$ $(-5, -4)$ (x_1, y_1; x_2, y_2)

$y = mx + b$

$m = \frac{y_2 - y_1}{x_2 - x_1}$ $b =$

$m = \frac{-4 - 2}{-5 - (-3)} = \frac{-6}{-5+3} = \frac{-6}{-2} = 3$

To find equation w the 'b'

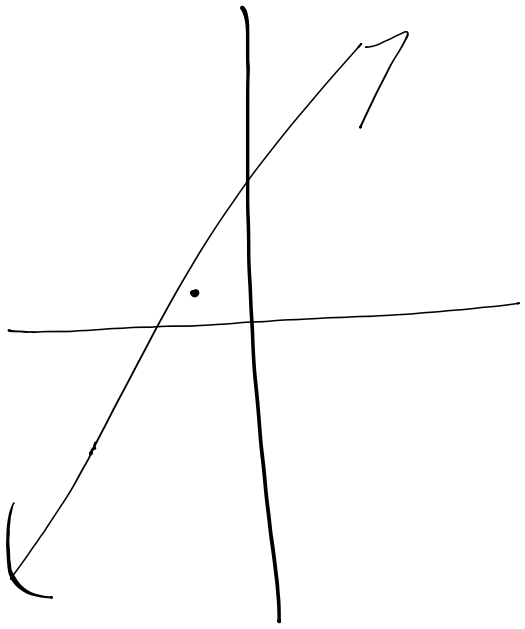
$m = \frac{y - y_1}{x - x_1}$

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

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

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

$y = 3x + 11$

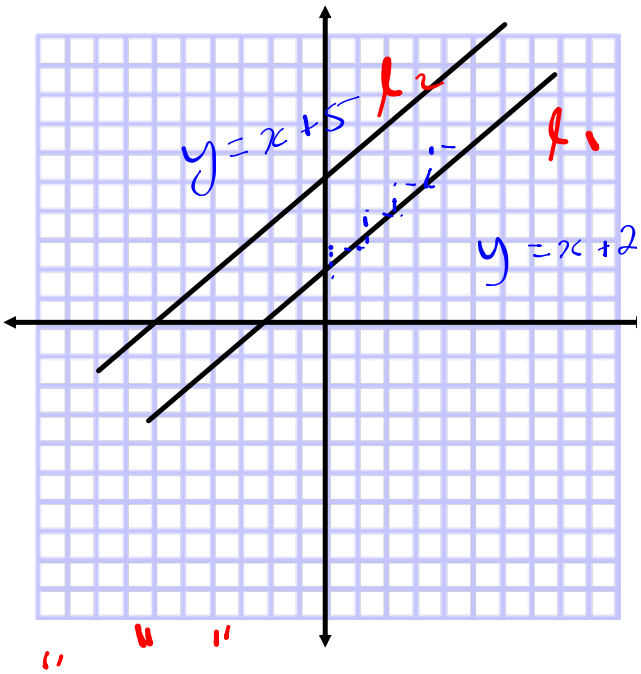


Unit 2 : Parallel and Perpendicular Lines and their equations

Parallel lines : 2 parallel lines that never intercept / touch

// train tracks. staircases / st laurent

love lifes



Nota Bene:

Parallel Lines have the same slope. "m_1" = m_2

Which lines are parallel?

$y = mx + b$

l_1: $y = x + 2$ $\quad m_1 = 1$

l_2: $y = 2x + 2$ $\quad m_2 = 2$

l_3: $y = -2x + 2$ $\quad m_3 = -2$

l_4: $y = 2x + 4$ $\quad m_4 = 2$

$l_2 \parallel l_4$

Which lines are parallel:

$y = mx + b$

l_1 : $2y = 4x + 3$

$y = 2x + 3/2$

l_2 : $y = -2x + 1$

l_3 : $3y = -6x + 4$

$y = -2x + 4/3$

to find the slope, first isolate y by performing opposite operation to both sides.

