Midterm Notes

+ Order of operations

- GEMDAS

① Groupings ② Exponents ③ L → R Mult/Div ④ L → R Add/Sub

Ex: $60 \div 3 \cdot 5 + (10 - 2^2)$

$20 \cdot 5$ $\qquad$ $10 - 4$

$100 \quad + \quad 6$

$\boxed{106}$

+ Properties

$3(a+b) = 3(b+a)$ - Commutative (order changes)

$(x+6)\frac{1}{2} = \frac{1}{2}x + 3$ - Distributive

$5 \cdot (2x) = (5 \cdot 2)x$ - Associative (groups changed)

+ Words $\longleftrightarrow$ Numbers

Ex: Five less than twice a number
x

$$2x - 5$$

Ex: $3(x+7)$

• Three times the sum of a number and seven

+ Evaluating Expressions / Combine Like Terms

$$3(m-n)+3z+5(m+z)$$

$$3m-3n+3z+5m+5z$$

$$8m+8z-6$$

Ex: Let $x=-8$ $y=2$ $z=\frac{1}{2}$

Evaluate

$$4y+z(x-y)$$

$$4(2)+\frac{1}{2}(-8-2)$$

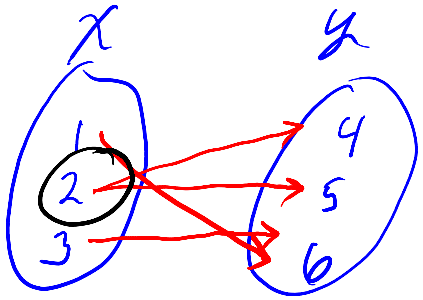
$8 + \frac{1}{2}(-10)$

$8 + (-5)$

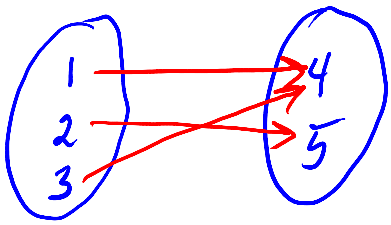
$\boxed{3}$

+ Functions - every input (x) only has one output (y)

Mapping Diagram

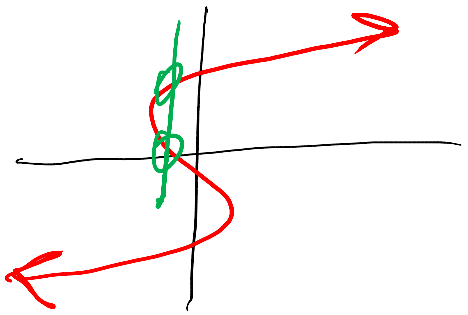


No! each x can only have one arrow

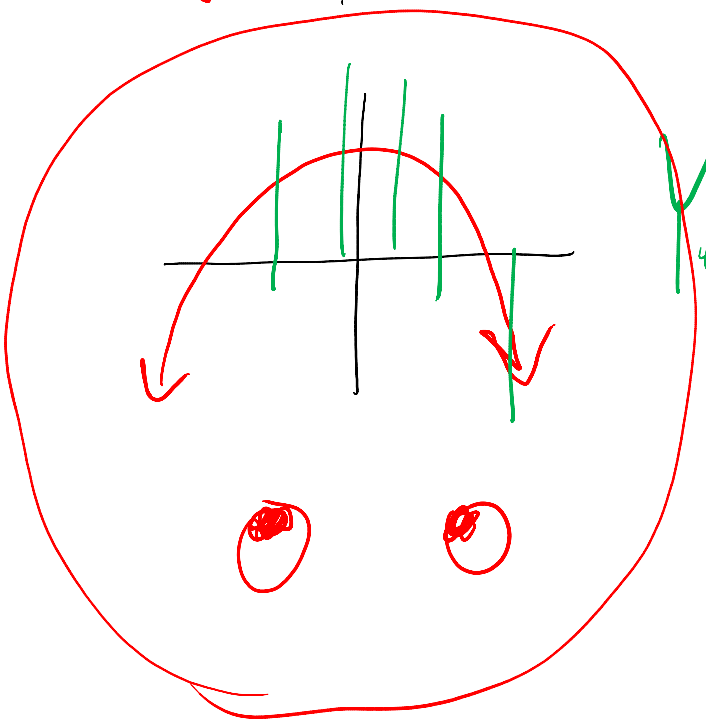


Yes!!

