1.1 Linear Equations

08/20/2018
Monday

Equation: a statement that two expressions are equal.

Solve:

1.) $-2x + 7 = 10$
$\quad -7 = -7$
$\frac{-2x}{-2} = \frac{3}{-2}$
$x = -\frac{3}{2}$

The answer is called the <u>Solution</u> OR <u>ROOT</u>

2.) $-5(x+3) = 3x + 7x$
$-5x - 15 = 3x + 7x$
$-5x - 15 = 10x$
$+5x - 15 = +5x$
$\frac{-15}{15} = \frac{15x}{15}$
$x = -1$ check

$-5(-1+3) = 3(-1) + 7(-1)$
$-5(2) = -3 + -7$
$-10 = -10$

3.) $5x - 17 - 2x = 6x - 1 - x$
$3x - 17 = 5x - 1$
$-3x \quad = -3x$
$-17 = 2x - 1$
$+1 \quad = \quad +1$
$\frac{-16}{2} = \frac{2x}{2}$
$x = -8$

4.) $-4(3x-5) = 3 - 2(8x+7)$
$-12x + 20 = 3 - 16x - 14$
$-12x + 20 = -11 - 16x$
$+16x \quad\quad +16x$
$4x = -11 - 20$
$\frac{4x}{4} = \frac{-31}{4}$
$x = -\frac{31}{4}$

1.1 More Equations

Rational Equations "Fractional Equatitions"

STEPS:

1) Factor any denominator if necessary
2) Get LCD (note any extraneous values)
3) Multiply <u>ALL</u> terms of the EQ by LCD to clear fractions

1.1 More Equations

Solve:

1) $\frac{1}{3} - \frac{5}{6} = \frac{1}{x}$ $\rightarrow$ $6x\left(\frac{1}{3}\right) - 6x\left(\frac{5}{6}\right) = 6x\left(\frac{1}{x}\right)$

LCD $= 6x$

$$\frac{\cancel{6}^{2}x}{\cancel{3}_{1}} - \frac{\cancel{30}^{5}x}{\cancel{6}_{1}} = \frac{6\cancel{x}}{\cancel{x}}$$

$$2x - 5x = 6$$

$$\frac{-\cancel{3}x}{-\cancel{3}} = \frac{\cancel{6}}{-\cancel{3}}$$

$$\underline{\underline{x = -2}}$$

2) $\frac{6}{5}y + \frac{3}{1} = \frac{6}{10}$ $\rightarrow$ $\cancel{10}\left(\frac{6}{\cancel{5}}y\right) + 10\left(\frac{3}{1}\right) = \cancel{10}\left(\frac{6}{\cancel{10}}\right)$

LCD $= 10$

$$\frac{2 \times 6y}{= 12y} + \frac{30}{1} = 6$$

$$12y + \cancel{30} = 6$$

$$\cancel{-30} = -30$$

$$\frac{\cancel{12}y}{\cancel{12}} = \frac{-24}{\cancel{12}}$$

$$\underline{\underline{y = -2}}$$

H.W - Math Lab 1.1 #1-5

H.W

1) $\frac{4x}{4} = \frac{32}{4}$

$x = 8$

2) $\frac{1}{4}x = \frac{3}{20}$ $\rightarrow 20\left(\frac{1}{4}x\right) = 20\left(\frac{3}{20}\right)$

$\frac{5x}{5} = \frac{3}{5}$

$x = 3/5$

3) $8 + 9n = 7n + 2$

$-7n \quad -7n$

$8 + 2n = +2$

$-8 \qquad = -8$

$\frac{2n}{2} = \frac{-6}{2}$

$n = -3$

4) $4(1+2x) = 7(x-1)$

$4 + 8x = 7x - 7$

$-7x = -7x$

$4 + 1x = -7$

$-4 + 1x = -4$

$x = -11$

5) $2x - (8x + 2) = 8x - 44$

$2x - 8x - 2 = 8x - 44$

$-6x - 2 = 8x - 44$

$+6x \quad -2 = +6x - 44$

$-2 = 14x - 44$

$+44 = 14x + 44$

$\frac{42}{14} = \frac{14x}{14}$

$x = 42/14$ OR 3

Practice finding LCD's & Extraneous Values 08/22/2018 WEDNESDA

Extraneous Values - A # that would cause a denominator to be a zero

<u>Find LCD & EV</u>

Ex:

1) $\frac{1}{4} + \frac{1}{5} = \frac{1}{t}$

LCD = $20t$

EV = $t \neq 0$

2) $\frac{1}{(x+5)} = 8$

LCD = $(x+5)$

EV = $x \neq -5$

3) $\frac{2x}{(x+7)} = \frac{5}{(x+1)}$

LCD = $(x+7)(x+1)$

EV = $x \neq -7,\ x \neq -1$

4) $x + \frac{6}{x} = 5$

LCD = x

EV = $x \neq 0$

<u>SOLVE</u>:

1) $\frac{3}{5} + \frac{7}{x+2} = 2 \rightarrow 5(x+2)\left(\frac{3}{5}\right) + 5\cancel{(x+2)}\left(\frac{7}{\cancel{x+2}}\right) = 5(x+2)\left(\frac{2}{1}\right)$

LCD = $5(x+2)$

EV = $x \neq -2$

$3(x+2) + 35 = 10(x+2)$

$\cancel{3x} + 6 + 35 = 10x + 20$

$-\cancel{3x} \qquad -3x$

$+6 + 35 = 7x + 20$

$41 = 7x + \cancel{20}$

$-20 \qquad -\cancel{20}$

$\frac{\cancel{21}}{\cancel{7}} = \frac{\cancel{7}x}{\cancel{7}}$

$\underline{\underline{x = 3}}$

2) $\frac{5}{2x-3} = \frac{3}{x+5}$ $\rightarrow (\cancel{2x-3})(x+5)\left(\frac{5}{\cancel{2x-3}}\right) = (2x-3)(\cancel{x+5})\left(\frac{3}{\cancel{x+5}}\right)$

LCD $= (2x-3)(x+5)$

EV $= x \neq +3/2,\ x \neq -5$

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

$\cancel{5x} + 25 = 6x - 9$

$\underline{-\cancel{5x}}$ $\quad -5x$

$+25 = 1x - \cancel{9}$

$+9 = x \cancel{+9}$

$\underline{34 = x}$

Difference of TWO SQUARES:

1) $x^2 - 9$
$(x-3)(x+3)$

2) $x^2 - 25$
$(x-5)(x+5)$

3) $49x^2 - 1$
$(7x-1)(7x+1)$

Greatest Common FACTOR: (GCF)

1) $2x^2 + 12$
$2(x^2+6)$

2) $m^2 - 19m$
$m(m-19)$

3) $3q^3 + 27q^2$
$3q^2(q+9)$

TRINOMIALS:

1) $x^2 + 7x + 12$
$(x+3)(x+4)$

1.2 Quadratic Equation & Zeros

to solve a quadratic equation by factoring:

STEPS

1) Set equal to zero
2) Factor
3) Get 2 answers

* The solutions to the QE are also called the zeros of the solution. *

Solve:

1.) $x^2 - 16 = 0$

$(x+4)(x-4) = 0$

$x + \cancel{4} = 0$
$\cancel{-4} = 0 - 4$
$\underline{\underline{x = -4}}$

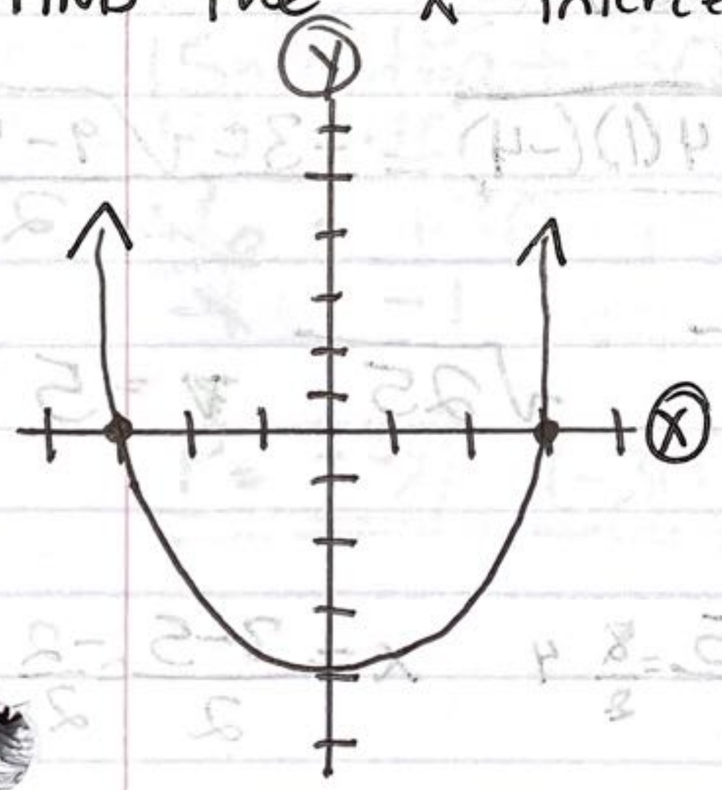
$x - \cancel{4} = 0$
$\cancel{+4} = 0 + 4$
$\underline{\underline{x = +4}}$

2) $2x^2 - x = \cancel{3}$
$-3 \quad -\cancel{3}$
$2x^2 - x - 3 = 0$
$(2x-3)(x+1) = 0$

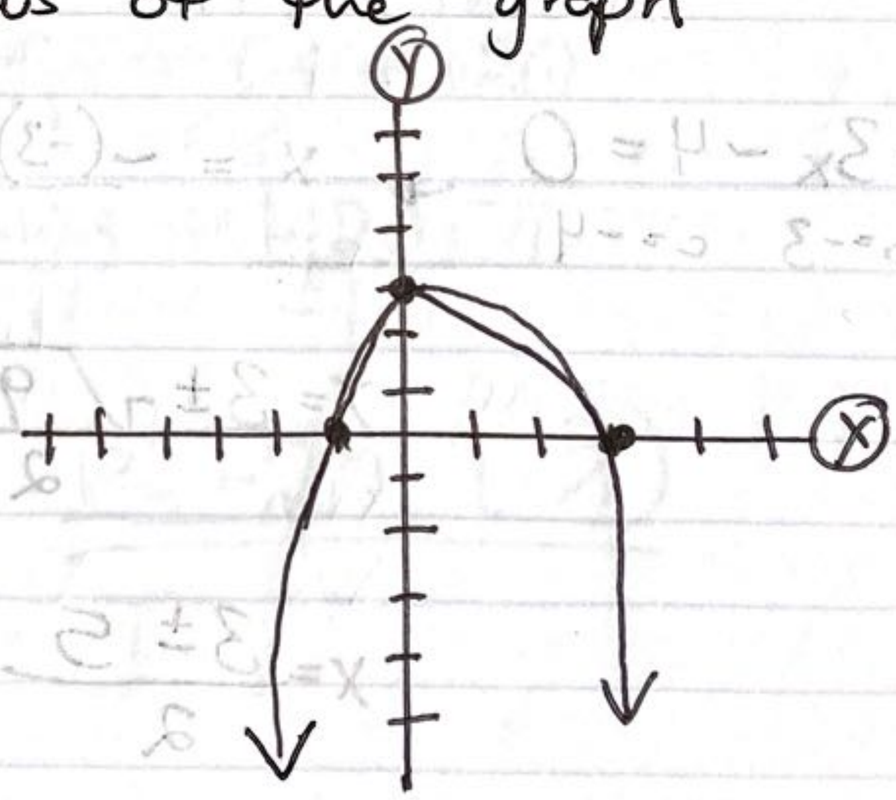
$2x - \cancel{3} = 0$
$\cancel{+3} = +3$
$\frac{\cancel{2}x}{\cancel{2}} = \frac{3}{2}$
$\underline{\underline{x = 3/2}}$

$x + \cancel{1} = 0$
$\cancel{1} = -1$
$\underline{\underline{x = -1}}$

FIND the x-intercepts & zeros of the graph



x-int: (-3,0) (3,0)
zeros: -3 , 3



x-int: (-1,0) (3,0)
zeros: -1 , 3

1.2 Graphing Calculator "Shortcut" for solving a Quadratic Equation by Factoring

Solve

1.) $\boxed{x^2-16}=0$

↳ only this in G.C.

Key Strokes:
Y=
X + On
X ~ -16
Last (Graph)

Solving a Quadratic Equation using the Quadratic Formula:

STEPS

1.) Put Quadratic Equ. in (Standard form) → $ax^2+bx+c=0$
2) ID A, B, C
3) Plug A, B, C into Quad. Form.

Quadratic Formula:

$$x=\frac{-b\pm\sqrt{(b)^2-4(a)(c)}}{2(a)}$$

Solve

1) $x^2-3x-4=0$ → $x=\frac{-(-3)\pm\sqrt{(-3)^2-4(1)(-4)}}{2(1)}=\frac{+3\pm\sqrt{9-4(-4)}}{2}$

a=1 b=-3 c=-4

$x=\frac{3\pm\sqrt{9+16}}{2}$ $\sqrt{25}$ $=5$

$x=\frac{3\pm5}{2}$ $x=\frac{3+5}{2}=\frac{8}{2}$ 4 $x=\frac{3-5}{2}=\frac{-2}{2}$

$\underline{\underline{x=4}}$ $\underline{\underline{x=-1}}$

H.W 1.1

LCD = 4

6) $\frac{5}{4}x + 5 = \frac{1}{4} + \frac{1}{4}x$

$4\left(\frac{5}{\cancel{4}}x\right) + 4\left(\frac{5}{1}\right) = 4\left(\frac{1}{4}\right) + 4\left(\frac{1}{4}x\right)$

$5x + \cancel{20} = 1 + 1x$

$\cancel{-20} = -20$

$5x = -19 + 1x$

$-1x \qquad -1x$

$\frac{+\cancel{4}x}{\cancel{4}} = \frac{-19}{4}$

$x = -19/4$

LCD = 3

$\frac{7}{3}x + 2 = \frac{1}{3} + \frac{1}{3}x$

$3\left(\frac{7}{3}x\right) + 3\left(\frac{2}{1}\right) = 3\left(\frac{1}{3}\right) + 3\left(\frac{1}{3}x\right)$

$7x + \cancel{6} = 1 + x$

$\cancel{-6} = -6$

$7x = -5 + x$

$-x \qquad -x$

$\frac{6x}{6} = \frac{-5}{6}$

$x = -5/6$

LCD: 12

7) $\frac{5}{4}p = \frac{4}{3}p + \frac{5}{2}$

$12^3\left(\frac{5}{4}p\right) = 12^4\left(\frac{4}{3}p\right) + 12^6\left(\frac{5}{2}\right)$

$15p = \cancel{16p} + 30$

$-16p = -\cancel{16p}$

$\frac{-1p}{-1} = \frac{+30}{-1}$

$p = -30/1 \quad (-30)$

LCD = 30

$\frac{1}{6}p = \frac{1}{5}p + \frac{2}{3}$

$30^5\left(\frac{1}{6}p\right) = 30^6\left(\frac{1}{5}p\right) + 30^{10}\left(\frac{2}{3}\right)$

$5p = \cancel{6p} + 20$

$-6p \quad -\cancel{6p}$

$\frac{-1p}{-1} = \frac{+20}{-1}$

$p = -20 \quad (-20/1)$

8) $\frac{x}{x-4} + 7 = \frac{4}{x-4}$ LCD $= (x-4)$

$\cancel{(x-4)}\left(\frac{x}{\cancel{x-4}}\right) + (x-4)\left(\frac{7}{1}\right) = \cancel{(x-4)}\left(\frac{4}{\cancel{x-4}}\right)$

$x + 7x \cancel{-28} = 4$

$8x \cancel{+28} = +28$

$\frac{8x}{8} = \frac{32}{8}$

$\underline{x = 4}$ $\boxed{\text{NO SOLUTION}}$ $x \neq 4$

cont. 8) $\frac{x}{x-3} + \frac{7}{1} = \frac{3}{x-3}$ LCD $(x-3)$

$\cancel{(x-3)}\left(\frac{x}{\cancel{x-3}}\right) + (x-3)\left(\frac{7}{1}\right) = \cancel{(x-3)}\left(\frac{3}{\cancel{x-3}}\right)$

