Doing Lines

Slope intercept equation

$$y = mx + b$$

- Slope
- how fast our line goes up/down
- rate of change
- per/each

- y-intercept
- where our line hits y-axis
- starting amount in word problems

Slope

- is a fraction

$$\frac{\text{how much up/down}}{\text{how much over}}$$

Positive

Negative

undefined

$x = 3$

Zero

$y = 3$

Linear Equations and Word Problems

Variable

- This is the thing we don't know.
- It is **not** one of the numbers.
- It is what they are asking about. Go to the ?

Slope

- This is our rate of change
- Usually beside the words:
  - each
  - per
  - increasing
  - decreasing

y-intercept

- This is our starting amount
- If there isn't a starting amount then it is 0.

Writing the equation

$$y = mx + b$$

slope goes there, include + or −

y-intercept goes there include + or −

Slope from Coordinates

$$\frac{\text{subtract } y\text{'s}}{\text{subtract } x\text{'s}}$$

(x, y)

or $\frac{\Delta y}{\Delta x}$ or $\frac{y_2 - y_1}{x_2 - x_1}$

if that looks like Greek to you, well, it is. That is lower case delta.

Slope

How fast our line is going up or down

positive

negative

zero

undefined

Slope from Coordinates

(x, y)

bigger ⇒ subtract y's

⇒ subtract x's

ex:

$(1,2)(3,4)$

$$\frac{4-2}{3-1} = \frac{2}{2} = 1$$

$$\frac{2-4}{1-3} = \frac{-2}{-2}$$

$$= 1$$

Slope from Coordinates

$(5, 10)$ $(6, 30)$

x y x y

$$\frac{30-10}{6-5} = \frac{20}{1} = 20$$

Slope From Tables

x	y
1	10
2	13
3	16
4	19

Pick 2 points and do the same as before.