Graph - Needs to pass the Vertical Line Test



No!! Fails VLT



Yes!!

Table

x	y
1	5
-1	7
1	-5
2	3

Nooo...

Set of Pairs

(1, 5), (2, 5), (3, 5)

Yes, different x-values.

+ Function Notation

$f(x) \longleftrightarrow y$

Ex: $f(x) = 7x + 1$

Find $f(3)$, $f(-1)$, and $f(2w)$

$f(3) = 7(3) + 1 = 22$

$f(-1) = 7(-1) + 1 = -6$

$f(2w) = 7(2w) + 1 = 14w + 1$

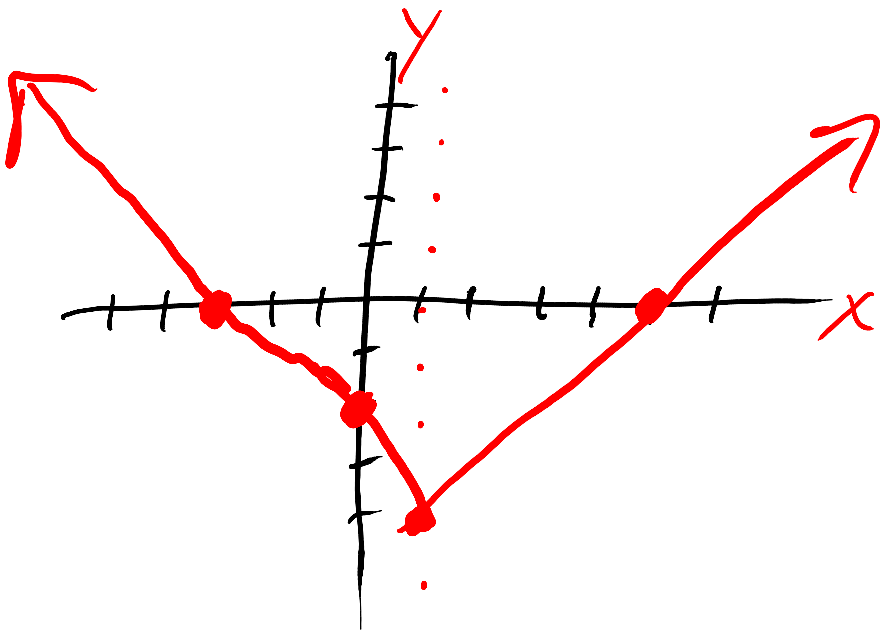
+ Drawing Graphs

- increasing / decreasing / constant intervals

- x and y intercept

Ex: Make a graph with

- y-int: -2
- x-ints: -3 and 5
- $f(1) = -4 \rightarrow (1, -4)$
- Decreasing when $x < 1$



+ Solving Equations

Ex: $\left(\frac{1}{3}x + 2 = \frac{1}{6}x - 1\right) \times 6$

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

$$2x + 12 = x - 6$$

$-x \qquad -x$

$$x + 12 = -6$$

$-12 \qquad -12$

$$\boxed{x = -18}$$

Ex: $\frac{1}{2}(4x - 10) + x = -2(x + 15)$

$$2x - 5 + x = -2x - 30$$

$$3x - 5 = -2x - 30$$

$+2x \quad +5 \qquad +2x \quad +5$

$$\frac{5x}{5} = \frac{-25}{5}$$

$$\boxed{x = -5}$$

+ Absolute Value

- Ex: $|10| = 10$ $\quad |-10| = 10$

- Distance from zero

- Solve:
  1. isolate absolute value bars
  2. split into two equations (one positive, one negative)
  3. Solve both