$x + 7x \cancel{-21} = 3$

$8x \cancel{+21} = +21$

$\frac{8x}{8} = \frac{24}{8}$

$\underline{x = 3}$ $\boxed{\text{NO SOLUTION}}$ $x \neq 3$

9) $\frac{6x}{x^2-16} = \frac{24}{x^2-16} - \frac{2}{x+4}$ LCD $= (x^2-16)(x+4)$
$(x-4)(x+4)$

$$\frac{6x}{(x+4)(x-4)} = \frac{24}{(x+4)(x-4)} - \frac{2}{(x+4)(x-4)}$$

$$\cancel{(x+4)(x-4)}\left(\frac{6x}{\cancel{(x+4)(x-4)}}\right) = \cancel{(x+4)(x-4)}\left(\frac{24}{\cancel{(x+4)(x-4)}}\right) - (\cancel{x+4})(x-4)\left(\frac{2}{\cancel{x+4}}\right)$$

$$6x = 24 - (x-4)(2)$$
$$6x = 24 - 2x + 8$$
$$6x = 32 - \cancel{2x}$$
$$+2x = \quad + \cancel{2x}$$
$$\frac{8x}{8} = \frac{32}{8}$$

$\underline{x = 4}$ $\boxed{\text{NO SOLUTION}}$ $x \neq 4$

10) $\frac{7}{4x-3} = \frac{2}{x+1}$ LCD $= (4x-3)(x+1)$

$$\cancel{(4x-3)}(x+1)\left(\frac{7}{\cancel{4x-3}}\right) = (4x-3)\cancel{(x+1)}\left(\frac{2}{\cancel{x+1}}\right)$$

$$\cancel{7x} + 7 = 8x - 6$$
$$\cancel{-7x} \quad -7x$$
$$7 = 1x - \cancel{6}$$
$$+6 = \quad + \cancel{6}$$
$$\underline{13 = x}$$

11) $\frac{3}{x-5} = \frac{-5}{x+5} + \frac{22}{(x-5)(x+5)}$

$\cancel{(x-5)}(x+5)\left(\frac{3}{\cancel{x-5}}\right) = (x-5)\cancel{(x+5)}\left(\frac{-5}{\cancel{x+5}}\right) + \cancel{(x-5)(x+5)}\left(\frac{22}{\cancel{x-5}\,\cancel{x+5}}\right)$

$3(x+5) \quad -5(x-5) \quad + 22$

$3x + 15 = -5x + 25 + 22$

$3x + \cancel{15} = -5x + \cancel{47}$

$\cancel{-15} \qquad \cancel{-15}$

$\cancel{3}x = -\cancel{5}x + 32$

$+5x \qquad +$

$\frac{8x}{8} = \frac{32}{8}$

$\underline{\underline{x = 4}}$

1.3 - Complex Numbers

08/27/2018
MONDAY
(week 2)

$\sqrt{-4}$ = Not Real $\qquad \sqrt{4} = 2$

$(?)(?) = -4$

Imaginary Unit (i) is the number where square is -1.

$i = \sqrt{-1}$ $\qquad$ i = can be an answer

$i^2 = -1$ $\qquad$ i^2 = must always be replaced with $\underline{-1}$

Remember <u>PERFECT SQUARES</u> #'s

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121

SIMPLIFY USING IMAGINARY NUMBERS

① $\sqrt{-4}$ NOT OK
$\sqrt{-1 \cdot 4}$
$2i$ OK

② $\sqrt{-11}$
$\sqrt{-1 \cdot -11}$
$i\sqrt{11}$

③ $\sqrt{-20}$
$\sqrt{-1 \cdot 4 \cdot 5}$
$2i\sqrt{5}$

④ $\sqrt{-6}$
$\sqrt{-1 \cdot 6}$
$i\sqrt{6}$

Complex Numbers
↳ a number written in the form $\underline{a + bi}$

Real part ↙ ↘ Imaginary

Ex:

$3 + 3i$ $\qquad$ $7i$ $\qquad$ 3

$a + bi$ $\qquad$ $0 + 7i$ $\qquad$ $3 + 0i$

$a + bi$ $\qquad$ $a + bi$

MATH LAB will want you to write out the answer ALWAYS

1) $\frac{-8 \pm \sqrt{-128}}{4}$

$\frac{-8 \pm \sqrt{-1 \cdot 64 \cdot 2}}{}$

$\frac{-8 \pm 8i\sqrt{2}}{4}$

$\frac{-8}{4} \pm \frac{8i\sqrt{2}}{4}$

ANS $= -2 \pm 2i\sqrt{2}$

2) $\frac{15 \pm \sqrt{-75}}{5}$

$\frac{15 \pm \sqrt{-1 \cdot 25 \cdot 3}}{5}$

$\frac{15 \pm 5i\sqrt{3}}{5}$

ANS $= 3 \pm i\sqrt{3}$

* Always use *
Biggest Perfect
* Square Multide *

ADDING + SUBTRACTING Complex Numbers

1) $(3-4i) + (-2+6i)$

$1+2i$

2) $(-4+3i) - (6-7i)$

$-10+10i$

Multiply $= i^2 = -1$

* Anytime i^2 must change -1 *

1) $7i(2-5i)$

$14i - 35i^2$

$14i - 35(-1)$

$14i + 35$

Ans $= 35 + 14i$

$a + bi$

2) $(1+2i)(1+3i)$

$1 + 3i + 2i + 6i^2$

F O I L

$1 + 5i + 6(-1)$

$1 + 5i - 6$

Ans $= -5 + 5i$

What is Conjugate of a complex number?

means opposite

Ex: $(-3+7i)$
$(-3-7i)$

What is the <u>conjugate</u> of a complex number?

means opposite

1) $(-3+7i)$ $(-3-7i)$

2) $(2-4i)$ $(2+4i)$

3) $(5+7i)$ $(5-7i)$

X <u>Multiply the Conjugate Pairs</u> → Answer will BE A <u>WHOLE NUMBER</u>

$(5+7i)(5-7i)$

74

% <u>DIVIDE</u> $i=\sqrt{-1}$

* You can never HAVE a $\sqrt{\ }$ in the denominator of a fraction

$$\frac{(2-5i)}{(1-6i)} \cdot \frac{(1+6i)}{(1+6i)} = \frac{32+7i}{37}$$

<u>MATH LAB</u> $= \frac{32}{37} + \frac{7}{37}i$

$= a + bi$

To get Fraction

<u>Graphing Calculator</u> $(2-5i)/(1-6i) = .864864$ PRESS (MATH) Select <u>1: FRAC</u>

<u>1.3</u>

Will EQUAL A RADICAL

A = 1 B = -14 C = 74

$x^2 - 14x + 74 = 0$

$$\frac{-(-14) \pm \sqrt{(-14)^2 - 4(1)(74)}}{2(1)} = +14 \pm \sqrt{196 - 4(74)}$$

$196 - 296 = -100$

$$x = \frac{+14 \pm \sqrt{-100}}{2} = \frac{+14 \pm \sqrt{-1 \cdot 100}}{2} = \frac{14 \pm 10i}{2} = \underline{7 \pm 5i}$$

ANSWER

1.4 RADICAL EQUATIONS $\sqrt{\ }$

STEPS

1) Isolate the Radical on one side of the equal sign.

2) Square both sides.

3) Must Check.

* Why must you check?

to cancel out $\sqrt{\ }$ you times ^{2}

Solve: $\left(\sqrt{4x+1}\right)^2 = (3)^2$

Linear Equation

$4x + 1 = 9$

$-1 \quad = -1$

$\frac{4x}{4} = \frac{+8}{4}$

$x = 2$

Check:

$\sqrt{4(2)+1} = 3$

$\sqrt{8+1} = 3$

$\sqrt{9} = 3$

✓

Glitch

$x = 2$

$(x)^2 = (2)^2$

$x^2 = 4$

NO SOLUTION

Solution Set

$\{2\}$

$\{2, -2\}$

not Lunchtime

Ex

STEPS $\sqrt{}$
- Isolate
- SQUARE
- Check

(Isolate)

① $\sqrt{y-1} + 4 = 0$

$\sqrt{y-1} \cancel{+4} = 0$
$\cancel{-4} \quad -4$

$(\sqrt{y-1})^2 = (-4)$ ← (SQUARE)

$y - \cancel{1} = \cancel{+}16$
$\cancel{+1} = \cancel{+1}$

$\underline{y = 17}$ ← (Now Verify)

Check

$\sqrt{17-1} + 4 = 0$
$\sqrt{16} + 4 = 0$
$4 + 4 = 0$

$\boxed{\text{NO SOLUTION}}$

$-$ $+$
larger smaller

$(x-8)(x-3)$

Both numbers

$(x^2 + 8x - 20)$
$(x \quad -2)$
$(x + 10)$
-8 without

* Remember to always *
* Keep x^2 positive *

② $\sqrt{3-2x} = x$

$(\sqrt{3-2x})^2 = (x)^2$ } Square

$3 - 2x = x^2$ } Isolate

$0 = x^2 + 2x - 3$ ⟵ 1) Set it $= 0$
2) Factor / G.C / Quad Form
3) Get 2 answers

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

• Factor or Quadratic Form.

$x - 1 = 0$ $\quad$ $x + 3 = 0$
$+1 = +1$ $\quad$ $-3 = -3$
$\underline{x = +1}$ $\quad$ $\underline{x = -3}$

Check

$\sqrt{3-2(1)} = 1$
$\sqrt{3-3}$
$\sqrt{1} = 1$
$\underline{1 = 1}$
✓

$\sqrt{3-2(-3)} = -3$
$\sqrt{3+6}$
$\underline{\sqrt{9} = -3}$

$\boxed{\text{NO SOLUTION}}$

• USE as one variable thats valid

Rembea

Quadratic Formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

3) $\dfrac{-(2) \pm \sqrt{(2)^2 - 4(1)(-3)}}{2(1)}$

$-2 = \sqrt{4 + 12}$

$\dfrac{-2 \pm \sqrt{16}}{2}$

$\dfrac{-\cancel{2} \pm 4}{\cancel{2}} = \dfrac{-\cancel{2}}{\cancel{2}} \pm \dfrac{-4}{2}$

$\underline{\underline{1}}, \underline{\underline{-3}}$

KEY

Quadratic Form = $\dfrac{-b \sqrt{a^2 - 4ac}}{2a}$

Quadratic Equation = Factor

Radical Equation = $\sqrt{}$

Example:

$x = 2\sqrt{2x - 4}$

$(x)^2 = (2\sqrt{2x-4})^2$

$x^2 = 4(+2x - 4)$

$x^2 = 8x - 16$

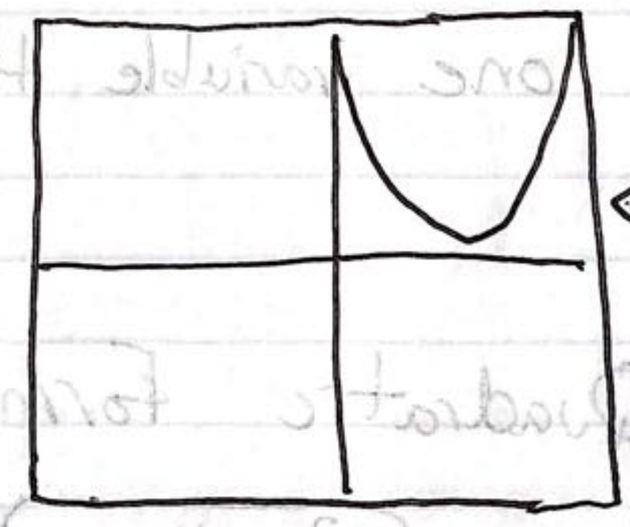
$x^2 - 8x + 16 = 0$

$(x-4)(x-4) = 0$

$\boxed{x = 4}$

Radical Equation
- Isolate
- SQ
- Check

Q.F
- Set = 0
- Factor / G.C / Q.F
- Get 2



← one answer.

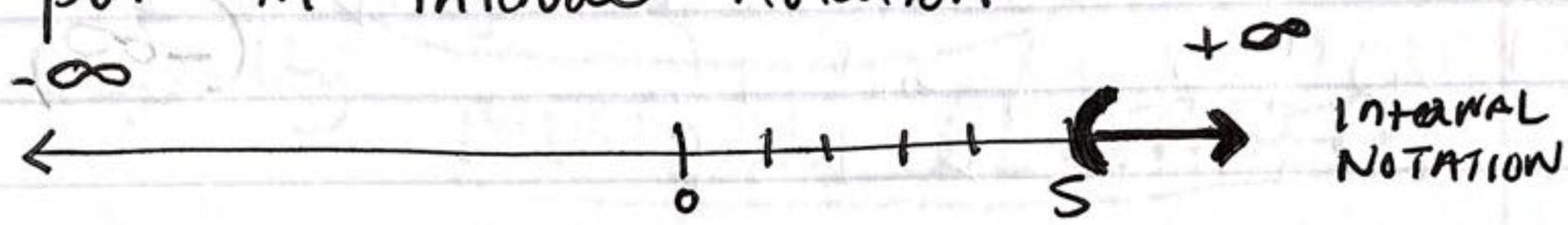
1.5 Linear Inequalities

) < less than > Greater than (

] ≤ less than or Equal to ≥ Greater than or Equal [

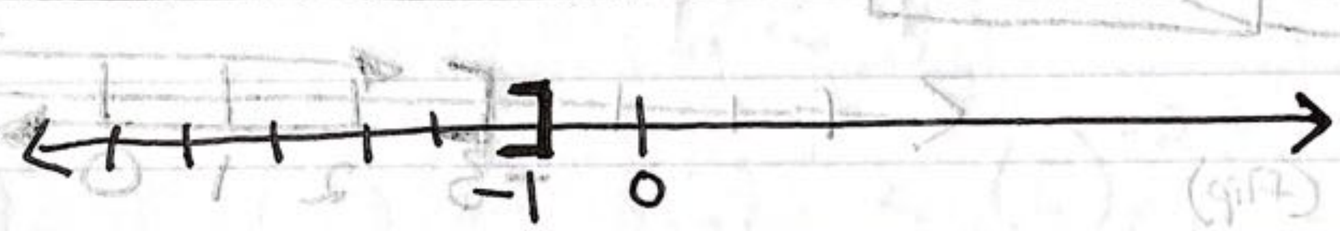
Graph → then put in interval notation

$X > 5$



Read Left to Right $(5, \infty)$

$X \leq -1$



$(-\infty, -1]$

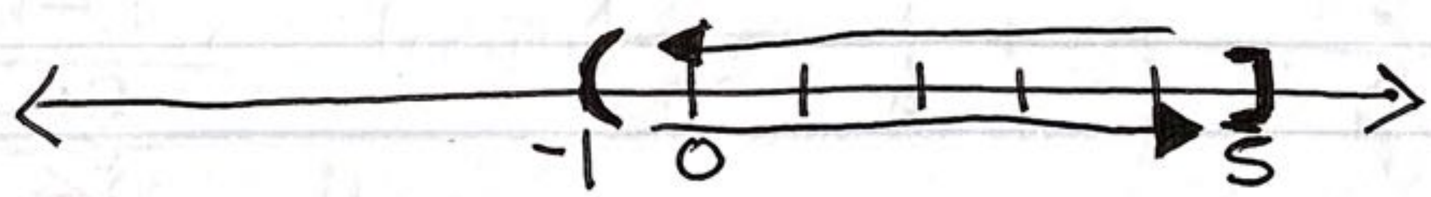
$2 < 11$
$37 \geq 37$

* The interval notation answer is where they overlap.