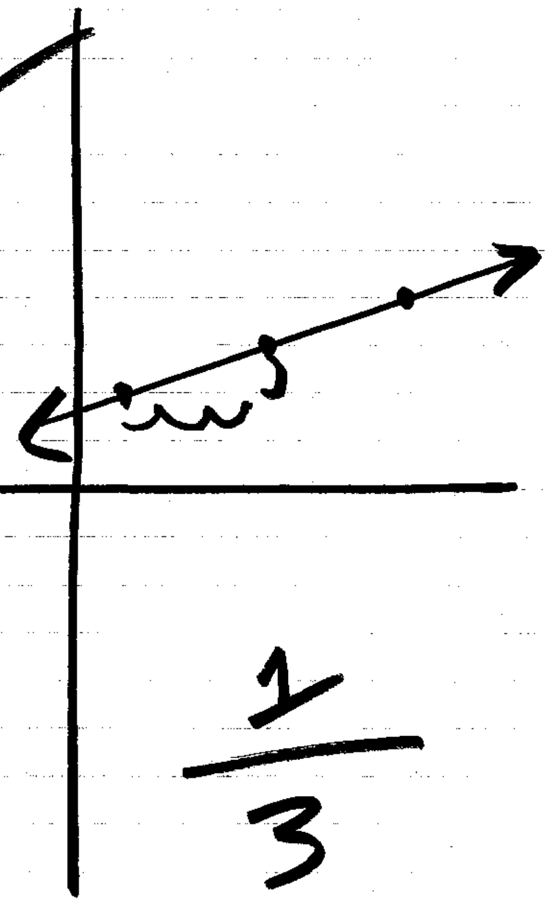
$$\frac{16-13}{3-2} = \frac{3}{1}$$

$$\frac{\text{subtract } y\text{'s}}{\text{subtract } x\text{'s}}$$

Slope from a graph

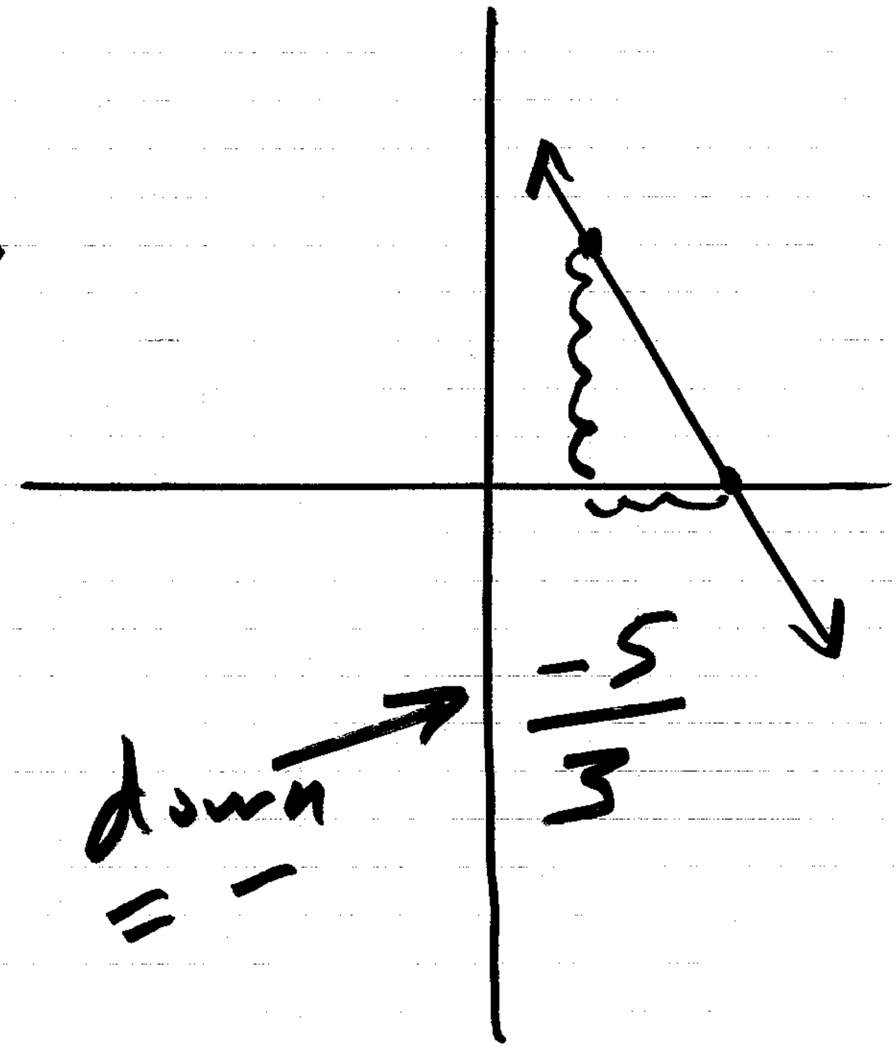
Pick 2 corners

count