Ex: $|x-2| = 10$

(A) $x - 2 = 10$ $\quad$ (B) $x - 2 = -10$

+2 +2

$x = 12$

+2 +2

$x = -8$

Ex: $2|x+1| - 4 = 12$

$+4 \quad +4$

$\frac{2|x+1|}{2} = \frac{16}{2}$

$|x+1| = 8$

(A) $x + 1 = 8$

$-1 \quad -1$

$x = 7$

or

(B) $x + 1 = -8$

$-1 \quad -1$

$x = -9$

+ Literal Equations (formulas)

- Solving for a variable by rearranging a formula

Ex - Solve for y: $z \cdot \frac{xy-1}{z} = 2 \cdot z$

$xy - 1 = 2z$

$+1 \qquad +1$

$\frac{xy}{x} = \frac{2z+1}{x}$

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

+ Ratios + Proportions

- cross multiply

Ex: $\frac{2}{3} = \frac{17}{x-38}$

$2(x-38) = 3(17)$

$2x - 76 = 51$

$+76 \quad +76$

$2x = 127$

$x = \frac{127}{2} = 63.5$

+ Percent Change

Ex: original: $70

sale: $45

Find % of decrease.

$$\%\ \text{change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

$$= \frac{45 - 70}{70} \times 100$$

$$= \frac{-25}{70} = \boxed{35.7\%\ \text{decrease}}$$

- Price: \$25

  Tax: 8%

  Discount: 25% off

$$25(1 + .08)(1 - .25)$$

$$25(1.08)(.75) = \boxed{\$20.25}$$

- Dimensional Analysis

Convert $\frac{25 \text{ miles}}{\text{hour}}$ to $\frac{\text{feet}}{\text{sec}}$

$$\frac{25 \text{ miles}}{1 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ miles}}$$

$$\frac{132000 \text{ ft}}{3600 \text{ sec}} = \boxed{36.6 \text{ ft/sec}}$$

+ Inequalities

* when you multiply or divide by a negative, you have to flip the sign *

Ex: Solve AND Graph.