Compound Inequality

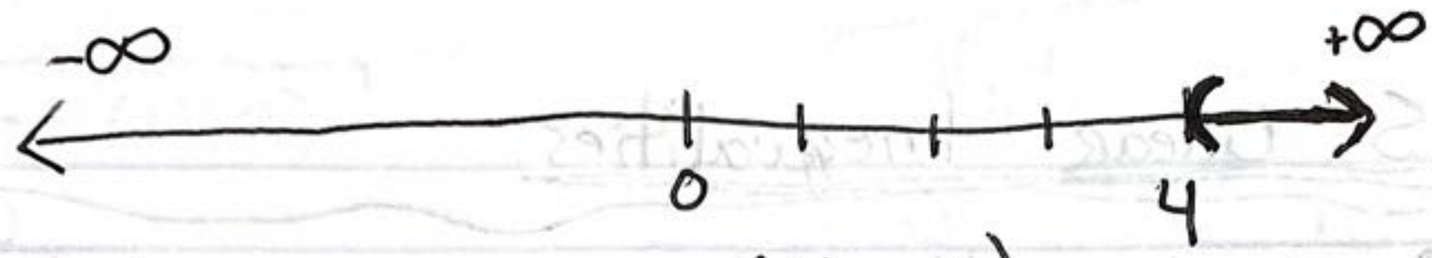
$-1 < x \leq 5$

$-1 < x$ (Flip)
$x > -1$



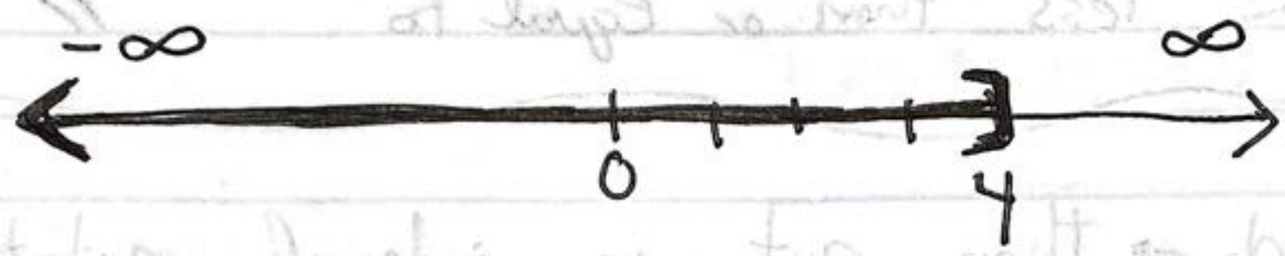
$(-1, 5]$

$x > 4$



$(4, \infty)$

$x \leq 4$

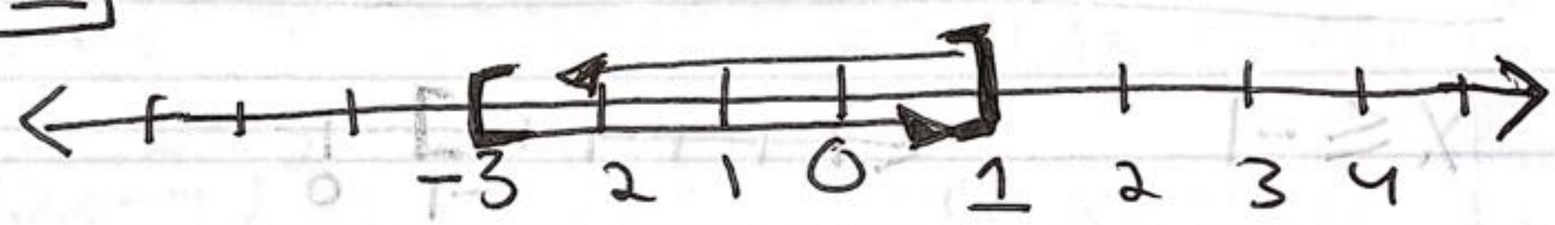


$(-\infty, 4]$

$-3 \leq \boxed{x} \leq 1$

$-3 \leq x$ (Flip)

$x \geq -3$



$[-3, 1]$

Solving LINEAR INEQUATIONS

Linear Inequalities are SOLVED just like Linear Equations with an exception.

Exception:

If we multiply or divide both side of an inequality by a negative number the direction of the inequality **MUST BE REVERSED**.

Why?

1.) $6 < 8$

$(6)^2 < (8)^2$

$12 < 16$ TRUE

$6 < 8$

$(6)^{-2} < (8)^{-2}$

$-12 > -16$ REVERSED

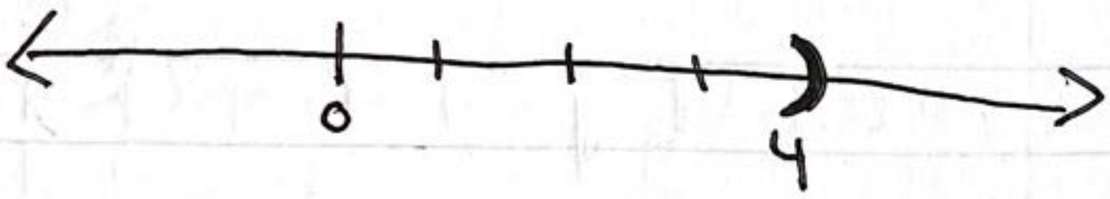
(FALSE $-12 < -16$)

SOLVE – Graph on number line – Put interval Notation

Divide negative

$$-3x + 5 > -7$$
$$-5 \quad -5$$
$$\frac{-3x}{-3} > \frac{-12}{-3}$$

$$x < +4$$

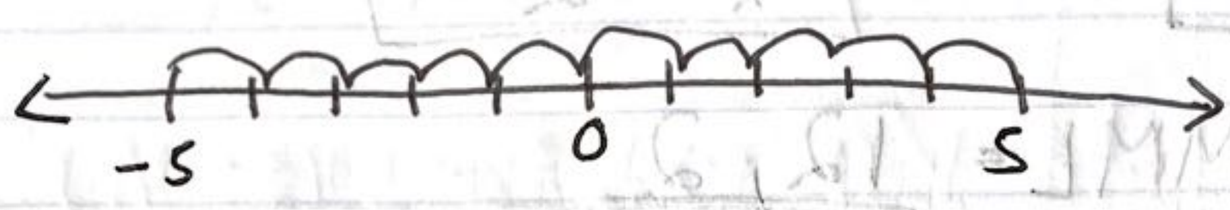


$(-\infty, 4)$

1.6 Solving Equations and Inequalities with Absolute Value

Always positive → The absolute value of a number is the distance from 0 on the number Line

$|5| = 5$
$|-5| = 5$



Absolute Value Equation		
$\lvert x\rvert = a$	$x = a$ OR	$x = -a$
Absolute Value Less THAN $<$ $\leq$		
$\lvert x\rvert < a$	$x < a$	$x > -a$
Absolute Value GREATER THAN $>$ $\geq$		
$\lvert x\rvert > a$	$x > a$	$x < -a$

Absolute Value Equations

Solve

$|x| = 5$

exactly same → $\boxed{x = 5}$

Exactly same → $\boxed{x = -5}$

WILL always be two answers on Abs. Value EQ

$|x-7| = 5$

$x-7=5$ $\qquad$ $x-7=-5$

$+7=+7$ $\qquad$ $+7=+7$

$\boxed{x=12}$ $\qquad$ $\boxed{x=2}$

MML = 12, 2

MATH LAB

Isolate 1st!

Solve

$|x-3| \cancel{-1} = 4$

$\cancel{+1} = +1$

$|x-3 = 5$

$x-3=5$ $\qquad$ $x-3=-5$

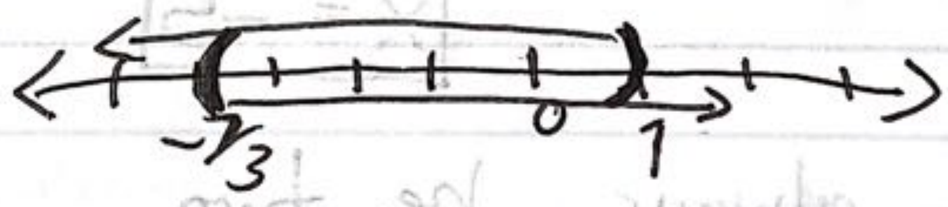
$+3=+3$ $\qquad$ $+3=+3$

$\boxed{x=8}$ $\qquad$ $\boxed{x=-2}$

ABSOLUTE v. INEQUALITIES

Solve & Graph the solution set

$|3x+2| < 5$



$3x+\cancel{2}<5$ $\qquad$ $3x+\cancel{2}>-5$

$\cancel{-2}\ -2$ $\qquad$ $\cancel{-2}\ -2$

$\frac{3x}{3} < \frac{3}{3}$ $\qquad$ $\frac{3x}{3} = \frac{-7}{3}$

$x=1$ $\qquad$ $x=-\frac{7}{3}$

$\boxed{x<1}$ $\qquad$ $\boxed{x>-7/3}$

$(-7/3, 1)$

GREATER THAN $\geq$ → $\cup$

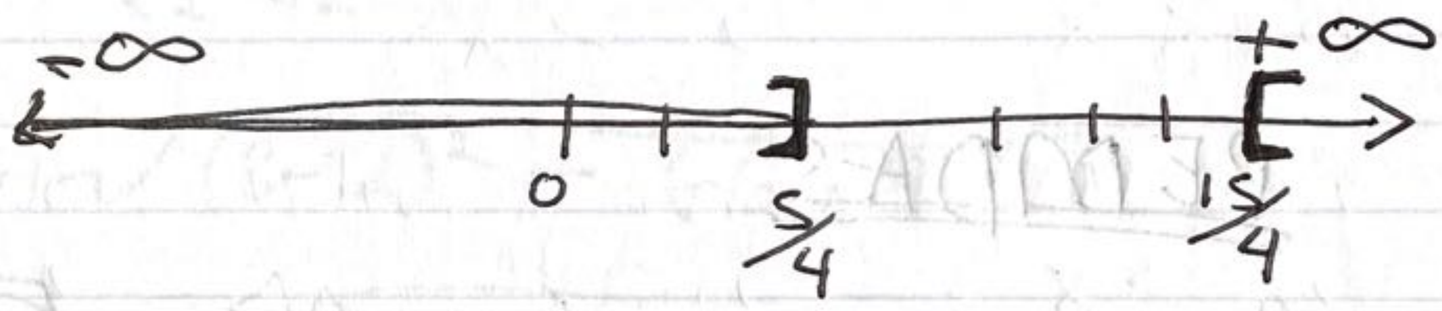
$|4x-10| \geq 5$

$4x-10 \geq 5$
$+10 \quad +10$
$\frac{4x}{4} \geq \frac{15}{4}$
$\boxed{x \geq \frac{15}{4}}$

$4x-10 \leq -5$
$+10 \quad +10$
$\frac{4x}{4} \leq \frac{5}{4}$
$\boxed{x \leq 5/4}$

Set Builder Notation $\{x / x \leq 5/4 \text{ OR } x \geq \frac{15}{4}\}$

GRAPH

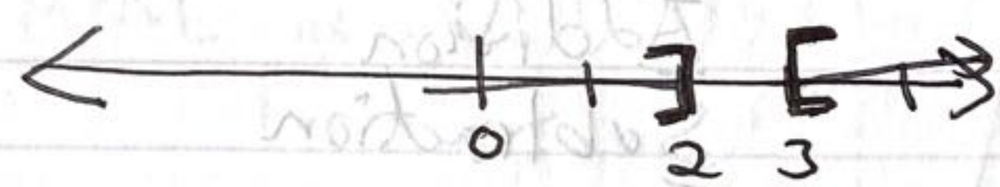


Internal Notation $(-\infty, 5/4] \cup [\frac{15}{4}, \infty)$

$|5-2x| \geq 1$

$+5-2x \geq 1$
$-5 \quad -5$
$\frac{-2x}{-2} \geq \frac{-4}{-2}$
Flip $x \leq 2$
$\boxed{x \leq 2}$

$5-2x \leq -1$
$+5 \quad +5$
$\frac{-2x}{-2} \leq \frac{-6}{-2}$
$x \geq 3$
$\boxed{x \geq 3}$



$(-\infty, 2] \cup [3, \infty)$

TEST #1

MEMORIZE

Q.F → $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Distance Formula
D.F $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula
M.F $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

PEMDAS

Parenthesis
Exponents
Multiplication
Division
Addition
Subtraction

$DF = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$M^{\text{polynomial}} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

2.1 Distance Formula

09/05/2018 WED

Given $P(x_1, y_1)$ (1st point) and $R(x_2\ y_2)$ (2nd point) are 2 points, the distance between P & R is given by:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Always Label First

Find the distance between each pair of points.

a) $(-2, 2)$ and $(3, -6)$ PEMDAS

1st: x_1 y_1 2nd: x_2 y_2

$$d = \sqrt{(3 - -2)^2 + (-6 - 2)^2}$$

$$d = \sqrt{(5)^2 + (-8)^2}$$

$$d = \sqrt{25 + 64}$$

$$d = \sqrt{89}$$ ← MML as Simplified

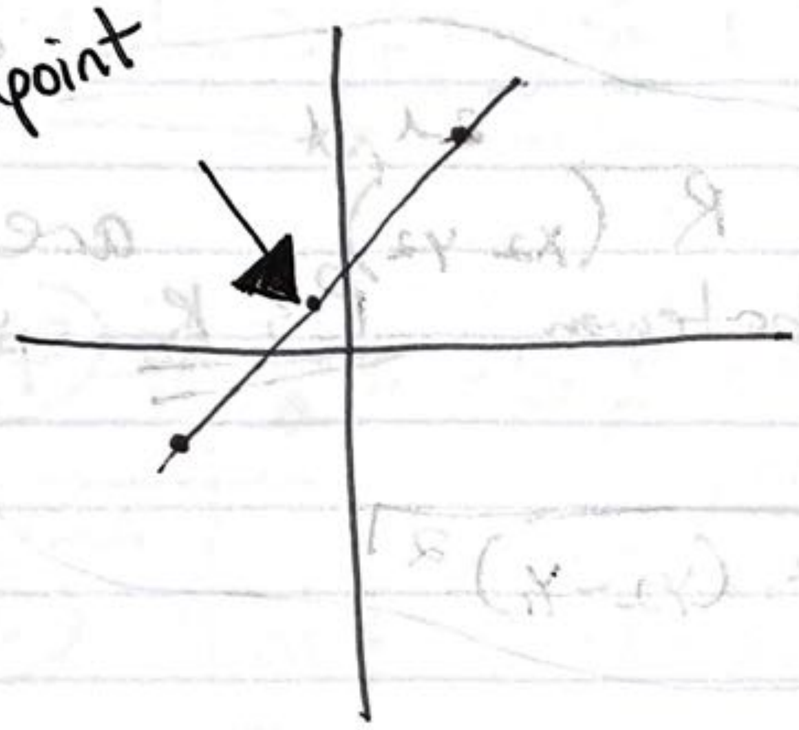
$$d \approx 9.434$$

Mid Point Formula:

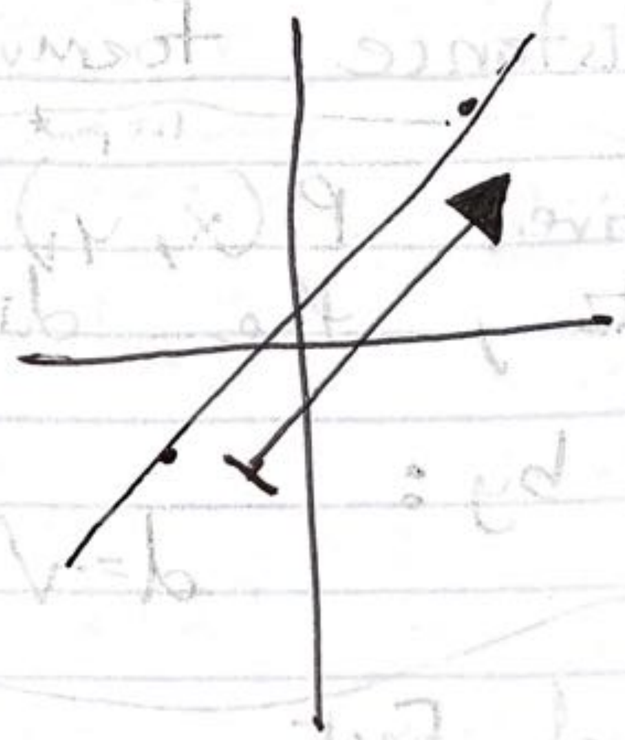
~ The midpoint of a line segment with endpoint $(x_1\ y_1)$ & $(x_2\ y_2)$ has coordinates