$\frac{1}{3}$

down = −



$\frac{-5}{3}$

Graphing Linear Equations

go up

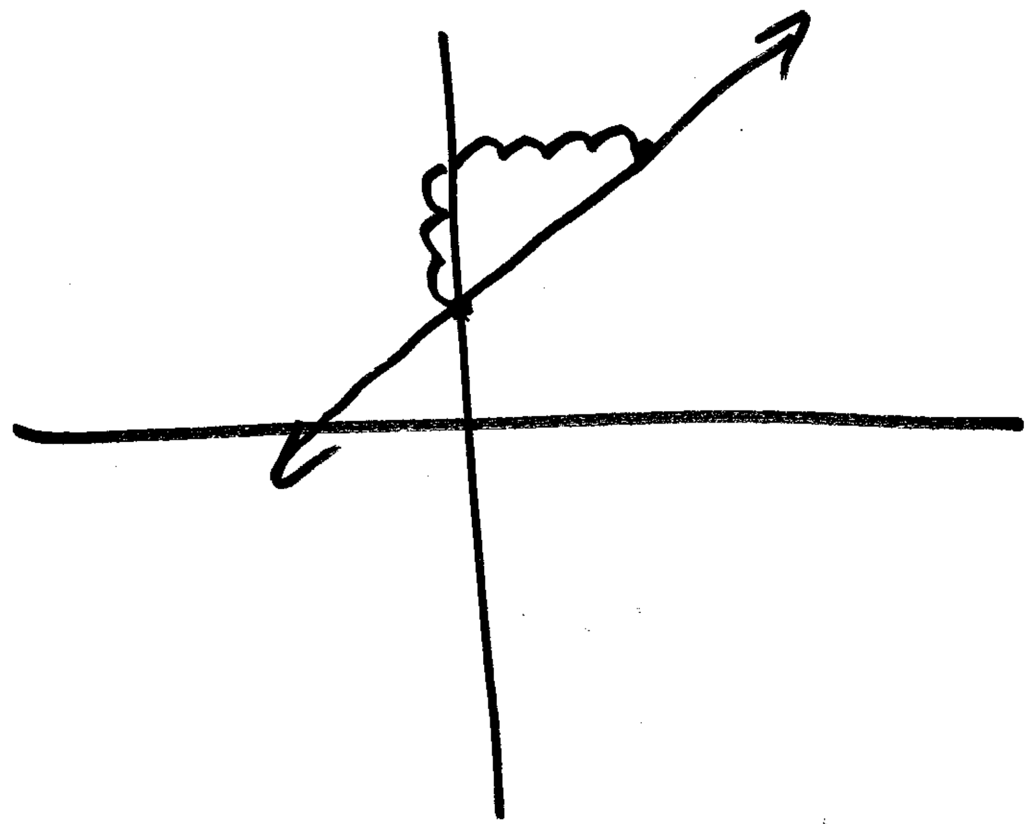
$$y = \frac{3}{4}x + 2$$

go right

put a dot there on y-axis first

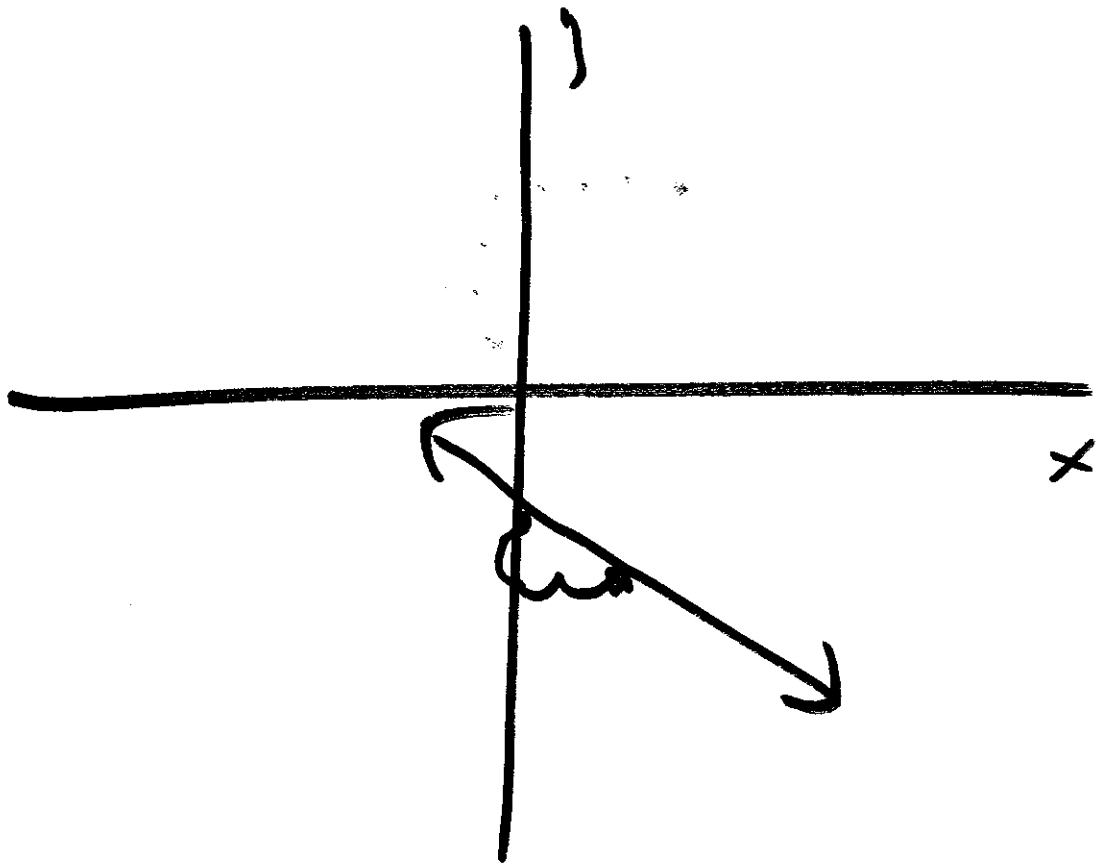
ex:

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

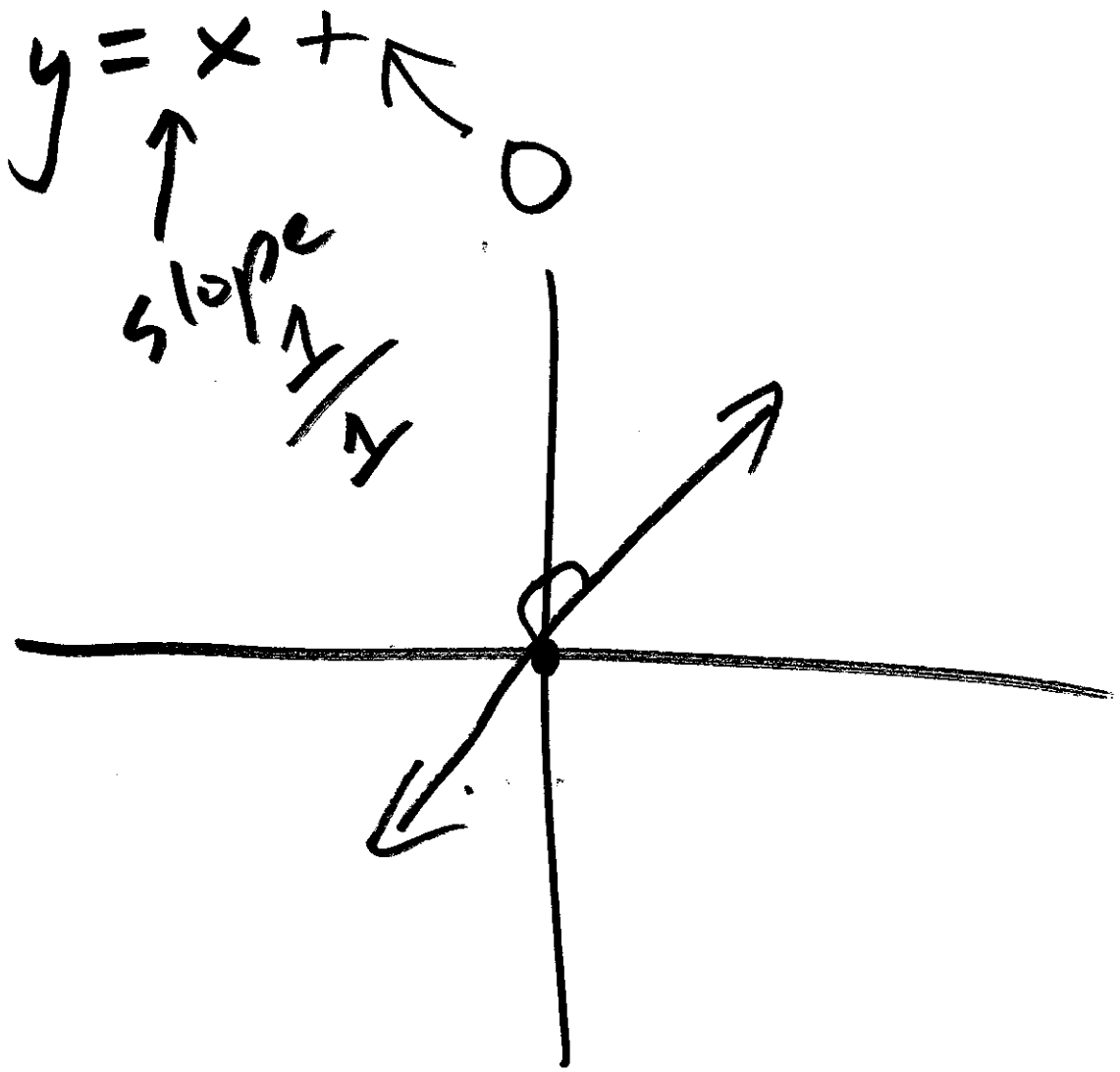


ex:

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

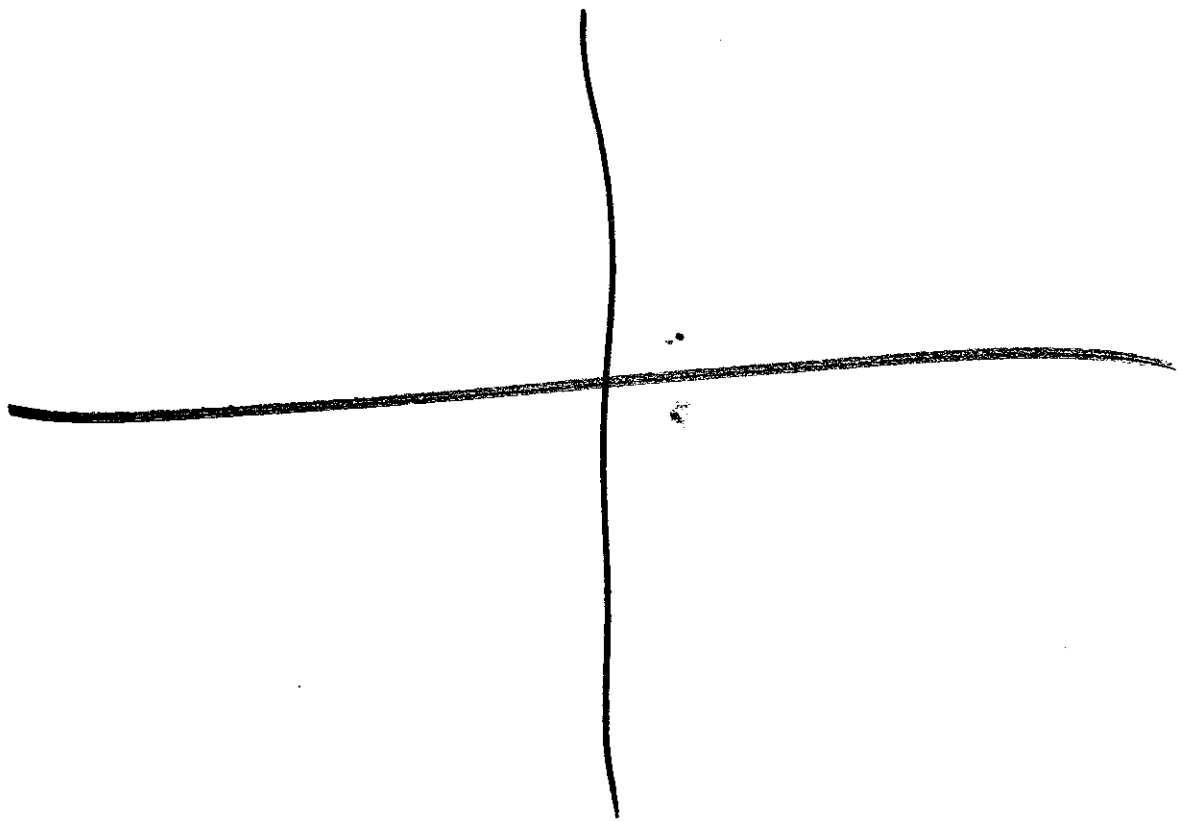


ex:



ex:

$y = x - 2$



Function Notation

Randomly thrown in

- important, but doesn't tie in neatly with other stuff.

What is function notation?

$$f(x) = 3x + 2$$

this is the same as y.
y = a number, but that
depends on what x equals.