Determine the equation of l_1 that passes through $(2, -3)$ and is parallel to $l_2: 5x + 4y - 9 = 0$

$m_2 = m_1$

First find m_2 by isolating y:

$5x + 4y - 9 = 0$ $+9$

$5x + 4y = 9 - 5x$

$\frac{4y}{4} = \frac{-5x + 9}{4}$

$l_2 \quad y = -\frac{5}{4}x + \frac{9}{4}$

$m_2 = -\frac{5}{4} = m_1$

$y = mx + b$

$y = -\frac{5}{4}x + b$

Now to find b use modified slope formula $m = -\frac{5}{4}$ $(2, -3)$ x_1, y_1

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

$\frac{-5}{4} = \frac{y - (-3)}{x - 2}$

$4(y + 3) = -5(x - 2)$

$4y + 12 = -5x + 10$

$4y = -5x - 2$

$\frac{4y}{4} = \frac{-5x - 2}{4}$

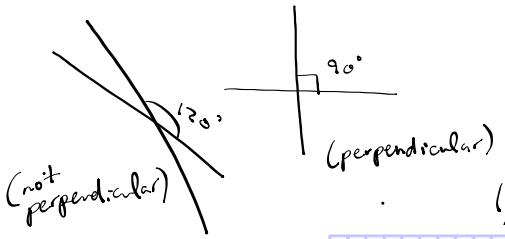
$l_1: y = -\frac{5}{4}x - \frac{1}{2}$

Determine the equation ($y = mx + b$) of l_1 that passes through $(-1, 4)$ and is parallel to l_2: $2y = -4x$

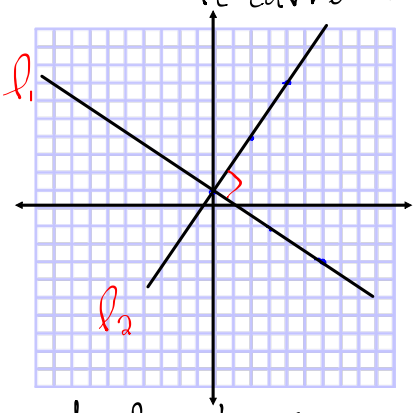
Boullion + St Cats.

Perpendicular Lines: Lines that cross each other at a 90°

• a corner of wall the constructed well



le carré rouge



l_1: $y = -\frac{2}{3}x + 1$

l_2: $y = \frac{3}{2}x + 1$

Nota Bene: Perpendicular Lines have negative reciprocal slopes.

To find the negative reciprocal, you flip the slope and change the sign.

ex. What's the negative reciprocal?

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

$\frac{3}{1}$ $-\frac{1}{3}$

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

-1 1

$-\frac{1}{\cdot\cdot}$ $\cdot\cdot$

$-\frac{5}{4}$ $\frac{4}{5}$

0.5 $-\frac{1}{0.5}$

1 -1

$\frac{1}{100}$ $-\frac{100}{1}$

$-\frac{1}{3}$ 3

$\frac{100}{1}$ $-\frac{1}{100}$

-50 $\frac{1}{50}$

-1 1

$\frac{4}{2}$ $-\frac{2}{4}$

Which lines are perpendicular?

l_1: $2y = 6x + 3$

$\frac{2y}{2} = \frac{6x + 3}{2}$

l_1: $y = 3x + 3/2$ $\quad m_1 = 3$

l_2: $-6y = -12x + 3$

$\frac{-6y}{-6} = \frac{-12x + 3}{-6}$

$y = \frac{-12}{-6}x + \frac{3}{-6}$

$y = 2x - \frac{1}{2}$ $\quad m_2 = 2$

l_3: $-12y = 4x + 3$

$\frac{-12y}{-12} = \frac{4x + 3}{-12}$

$y = \frac{4}{-12}x + \frac{3}{-12}$

$y = -\frac{1}{3}x - \frac{1}{4}$ $\quad m_3 = -1/3$

$m_1 = \frac{3}{1}$ $\quad m_2 = \frac{2}{1}$ $\quad m_3 = -\frac{1}{3}$

$l_1 \perp l_3$

Determine the equation of l_1 that passes through $(-3, 2)$ and is perpendicular to l_2

$l_2: \frac{2}{3}x + y - 9 = 0$ (isolate y) $\quad -\frac{2}{3}x \quad +9$

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

$m_2 = -\frac{2}{3}$ flip and change sign $\therefore m_1 = \frac{3}{2}$

Lastly, to find 'b' use

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

$(-3, 2)$
$x_1 \quad y_1$

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

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

$3x + 9 = 2y - 4$ $\quad -14 \quad +4$

$\frac{3x + 13}{2} = \frac{2y}{2}$

$y = \frac{3}{2}x + \frac{13}{2}$