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Midpoint



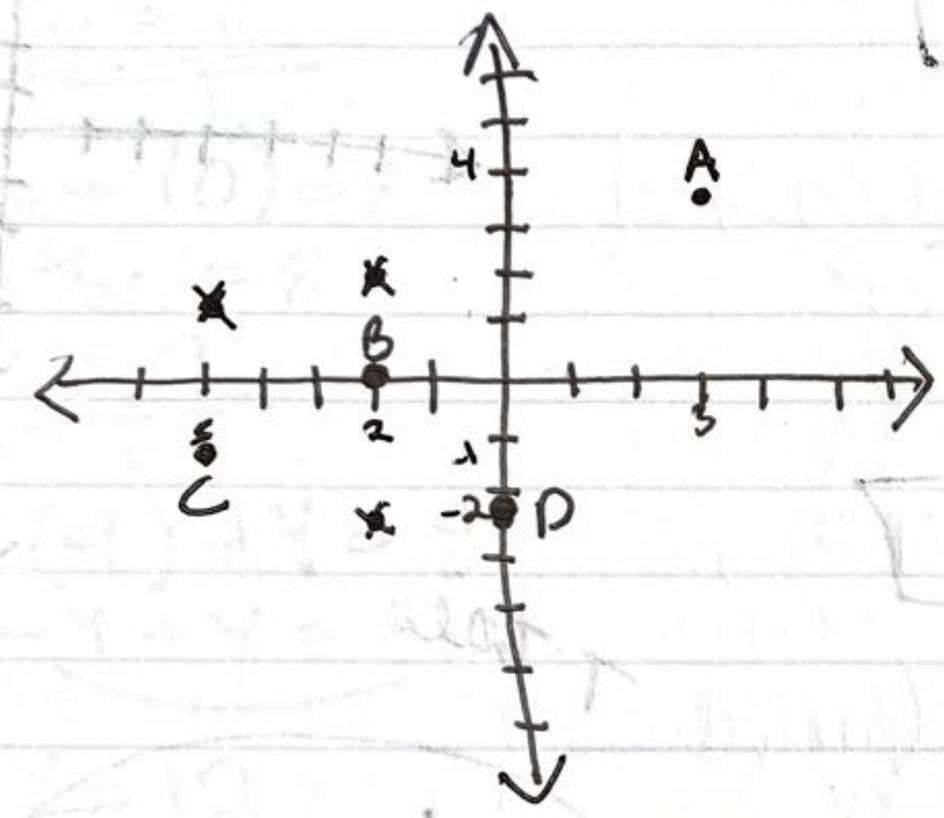
Distance



2.1 & 2.2 Intro to Graphing

09/10/2018
MONDAY

Rectangular Coordinate System



Plot the ordered pairs
(x, y)

(x (Left to right)) (y (up or down))

A (3, 4)
B (-2, 0)
C (-5, -1)
D (0, -2)

ORIGIN (0, 0)

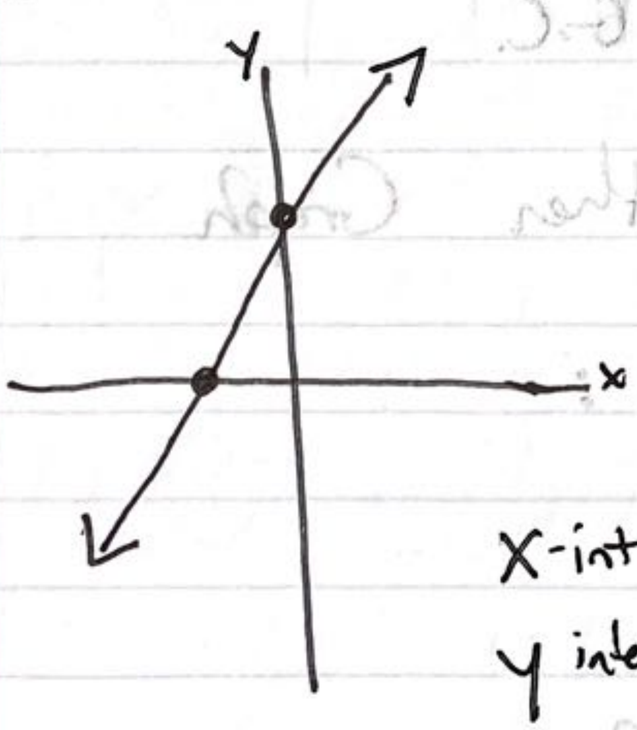
ORDER Pair MEANS (#, #)

MML = x-int: -1
y-inter: 4

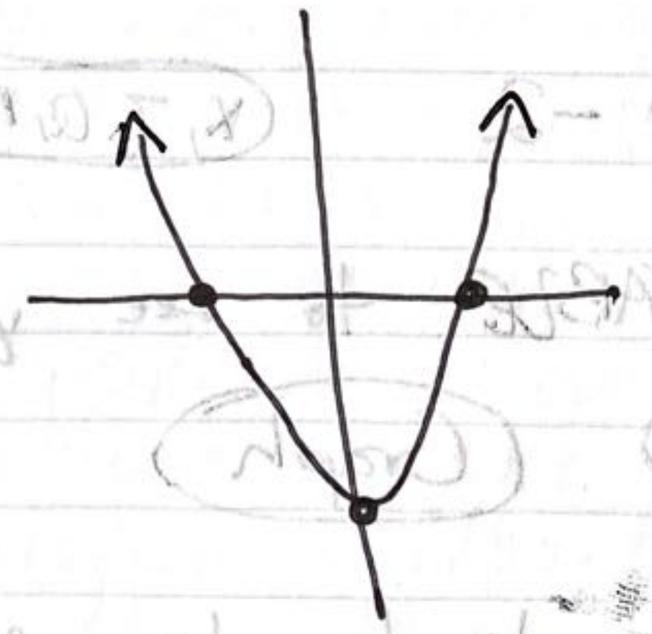
QUADRANTS

Intercepts - The points, if any, at which a graph crosses or touches the coordinate axes.

Find the x and y-intercepts of the graph.



x-int (-1, 0)
y inter (0, 4)



x-inter (-2, 0)
(2, 0)
y-inter (0, -4)

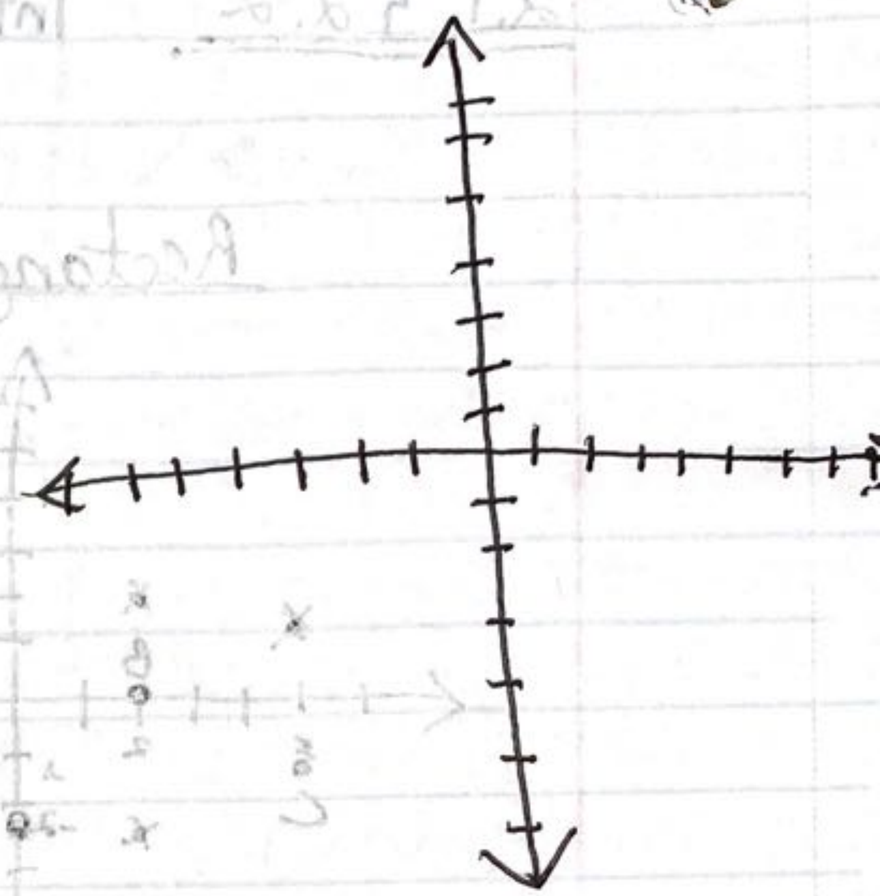
2.2 Graphing Equations

Graph $y = -2x + 5$

X	Y
1	7
0	5
-3	11

SUB

$\boxed{y = -2(1) + 5}$
$y = 2 + 5$
$y = 7$



$\boxed{Y = -2(0) + 5}$
$y = 0 + 5$
$y = 5$

T. Table

x	Y	Sub

$\boxed{Y = -2(-3) + 5}$
$y = 6 + 5$
$y = 11$

Graphing Calculator

- To graph $y = -2 + 5$ on G.C.

  Y= -2 X, T, Q, N + 5 then Graph

- Go to TABLE to see your t-table:

  2nd Graph

- To get back to main Screen

  2nd MODE

Find the x and y intercepts

1.) $4x + y = 8$

$4(0) + y = 8$

$y = 8$

$4x + (0) = 8$

$4x = 8$

$x = 2$

$4(-1) + y = 8$

$-4 + y = 8 + 4$

$y = 12$

T-Table

X	Y	
0	8	y-intercept
2	0	x intercept
-1	2	

To find x-intercept let $y = 0$

To find the y-intercept let $x = 0$

Test Review

Find Real Solution

17) $x^4 - 25x^2 + 144 = 0$

$(x^2-16)(x^2-9)$

$(x+4)(x-4)(x+3)(x-3) = 0$

$\boxed{x=-4}$ $\boxed{x=4}$ $\boxed{x=-3}$ $\boxed{x=+3}$

x^4 — means four answer.

x^3 — 3 answers

18) $7x^3 = 2x^2$

INEQUALITY

21) $\frac{x}{14} \geq 1 - \frac{x}{28}$

Find LCD

$28\left(\frac{x}{14}\right) \geq 28(1) - 28\left(\frac{x}{28}\right)$

$\frac{28x}{14} \geq \frac{28}{1} - \frac{28x}{28}$

VARIABLE CONSTANT VARIABLE

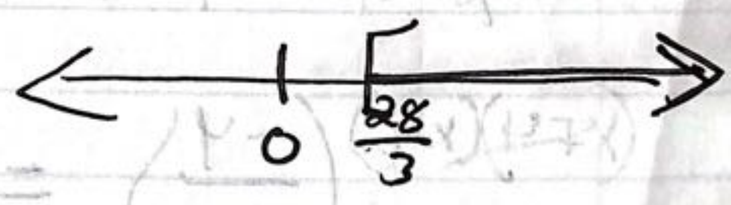
$2x \geq 28 - x$

ONLY when negative

-x before (≥) then flip to make positive

$\frac{3x}{3} \geq \frac{28}{3}$

$x \geq \frac{28}{3}$



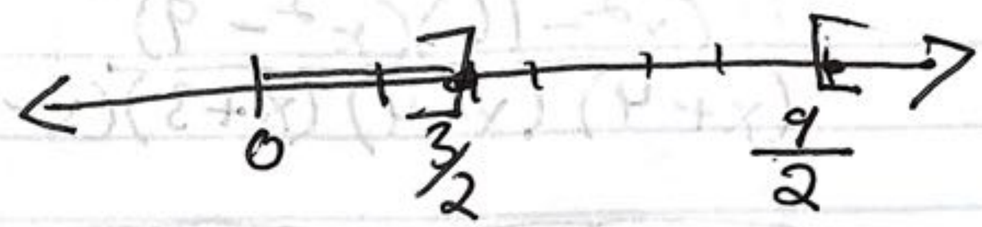
$\left[\frac{28}{3}, \infty\right)$

(29) $|2x-6| \geq 3$

switch & negate

$2x - 6 \geq 3$
$+6 \quad +6$
$\frac{2x}{2} = \frac{9}{2}$
$x \geq \frac{9}{2}$

$2x - 6 \leq -3$
$+6 \quad +6$
$\frac{2x}{2} = \frac{+3}{2}$
$x \leq 3/2$



$(-\infty, 3/2] \cup [9/2, \infty)$

Union

Greater than = $\cup$

Less than is compound $[\#, \#]$

Absolute value is the ~~real~~ result has to be positive

$|5| = 5 \quad (\times 1)$

$|-5| = 5 \quad (\times -1)$

No solution

9.) $\frac{-4}{x+4} = \frac{-3}{x+6}$

LCD: $(x+4)(x+6)$
EV. $x \neq -4$
$x \neq -6$

$\cancel{(x+4)}(x+6)\left(\frac{-4}{\cancel{x+4}}\right) = (x+4)\cancel{(x+6)}\left(\frac{-3}{\cancel{x+6}}\right)$

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

$\cancel{-4x} - 24 = \cancel{-3x} - 12$
$+\cancel{4x} \quad +\cancel{4x}$

$-24 = x - 12$
$+12 \quad +\cancel{12}$
$-12 = x$

Variable always positive

What if $-x = -4$

Then No solution

$\frac{3}{0}$ → no solution
impossible

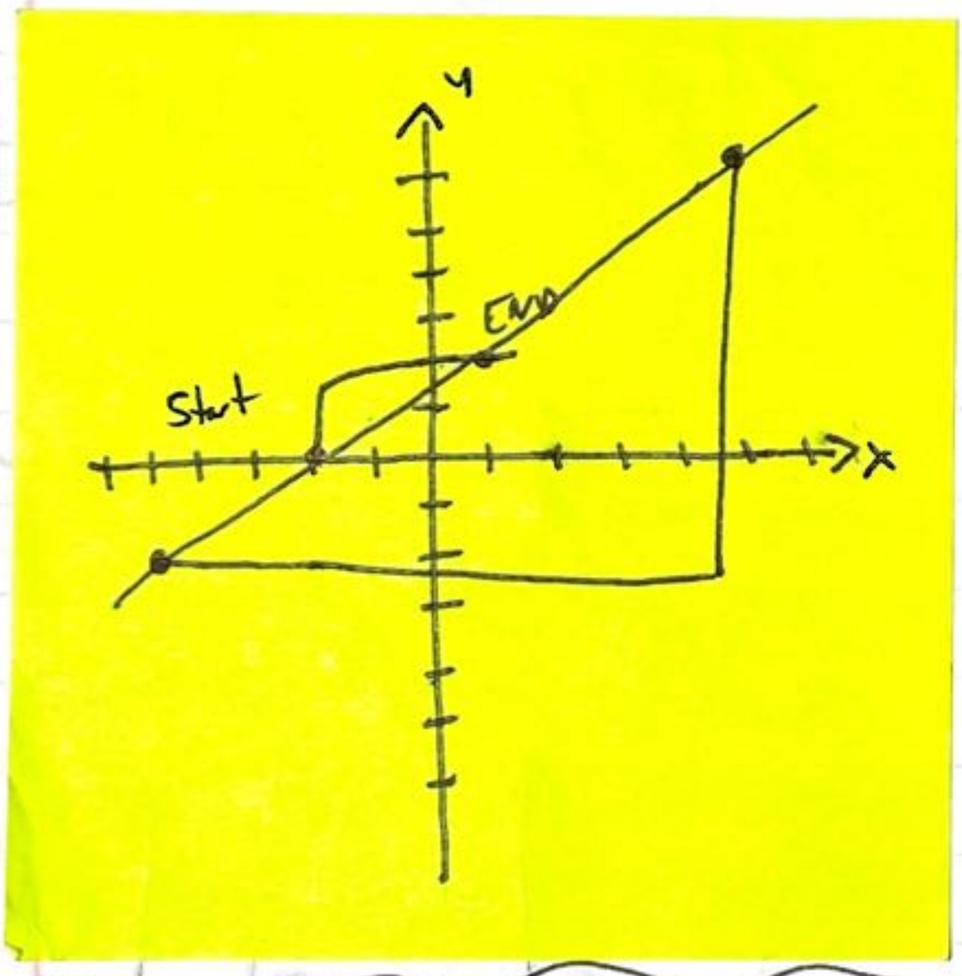
MONDAY
09/17/2018

2.5 Lines

Slope - a number used to describe the slant or steepness of a line.

$$m = \text{slope} = \frac{\text{Change in } Y}{\text{change in } x} = \frac{\text{RISE}}{\text{RUN}} \quad \frac{\text{(up / down)}}{\text{(left / Right)}}$$

* Slope is the same everywhere on a line.