y

when you see $f(x)$

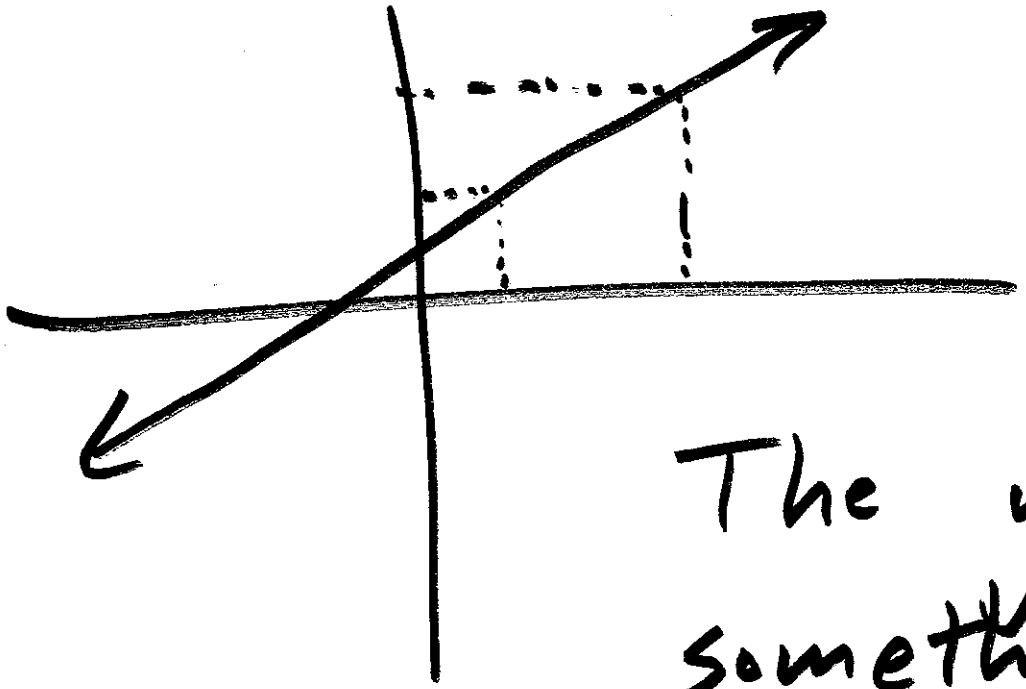
$g(x)$

$h(x)$

$v(t)$

$h(g)$

all of those are silly ways to write y.



The y equals something based on what x equals.

X is considered <u>independent</u>

y depends on x

so y is dependent.

x is independent.

Things that are always x

- time

Things that are always y

- money

$f(2)$

↑

this means:

what does y equal when x is 2?

(math people don't want to write that much)

ex:

$f(x) = 3x + 2$

$f(2) =$

Here, they put a 2 where the x was. We will do that for all x's.

$$f(2)=3(2)+2$$

$$f(2)=6+2=8$$

$$f(x)=3x^2+2x-2$$

$$f(2)=3(2)^2+2(2)-2$$

$$=12+4-2=14$$

Parallel and Perpendicular

Parallel Slope $\parallel$

→ slope is equal

Perpendicular Slope $\perp$

flip fraction

flip sign

ex:

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

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

$$-2$$

ex:

$$-\frac{3}{4}$$

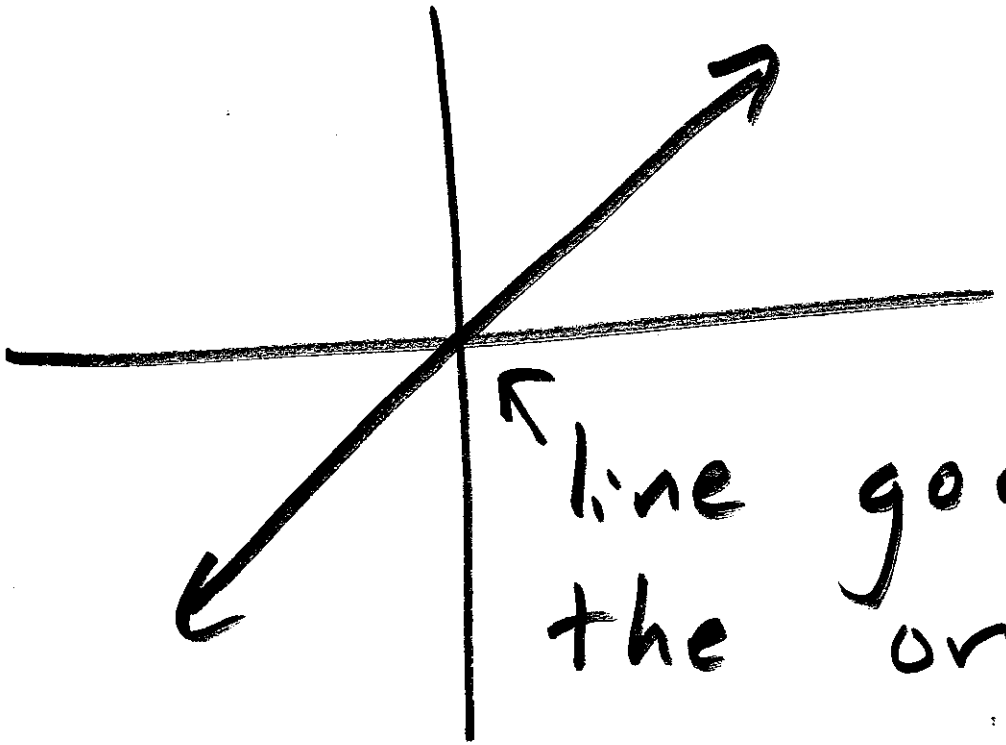
$$+\frac{4}{3}$$

Direct Variation

$y = mx + b$

- with direct variation, the y-intercept = 0
- so $\boxed{y = mx}$ starting amount = 0

Direct Variation



line goes through the origin

Standard Direct Variation Problems.

3 Numbers Version

- starts by saying "varies directly"
- has 3 numbers.

$$\frac{\text{same stuff}\ \text{top}}{\text{same stuff}\ \text{bottom}} = \frac{\text{same stuff}}{\text{top}}\ \frac{\text{top}}{\text{same stuff}\ \text{bottom}}$$

$$\frac{\$}{\text{things}} = \frac{\#}{\text{things}} \leftarrow \text{don't know}$$

$$\frac{\text{things}}{\$} = \frac{\text{things}}{\#}$$

ex: blood and weight

→ 160 lbs has 4.6 quarts

170 lbs has $\underline{x}$

$$(170)\frac{4.6}{160} = \frac{x}{170} \begin{array}{l} \leftarrow \text{quarts} \\ \leftarrow \text{lbs} \end{array}$$

$$x = 4.8875$$

$\underline{4.8875}$

Finding slope with Direct Variation

1. Plug in numbers
2. Solve for slope

$$y = mx$$ ~~$+b$~~

$$y = m x$$

$$\left(3, \frac{1}{2}\right)$$

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

$$m = \frac{1}{6}$$

$$\downarrow$$

$$y = mx$$

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

Linear Equations

Slope-intercept form

- we use this when we have slope and a y-intercept

$$y = mx + b$$

m: slope

b: y-intercept

Point Slope Equation

- We use this when we have a point and slope

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

We have to plug in numbers for x_1, y_1, m.

Two versions

a slope and a point

→ put point and slope into equation

two points

- find slope
- then do that ↑

What Next?

- Point slope is ugly and not super easy
- So we change it to slope intercept form.

Changing from Point Slope to Slope Intercept

1. Distribute m
2. +- to get y alone

ex:

$(3, -4)$ $m = 6$

x_1 y_1

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

$y + 4 = 6(x - 3)$

$y + 4 = 6x - 18$

$-4 \qquad -4$

$$y = 6x - 22$$

ex:

$(-2, -7) \quad m = \frac{4}{5}$

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

$y + 7 = \frac{4}{5}(x + 2)$

$\frac{35}{5}$ → $y + 7 = \frac{4}{5}x + \frac{8}{5}$

$\quad -\frac{35}{5} \qquad\qquad -\frac{35}{5}$

$$y = \frac{4}{5}x - \frac{27}{5}$$

ex:

$(1, 4)$ $(-1, 1)$

find slope

subtract y's / subtract x's

$$\frac{4-1}{1--1} = \frac{3}{2}$$

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

$-\frac{2}{2}$ → y

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

$+\frac{3}{2}$ $\quad$ $+\frac{2}{2}$

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

ex:

$(2,4)$ $(-3,-6)$

$$\frac{4--6}{2--3} = \frac{10}{5} = 2$$

$$y+6 = 2(x+3)$$

$$y+6 = 2x+6$$

$$-6 \qquad -6$$

$$y = 2x$$