① $-3x + 1 < 10$

$-1 \quad -1$

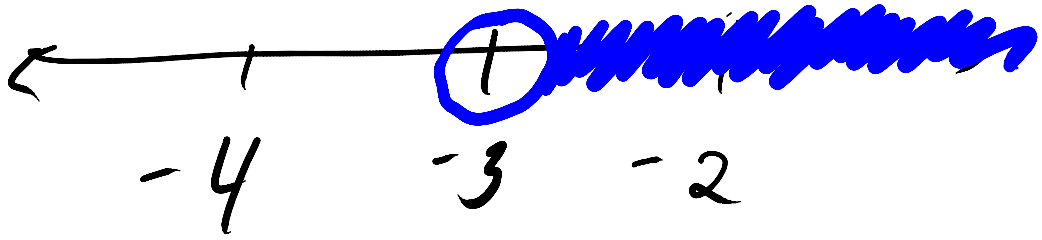
$-3x < 9$

$\div 3 \quad \div -3$

$\geq$ or $\leq$ ●

$>$ or $<$ ○

$x > -3$



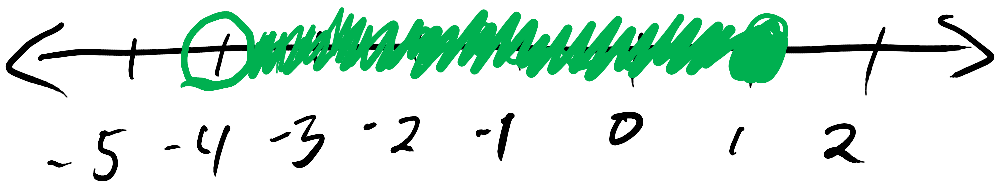
Interval Notation: $(3, \infty)$

② $-7 < 2x + 1 \leq 3$

$-1 \quad -1 \quad -1$

$$\frac{-8}{2} < \frac{2x}{2} \leq \frac{2}{2}$$

$$\boxed{-4 < x \leq 1}$$



Interval Notation: $(-4, 1]$

+ Rate of Change and Slope

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

+ x and y -intercepts

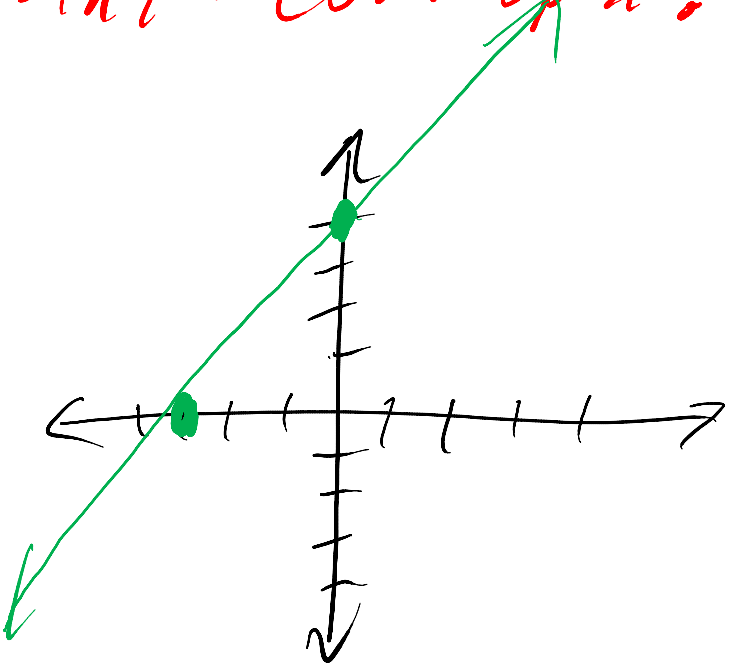
Ex: $3y - 4x = 12$

x-int: cover up y: $-4x = 12$

$x = -3$

y-int: cover up x: $3y = 12$

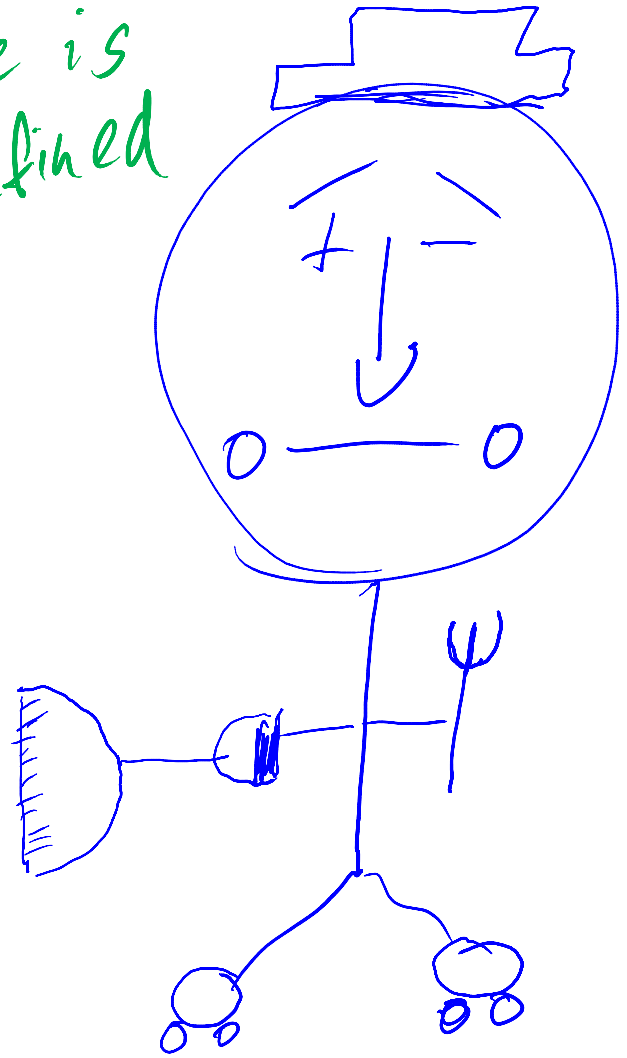
$y = 4$



+ Vertical and Horizontal Lines

slope is undefined

slope = 0