$m = \frac{\text{up } 2}{\text{Rt } 3}$ $\quad m = 2/3$

$m = \frac{\text{down } 8}{\text{left } 12} \simeq \frac{-8}{-12} = \frac{2}{3}$

$\frac{\text{top - up/down}}{\text{bottom left / Right}} \quad \frac{y}{x}$

- The slope m of the line containing points (x_1, y_1) and (x_2, y_2) is given by

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

Find the slopes of the line containing these points.

1.) $(-1, 5)$ and $(2, -3)$

2) $(-1, -2)$ and $(2, 4)$

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

1.) $\overset{P_1}{(\underset{x_1}{-1}, \underset{y_1}{5})}$ and $\overset{P_2}{(\underset{x_2}{2}, \underset{y_2}{-3})}$ | $m = \frac{-3-5}{2 \underset{+}{- -} 1} = \frac{-8}{3}$

2) $(\underset{x_1}{-1}, \underset{y_1}{-2})$ and $(\underset{x_2}{2}, \underset{y_2}{4})$ | $m = \frac{4 - -2}{2 - -1} = \frac{6}{3} = 2$

HORIZONTAL LINE

$y = b$

$m = 0$

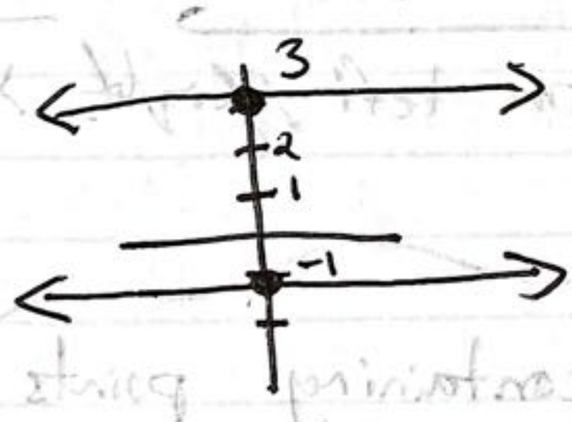
VERTICAL LINE

$x = a$

$m =$ undefined

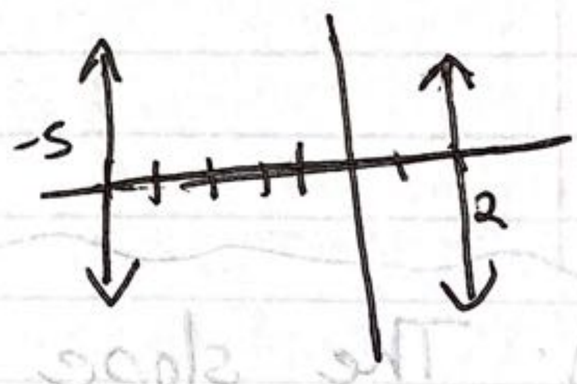
Graph:

1) $y = 3$



Graph:

2) $x = -5$



3) $y = -1$

4) $x = 2$

Example

1.) $(\underset{x_2}{0}, \underset{y_1}{2})$ $(\underset{x_2}{5}, \underset{y_2}{2})$

$m = \frac{2-2}{5-0} = \frac{0}{5}$

$\boxed{m = 0}$

2) $(-4, 0)$ and $(-4, 3)$

$m = \frac{3-0}{-4 - -4} = \frac{3}{0}$

$\boxed{m = \text{undefined}}$

* find an equation (linear Graph)

• SLOPE - INTERCEPT FORM of A LINE

$$y = \boxed{m}x + \boxed{b}$$

m = slope
b = y-intercept

<u>Identify m and b</u>

1.) $y = 2x - 4$
$m = 2$
$b = -4$ or $(0, -4)$
When it wants order pair

2) $y = -\frac{1}{2}x + 0$
$m = -1/2$
$b = 0$ or $(0, 0)$

$\boxed{\text{Negative goes anywhere} = -\frac{1}{2} \text{ or } \frac{-1}{2} \text{ or } \frac{1}{-2}}$

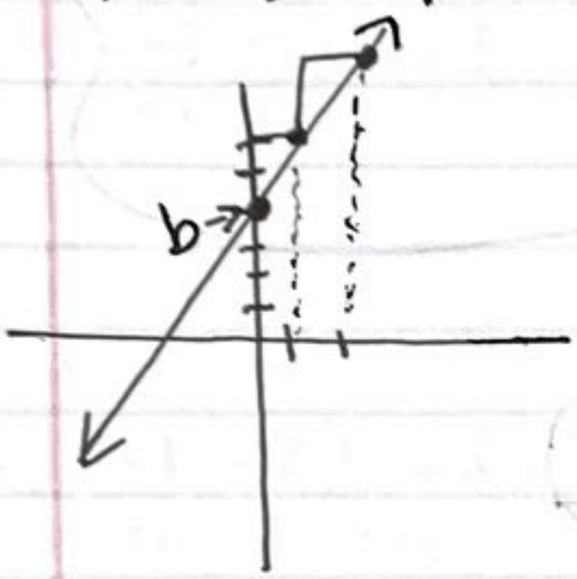
Write the following in $y = mx + b$ form

1.) $5x + 3y = 2$
$-5x \qquad = -5x$
$\frac{3y}{3} = \frac{-5}{3} + \frac{2}{3}$
$y = -\frac{5}{3}x + \frac{2}{3}$

Graphing an equation Long-hand using $y = mx + b$

$m = \frac{2}{1}$

$y = 2x + 4$ $\quad b = 4 \; (0,4)$

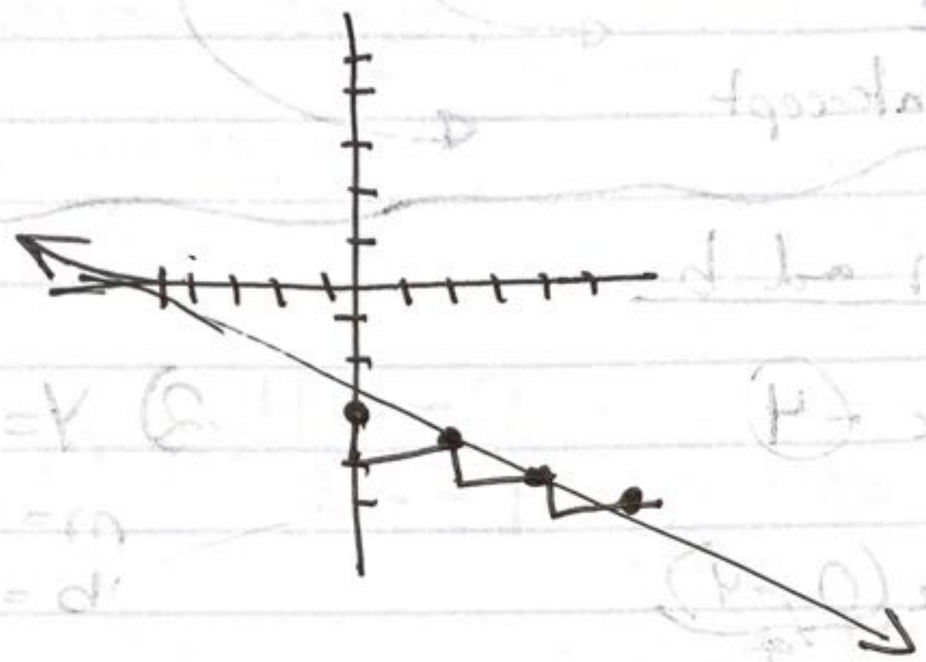


$m = -\frac{1}{2}$ $\quad \frac{\text{down } 1}{\text{right } 2}$

$y = -\frac{1}{2}x - 3$ $\quad b = -3 \quad (0,-3)$

1st: Plot b

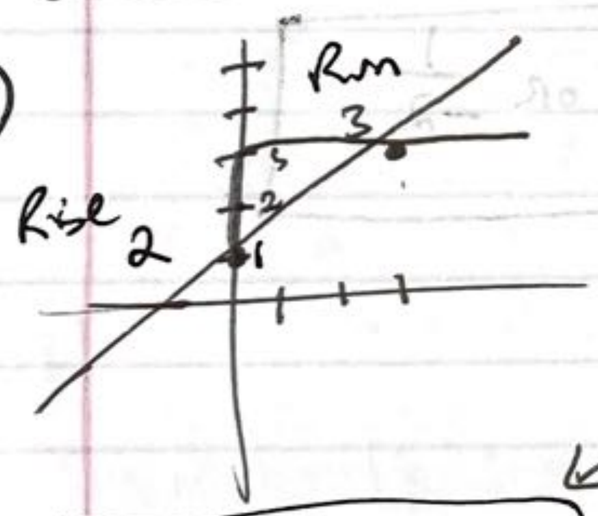
2nd: From b count $\frac{\text{RISE}}{\text{RUN}}$



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

$\boxed{y = mx + b}$ $\quad b = 1 \quad (0,1)$

1)



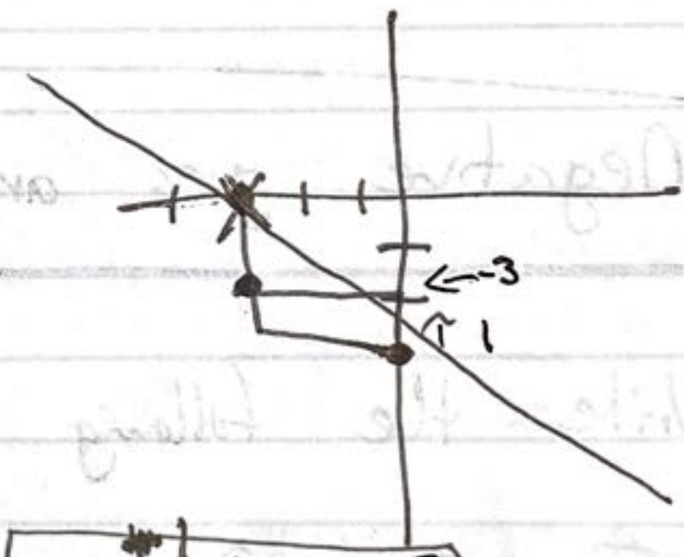
$m = \frac{2}{3}$

$b = 1$ or $(0,1)$

Put into equations

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

2)



$A = \frac{1}{-4}$

$b \; (0,-3)$

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

$\boxed{\text{LINEAR EQUATION}}$

$\boxed{\text{GENERAL FORM}}$

$Ax + By = C$

$\boxed{\text{SLOPE - INTERCEPT FORM}}$

$y = mx + b$

Slope

$y = mx + b$

Ay + By = C

Point Slope Form of an Equation of a Line

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

$\boxed{\text{WRITE the equation}}$ of a line given: $m = -2$, $P(-1, 5)$

May or May not specify which form

$y - 5 = -2(x - -1)$

$y - 5 = -2(x + 1)$

$y - 5 = -2x - 2$

$y = -2x - 2 + 5$

$y = -2x + 3$

$2x + y = 3$

Slope intercept

$\boxed{\text{Goal} = y = mx + b}$

$\boxed{\text{Standard form}: Ax + By = C}$

Write the equation of a line given:

$m = -\frac{2}{3}$ and $P(-4, 5)$

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

LCD = 3

$3(y) - (5)3 = -(\frac{2}{3}x)3 + (-\frac{8}{3})$

$3y - 15 = -2x + -8$ $+15$

$\frac{3y}{3} = \frac{-2x}{3} + \frac{7}{3}$

Slope

$y = -\frac{2}{3}x + \frac{7}{3}$

Standard

$\boxed{2x + 3y = 7}$

Parallel lines = lines with the same slope

Perpendicular lines – lines meet at a 90° angle,
– lines have slopes that are negative reciprocals

Parallel	Perpendicular	Neither
$y = 3x+1$	$y = \frac{2}{3}x+6$	$y = -2x+8$
$y = 3x-5$	$y = -\frac{2}{2}x$	$y = 2x+9$

What is a negative Reciprocal?

1.) $\frac{6}{1} = -\frac{1}{6}$

Negate (Become positive

2) $-\frac{1}{5} = 5$

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

$y = mx+b$

Find the equation of the line perpendicular to $y = -\frac{1}{4}x+5$ and contains the pt $(0,3)$

$y = -\frac{1}{4}x + 5$

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

$y - 3 = 4(x - 0)$

$y - 3 = 4x - 0$

$\boxed{y = 4x + 3}$

2.4 Circles

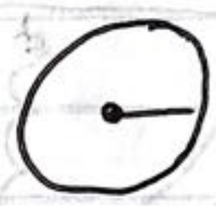
09./19/2018

STANDARD FORM of the equation of a Circle.

A circle with center (h, k) and radius R has equation

MEMORIZE

$$(x-h)^2 + (y-k)^2 = R^2$$



* Find an equation of the circle having radius 5 and center $(3, -7)$

(h, k)

•) $(x-3)^2 + (y--7)^2 = 5^2$

$(x-3)^2 + (y+7)^2 = 25$ ANSWER

Radius = 6 $\quad (h, k) = (-3, 4)$

$(x--3)^2 + (y-4)^2 = 6^2$

$(x+3)^2 + (y-4)^2 = 36$

Radius = 3 $\quad (h, k) = (0, 0)$

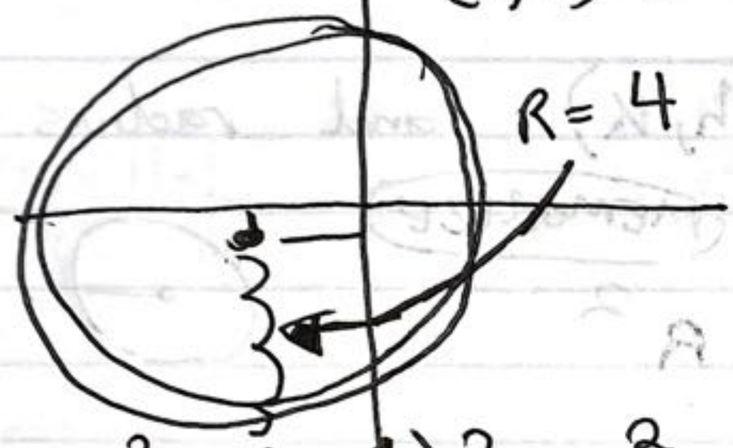
$(x-0)^2 + (y-0)^2 = 3^2$

$(x-0)^2 + (y-0)^2 = 9$

$\boxed{x^2 + y^2 = 9}$

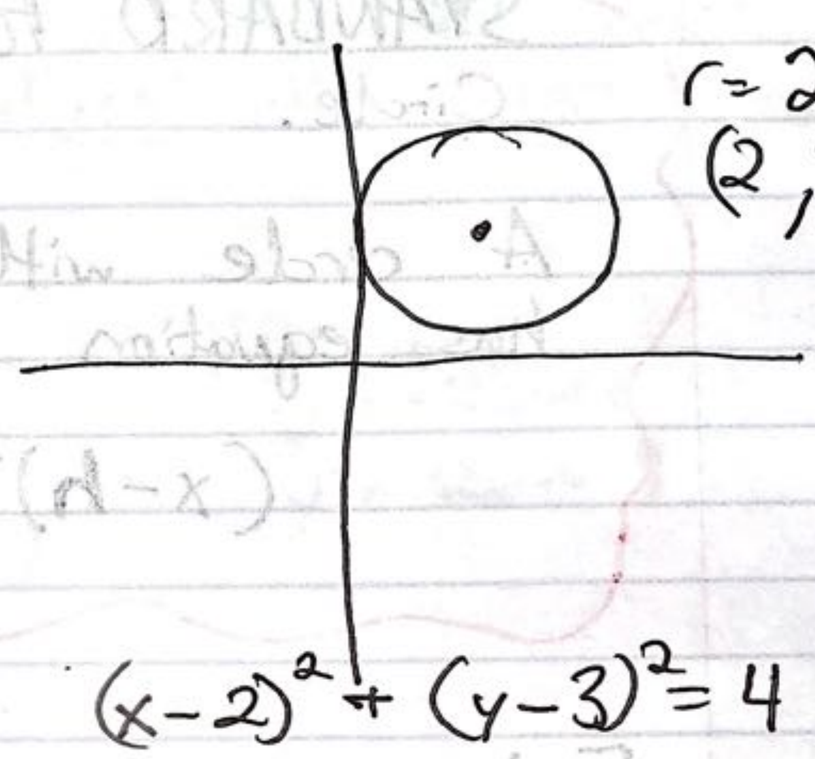
Determine the equation of the circle in standard form.

center
$(h,k) = (-2,-1)$



$(x - -2)^2 + (y - -1)^2 = 4^2$

$(x+2)^2 + (y+1)^2 = 16$



$r = 2$
$(2,3)$

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

Graph

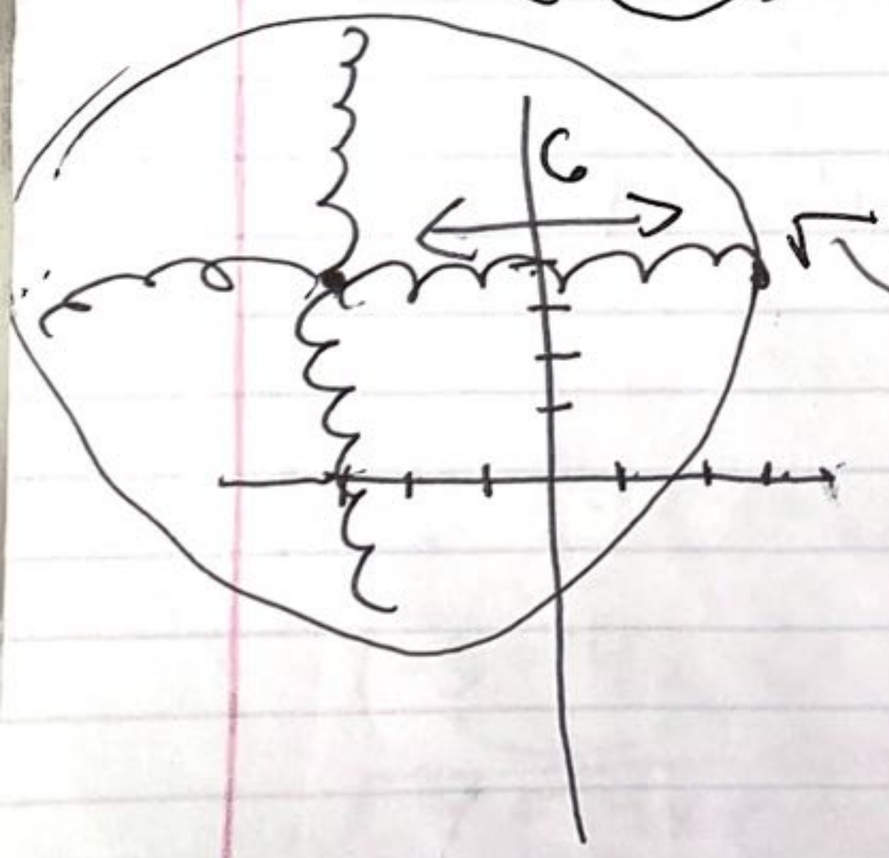
$(x+3)^2 + (y-4)^2 = 36$

Convert

$(x - -3)^2 + (y-4)^2 = 6^2$

Always show as formula

$(x-h)^2 + (y-k)^2 = r^2$



$(h,k) = (-3,4)$
$r = 6$ units

Find center & radius for the following equations

1) $(x-2)^2 + (y-1)^2 = 16 \rightarrow 4^2$ $(2,1)$ $R=4$

2) $x^2 + (y-5)^2 = 1$ $(0,5)$ $R=1$

$(x-0)^2 + (y-5)^2 = 1^2$

3) $(x+3)^2 + (y-1)^2 = 121$ $(-3,+1)$ $R=11$

$(x--3)^2 + (y-1)^2 = 11^2$

4) $x^2 + y^2 = 9$ $(0,0)$ $R=3$

$(x-0)^2 + (y-0)^2 = 3^2$

5) $(x+4)^2 + (y+3)^2 = 36$ $(-4,-3)$ $R=6$

$(x--4)^2 + (y--3)^2 = 6^2$

6) $(x+7)^2 + (y+2)^2 = 49$ $(-7,-2)$ $R=7$

$(x--7)^2 + (y--2)^2 = 7^2$

GENERAL FORM OF THE EQUATION OF A CIRCLE

$$x^2 + y^2 + ax + by + c = 0$$

Write the standard form and the general form of the equation of the circle with the given.

$r = 4$ $\quad (h, k) = (2, -3)$

$$(x-2)^2 + (y - -3)^2 = 4^2$$ → Standard form

$$(x-2)^2 + (y+3)^2 = 16$$

FOIL

$$(x-2)(x-2) + (y+3)(y+3) = 16$$

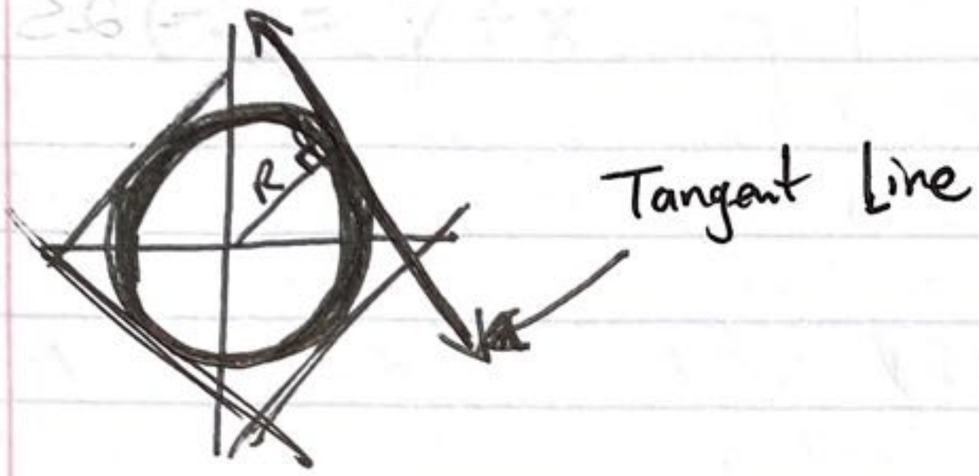
$$x^2 - 2x - 2x + 4 + y^2 + 3y + 3y + 9 = 16$$

$$x^2 + y^2 - 4x + 6y + 13 = \cancel{16}$$
$$-16 = -\cancel{16}$$

$$x^2 + y^2 - 4x + 6y - 3 = 0$$

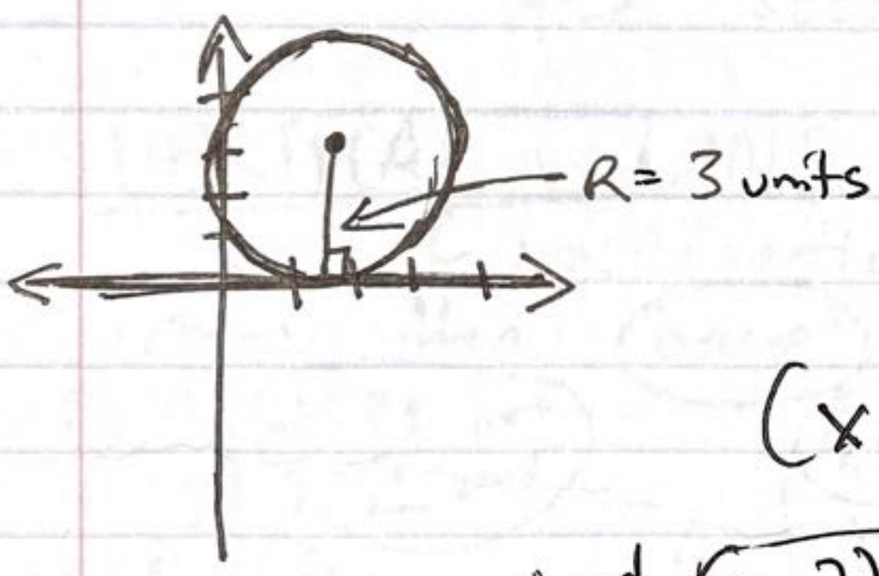
General FORM

The <u>tangent line</u> to a circle may be defined as the line that intersects the circle in a single point, called the point of <u>tagency</u>.



Find the standard form of the equation of a circle of the given:

Center (2,3) and $\underbrace{\text{tangent to the x-axis}}_{\text{the x axis touches the edge of a circle}}$



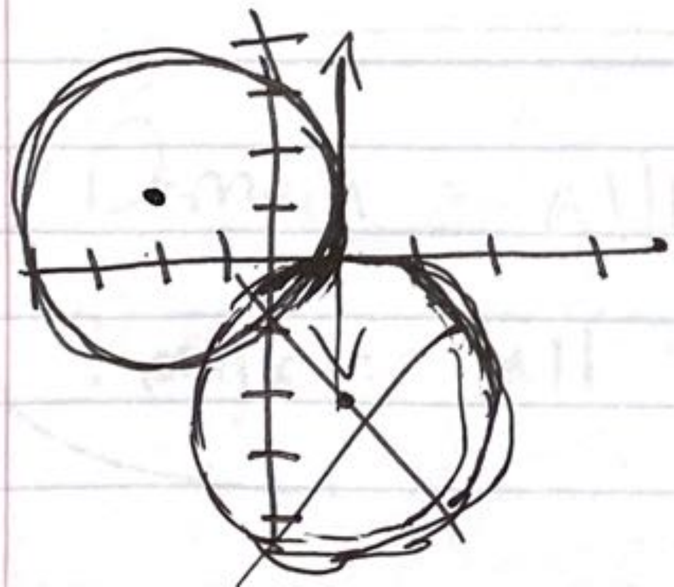
$$(x-2)^2+(y-3)^2=3^2$$

Answer → $(x-2)^2+(y-3)^2=9$

factored out $\boxed{(x-2)(x-2)+(y-3)(y-3)=9}$

Center $(\overset{x}{-2},\overset{y}{1})$ Tangent to $x=1$ → touches edge of circle

* what is the radius of the circle

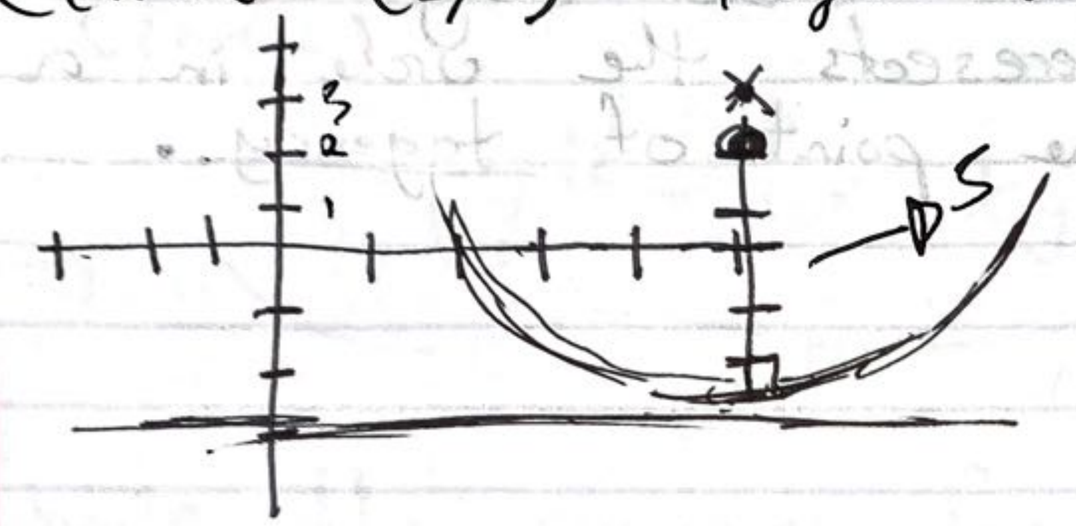


$R=2$

$$(x-{}^{-}2)^2+(y-1)^2=2^2$$

$$(x+2)^2+(y-1)^2=9$$

Center $(5,2)$ Tangent to $y=-3$ $r=?$ 5



$$(x-5)^2+(y-2)^2=5^2$$
$$=25$$

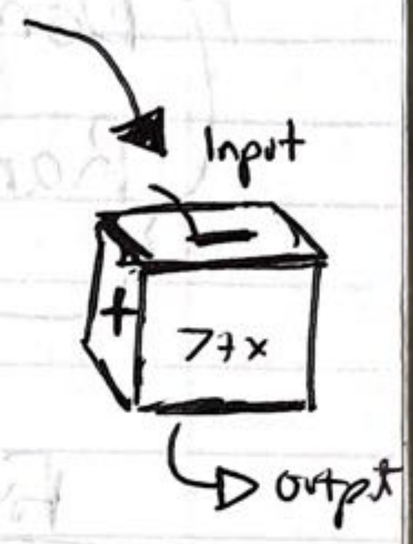
Similar To "T" table

3.1 Functions

$y = 7 + x$

$f(x) = 7 + x$

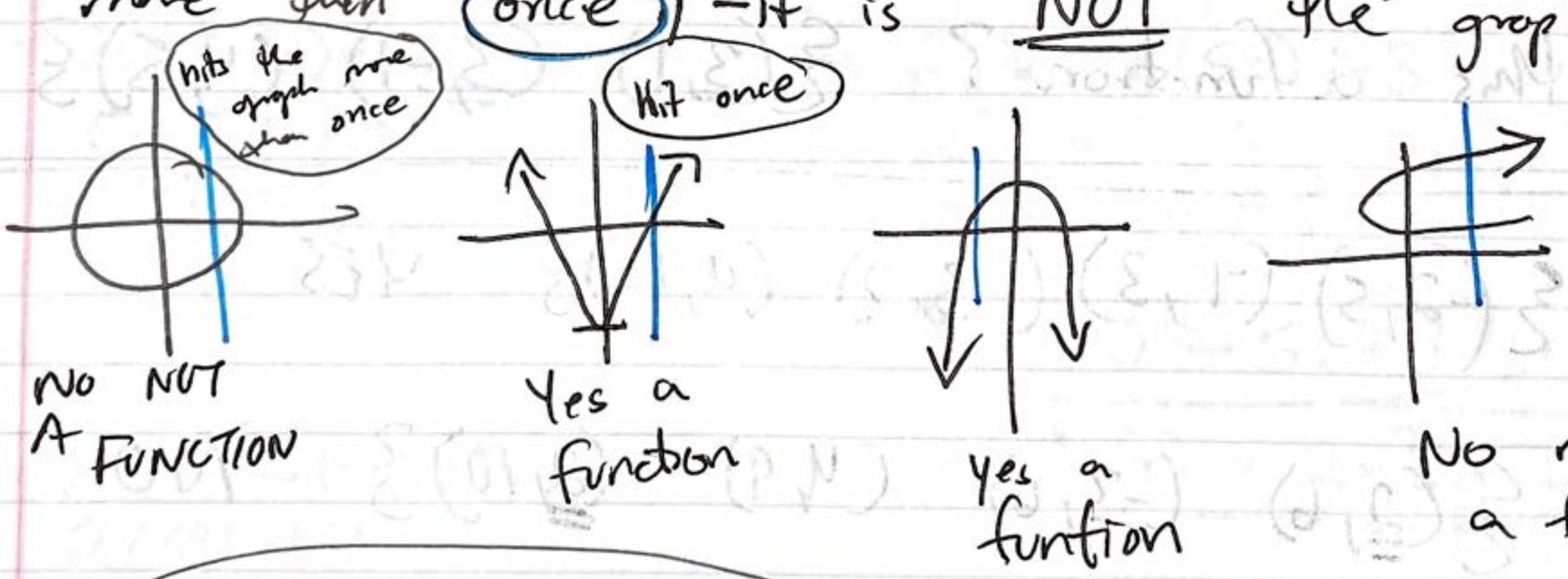
Input	output
X	Y
2	9
3	10
0	7



Function - a relation in which, for each distinct value of the first ~~[illegible]~~ component of the order pair, there is exactly one value of the second component.