$x =$

VUX

$y =$

HOY

+3 Linear Forms

① Slope-Intercept

$$y = mx + b$$

m: slope

b: y-int

slope

② Standard Form

$$Ax + By = C$$

→ No Fraction

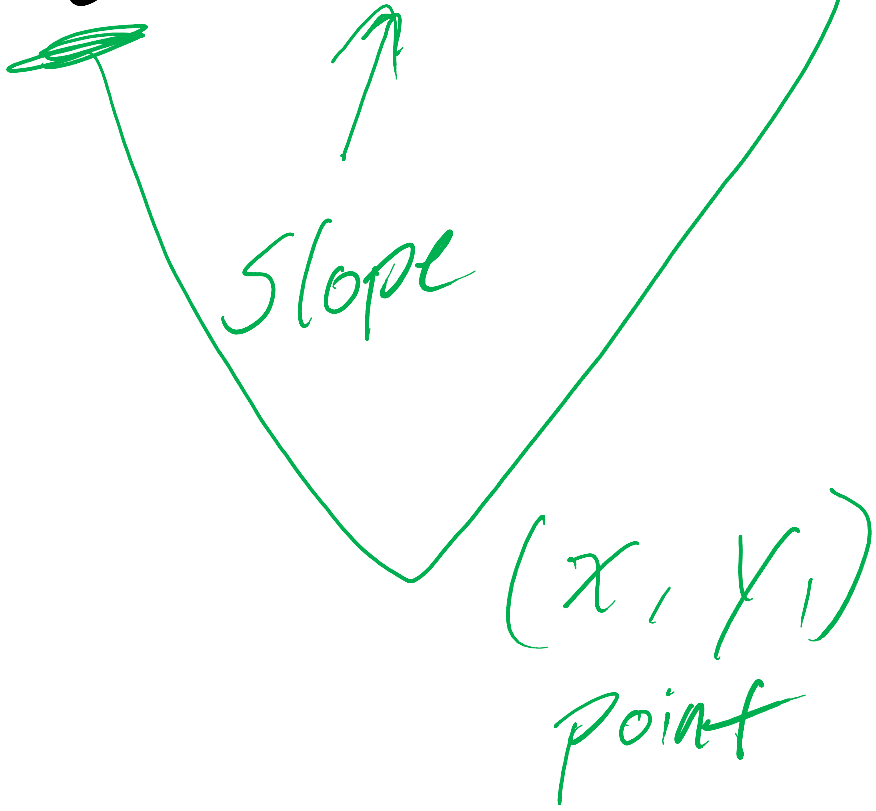
→ A has to be positive

→ x and y on same side

→ No common Factors
(GCF = 1)

③ Point-Slope

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



+ Arithmetic Sequences

$$a_n = a_1 + (n-1)(d)$$

- a_n: n^{th} term
- a_1: first term
- n: term numb (
- d: common difference

Ex: Write a formula for

$7, 20, 33, 46, \ldots$

$+13 \quad +13 \quad +13$

$a_1 \qquad d = 13$

$$a_n = a_1 + (n-1)(d)$$

$$a_n = 7 + (n-1)(13)$$

$$a_n = 7 + 13n - 13$$

$$\boxed{a_n = 13n - 6}$$

Ex: Find the 47^{th} term.

$$a_{47} = 13(47) - 6$$

$$\boxed{a_{47} = 605}$$