VERTICAL LINE TEST

If a vertical line passes through the graph more than once, it is NOT the graph function.



Domain : all X-values

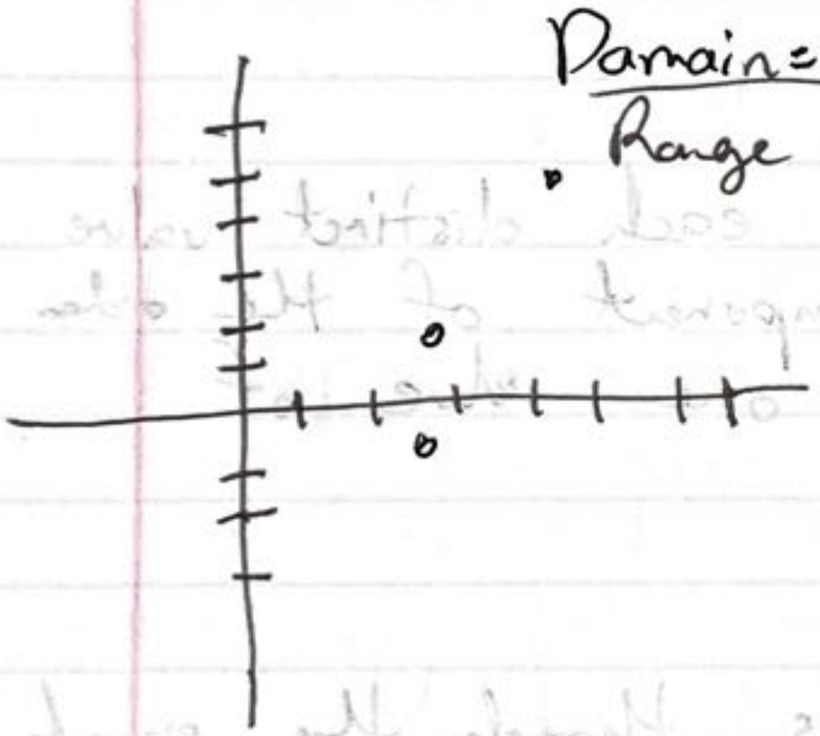
Range : all Y-values

Domain: all x-values
Range: all y-values

Find the domain & range of the function.

$\{(2,1)\ (-3,7)\ (4,5)\}$

Domain = $\{2, -3, 4\}$
Range = $\{1, 7, 5\}$



No Because repeating

Is this a function? $\{(3,1)\ (3,-1)\ (4,5)\}$

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① $\{(-2,5)\ (-1,3)\ (3,7)\ (4,12)\}$ YES

② $\{(2,6)\ (-3,6)\ (4,9)\ (2,10)\}$ NO

Function Notation

$\boxed{f(x) = 7+x}$

$\boxed{Y = f(x)}$

+1

$y = 7+x$

Find

$f(1) = 8$
$f(2) = 9$
$f(3) = 10$
$f(-100) = -93$

x	y
1	8
2	9
3	7
-100	-93

A function is given by: $\boxed{f(x) = 2x^2 - x + 3}$

<u>find</u>

$f(0)$

$= 2(0)^2 - (0) + 3$
$0 - 0 + 3$
$f(0) = 3$

$f(-7)$

$= 2(-7)^2 - (-7) + 3$
$2(49) + 7 + 3$
$98 + 7 + 3$
$= \underline{\underline{108}}$

$F(-7) = 108$

$f(5a)$

$= 2(5a)^2 - (5a) + 3$
$= 2(25a^2) - 5a + 3$
$= 50a^2 - 5a + 3$

$f(5a) = 50^2 - 5a + 3$

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

Set builder
= inequality

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

Find = $f(a-4) = 2(a-4)^2 - (a-4) + 3$

$2(\cancel{a^2+16}) - a + 4 + 3$

$2[(a-4)(a-4)] - a + 4 + 3$

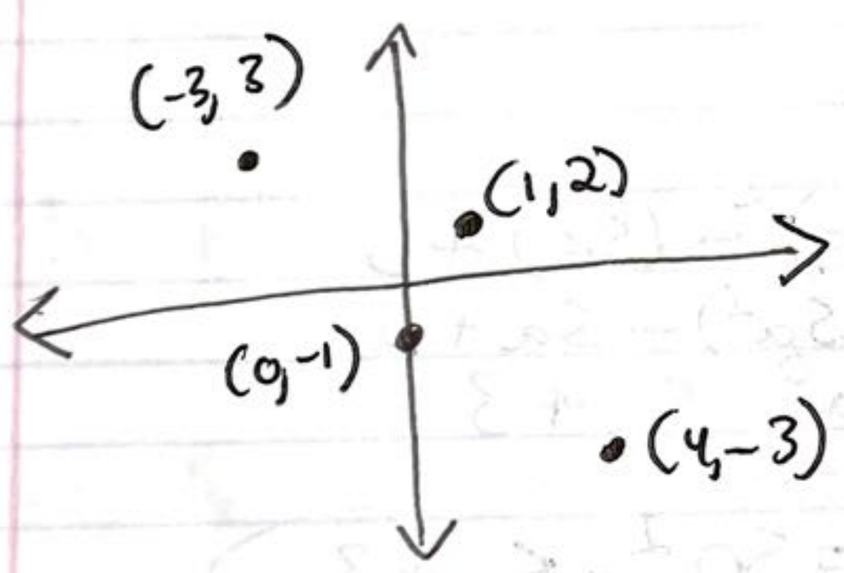
$2[a^2 - 4a - 4a + 16]$ " "

$2[a^2 - 8a + 16]$ " "

$2a^2 - 16a + 32 - a + 4 + 3$

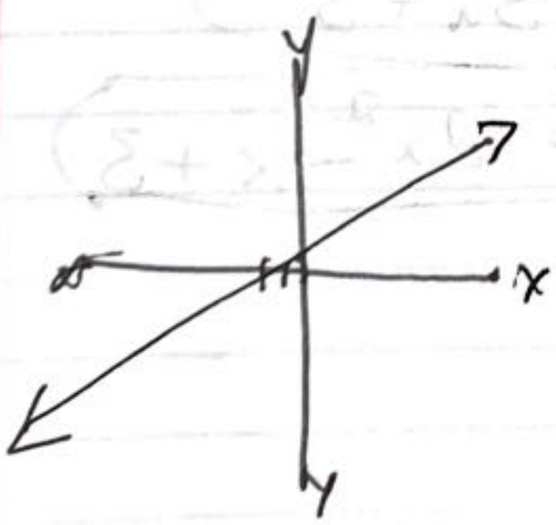
$= 2a^2 - 17a + 39$

3.1 Finding Domains & Ranges



$D = \{-3, 0, 1, 4\}$ →

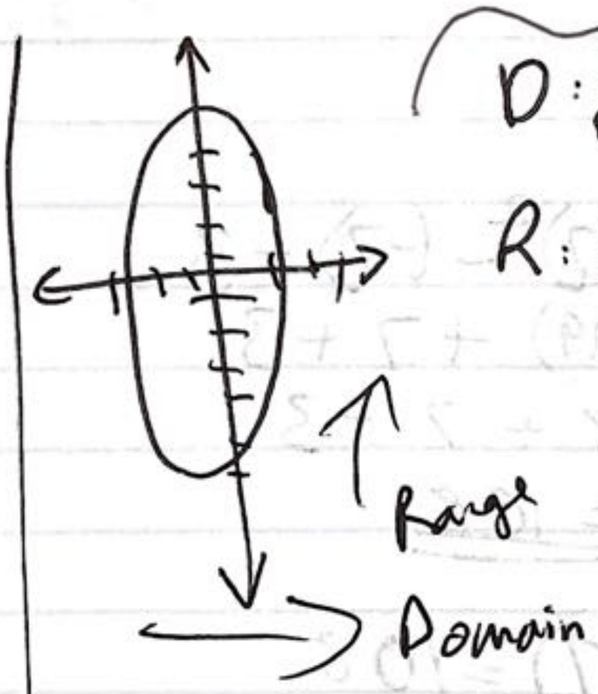
$R = \{-3, -1, 2, 3\}$ ↑



All Reals

$D: \{-\infty, \infty\}$

$R: \{-\infty, \infty\}$



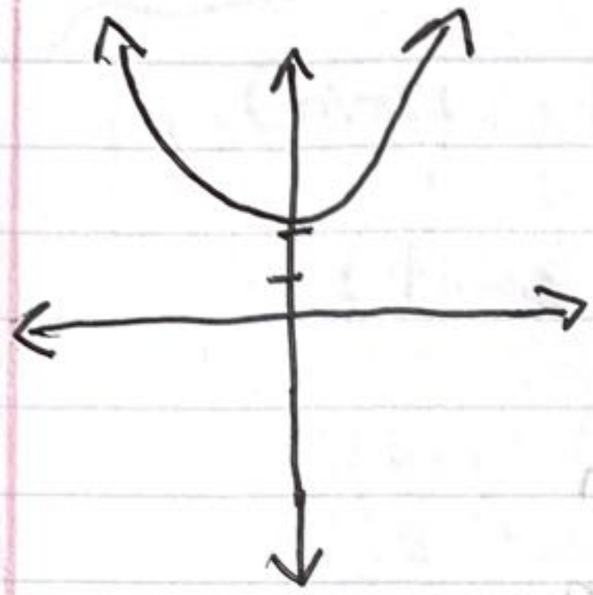
Interval notation

$D: [-2, 2]$

$R: [-4, 4]$

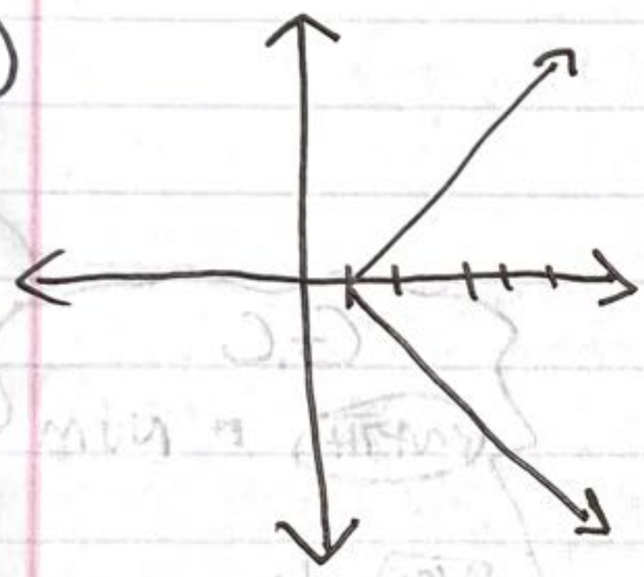
09/24/2018
MONDAY

Find the Domain & Range

① 

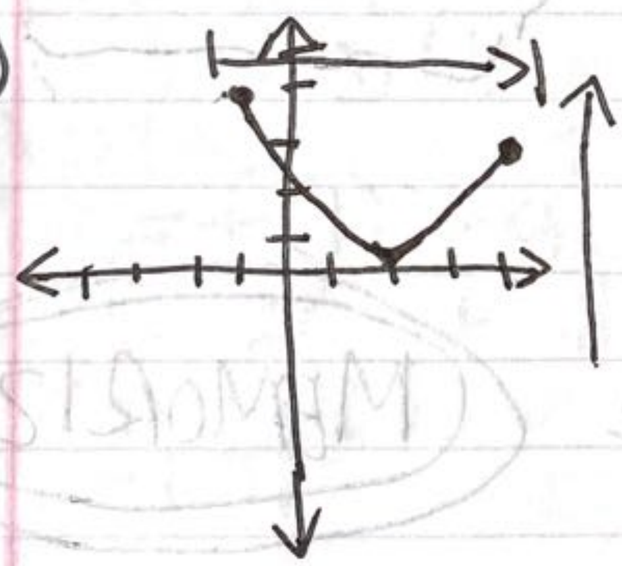
Domain: $(-\infty, \infty)$ MEANING = ALL REALS

Range: $[2, \infty)$

② 

Domain: $[1, \infty)$

Range: $(-\infty, \infty)$

③ 

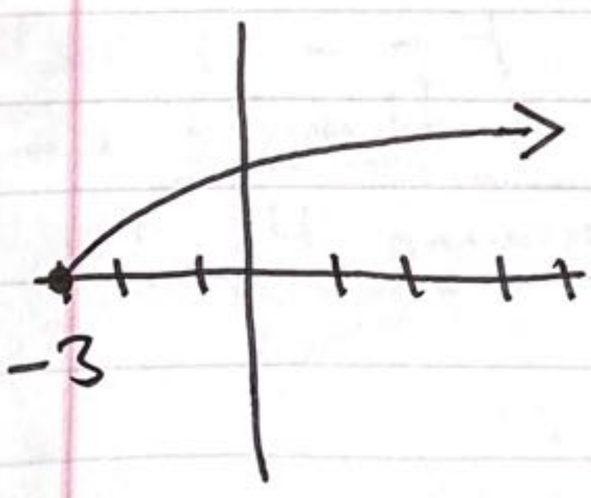
Domain: $[-1, 4]$

Range: $[0, 4]$

Find Domain & Range

④ $h(x) = \sqrt{x+3}$

GC
$Y = \sqrt{X+3}$
Graph

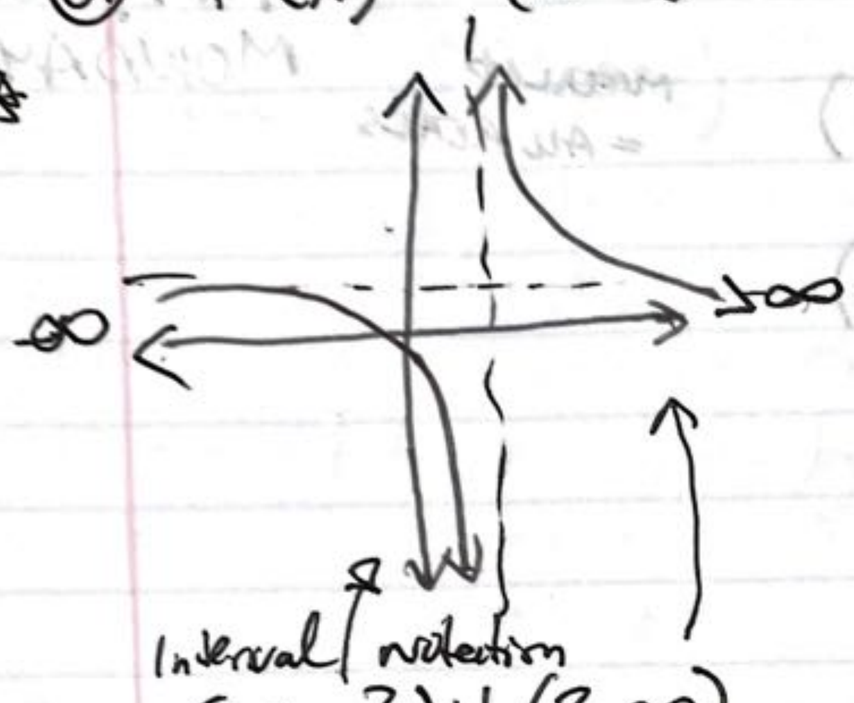


Domain: $[-3, \infty)$
Range: $[0, \infty)$

Test #3

#7

ⓓ $f(x) = \frac{(x+1)}{(x-3)}$



The Domains:

$\{x \mid x \neq 3\}$

Set builder notation
OR
Inequality notation

Interval notation
$= (-\infty, 3) \cup (3, \infty)$

$\boxed{\text{does not touch } 3}$

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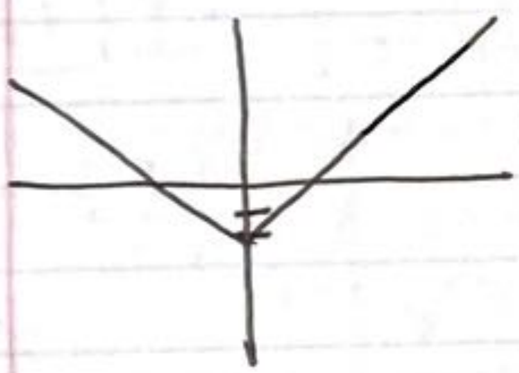
① $h(x) = |x| - 2$



Domain: $(-\infty, +\infty)$

Range: $[-2, \infty)$

G.C
MATH ▸ NUM
ABS 1:

$|x|$

Foundation Skill → Domain & Range

MEMORIZE

3.1 Algebra of functions

Given two functions f and g:

Rewritten

$$(f+g)(x) = f(x) + g(x)$$

$$(f-g)(x) = f(x) - g(x)$$

$$(fg)(x) = f(x) \cdot g(x)$$

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} \quad \boxed{g(x) \neq 0}$$

→ means no solution

can never have 0 at denominator

Given $\boxed{f(x) = x^2+1}$ $\boxed{g(x) = 3x+5}$

Find

$(f+g)(1)$

① $= f(1) + g(1)$

$2 + 8$

$= \underline{\underline{10}}$

Find =

$f(1) = (1)^2 + 1$

$= 1+1$

$\boxed{= 2}$

$g(1) = 3(1)+5$

$= 3+5$

$\boxed{= 8}$

② $(f-g)(-3)$

$= f(-3) - g(-3)$

2nd $= 10 - -4$

$= 10+4$

$= 14$ answer

1st ① $f(-3) = (-3)^2+1$

$= 9+1$

$= 10$

$g(-3) = 3(-3)+5$

$= -9+5$

$= -4$

$F(x) = x^2 + 1$ $\qquad$ $g(x) = 3x + 5$

Find

① $fg(5)$

~~$\frac{f(5)}{g(5)}$~~

$f(5) \cdot g(5)$

$= 26 \cdot 20$

$= \underline{520}$

~~$f(x) = (5)^2 + 1$~~
~~$= 25 + 1$~~
~~$= 26$~~

$= (5)^2 + 1$

$f(5) = 25 + 1$

$\boxed{= 26}$

$g(5) = 3(5) + 5$

$= 15 + 5$

$\boxed{= 20}$

---

② $\left(\frac{f}{g}\right)(0) =$

$f(0) = (0)^2 + 1$

$\boxed{= +1}$

$\frac{f(0)}{g(0)}$

$g(0) = 3(0) + 5$

$\boxed{= 5}$

$= \frac{1}{5}$

$\boxed{f(x) = 3x - 4}$ and $\boxed{g(x) = 2x^2 - 1}$

③ $(f+g)(x)$

$= f(x) + g(x)$

$= [3x - 4] + [2x^2 - 1]$

$= 2x^2 + 3x - 5$ Answer

31 The Different Quotient

$$\frac{f(x+h) - f(x)}{h}$$

DON'T HAVE To Memorize

Compute $(x+h)$ and simplify the difference quotient

$$\boxed{f(x) = 2x-3}$$

① $\boxed{f(x+h)} = 2x-3$
$= 2(x+h)-3$
$= 2x+2h-3$

② $\boxed{D.Q} = \dfrac{[2x+2h-3] - [2x-3]}{h}$

$= \dfrac{\cancel{2x}+2h\cancel{-3}-\cancel{2x}\cancel{+3}}{h}$

$= \dfrac{\cancel{2h}}{\cancel{h}}$

$\underline{\underline{D.Q = 2}}$

$8x+6$

$\dfrac{8x+8h+6-(x+h)}{h}$

$\dfrac{\overset{7x}{\cancel{8x}}+\overset{7h}{\cancel{8h}}+6-\cancel{x}-\cancel{h}}{\cancel{h}}$

$\dfrac{7x+\cancel{7h}+6}{\cancel{h}}$

$\dfrac{7x+13}{\cancel{h}}$?

③ Compute & Simplify the D.Q.

$$\boxed{f(x) = 4x+11}$$

$\dfrac{8x+8h+6-8x-8h}{h}$

$\dfrac{6}{h}$?

Compound inequality, set brackets not.

① $f(x+h) = 4(x+h)+11$
$= 4x+4h+11$

$DQ = \dfrac{[4x+4h+11]-[4x+11]}{h}$

$\dfrac{\cancel{4x}+4h\cancel{+11}\cancel{-4x}\cancel{-11}}{h}$

$= \dfrac{4\cancel{h}}{\cancel{h}}$

$= 4$

$DQ = \dfrac{f(x+h)-f(x)}{h}$

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

②

1st $= f(x+h) = \cancel{2x^2-3x}$
$= 2(x+h)^2 - 3(x+h)$
$= 2[(x+h)(x+h)] - 3x - 3h$
$= 2[x^2+xh+xh+h^2] - 3x - 3h$
$= 2[x^2+2xh+h^2] - 3x - 3h$
$= 2x^2+4xh+2h^2-3x-3h$

2nd

$D.Q. = \dfrac{[2x^2+4xh+2h^2-3x-3h]-[2x^2-3x]}{h}$

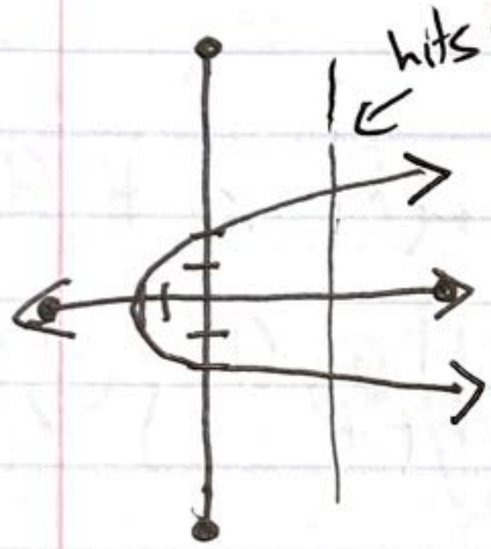
$\dfrac{\cancel{2x^2}+4xh+2h^2\cancel{-3x}-3h\cancel{-2x^2}\cancel{+3x}}{h}$

$= \dfrac{4x\cancel{h}+2h^2-3\cancel{h}}{\cancel{h}}$

Difference Quotient $= 4x+2h-3$

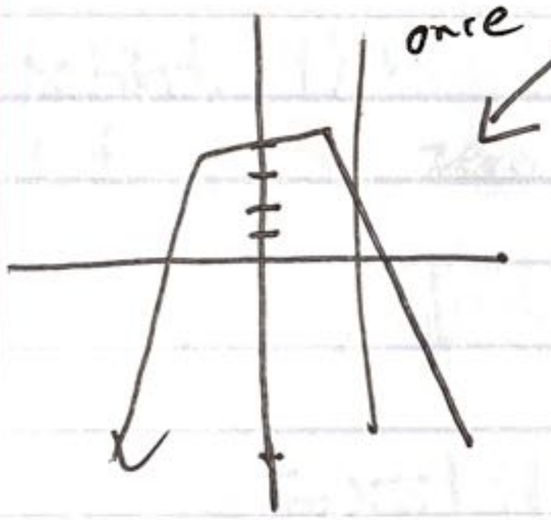
3.2 Determine whether the graph is a function using the vertical line test. If it is find.

ⓐ domain & Range
ⓑ Intercepts

① 

Not a function

D: $[-2, \infty)$
R: $(-\infty, \infty)$

② 

Yes a function

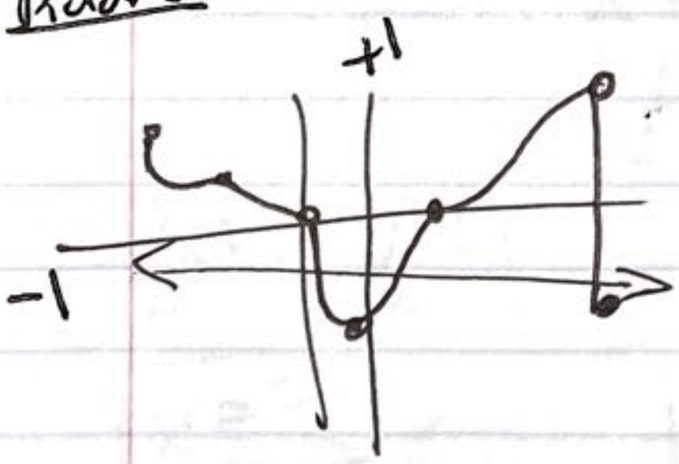
ⓐ D: $(-\infty, \infty)$
R: $(-\infty, 4]$

interval notation

ⓑ x-intercept: $(-4,0), (4,0)$
y-intercept: $(0,4)$

order pair

Review



Input → Table ← output

x	y
-4	2
-2	1
0	0
2	-2
4	0
ⓜ 5	3
6	0

ⓐ $f(0) = 0$, $f(6) = 0$
ⓑ $f(2) = -2$, $f(-2) = 1$
ⓒ $[-4, 6]$

x values

$-4 \le x \le 6$

compound inequality

Yvalues

ⓓ $[-2, 3]$ $-2 \le y \le 3$

Touching x → ⓔ $(0,0)$, $(4,0)$, $(6,0)$

Touching y ⓕ $(0,0)$

ⓖ 2

ⓗ 1

-1 horizontal
+1 vertical

? ← y
$f(x) = -2$

3.2

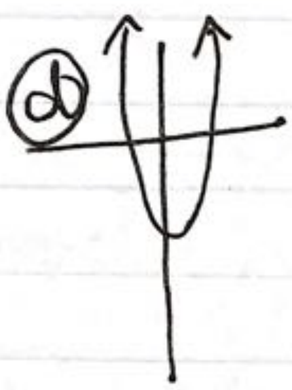
09/26/2018
WEDNESDAY

$f(x) = 2x^2 - x - 1$

A.) Is the point $(-1, 2)$ on the graph of f?

$2(-1)^2 - (-1) - 1$

ⓑ If $x = -2$, what is $f(x)$? What is .... $9 (-2, 9)$

ⓒ $(0, -1)$ ⓓ  Parabola is $(-\infty, \infty)$ infinites
All Reals

ⓔ x-int.
- set y to zero & solve

$y = 2x^2 - x - 1$

$0 = 2x^2 - x - 1$

$0 = (2x + 1)(x - 1)$

$\frac{2x}{2} + \frac{1}{2} = \frac{0}{2} - 1$ $\quad$ $x - 1 = 0$

$\boxed{x = \frac{-1}{2}}$ $\quad$ $\boxed{x = 1}$

Answer $(-\frac{1}{2}, 0)$ $(1, 0)$

ⓕ Y-intercept
- set $x = 0$ & solve

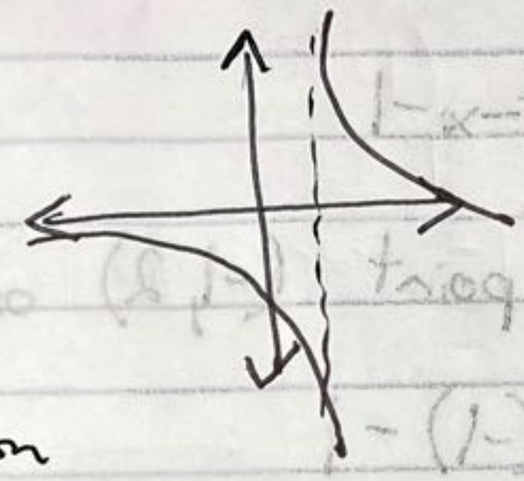
$Y = 2x^2 - x - 1$
$Y = 2(0)^2 - (0) - 1$
$Y = 0 - 0 - 1$
$\boxed{Y = -1}$

Answer $= (0, -1)$

X int set $Y = 0$
Y = set $x = 0$ y-int

Z-standard

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



$= Y_1 = (X+2)/(X-6)$

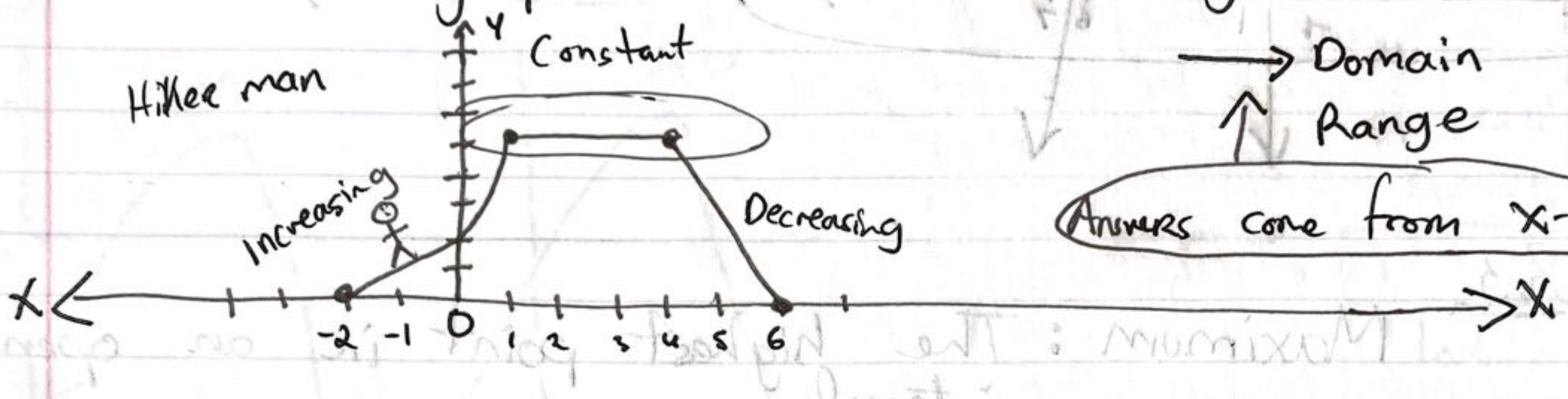
$\{x \mid x \neq 6\}$ → set builder notation

$(-\infty, 6) \cup (6, \infty)$ - interval notation

3.3 Increasing, Decreasing, Constant & Maximum & Minimum

09/26/2018
WED.

Read the graph from left to right



→ Domain
↑ Range

Answers come from x-axis

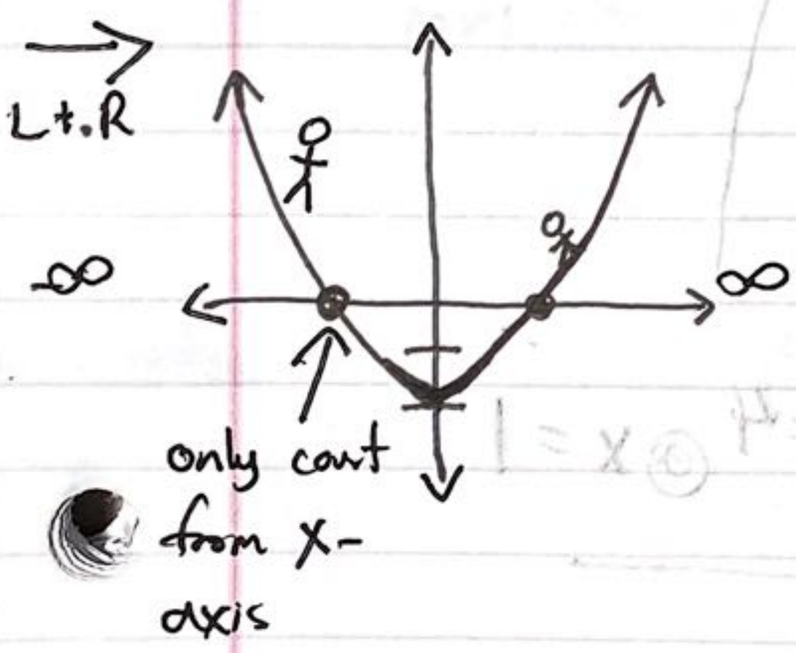
Determine the intervals in which the function is increasing, decreasing, and constant.

Increasing : (-2, 1) (Always use parenthesis on Ins, Des, Cnt.)

Decreasing : (4, 6)

Constant : (1, 4)

Intervals are written in terms of x-values (like DOMAIN)

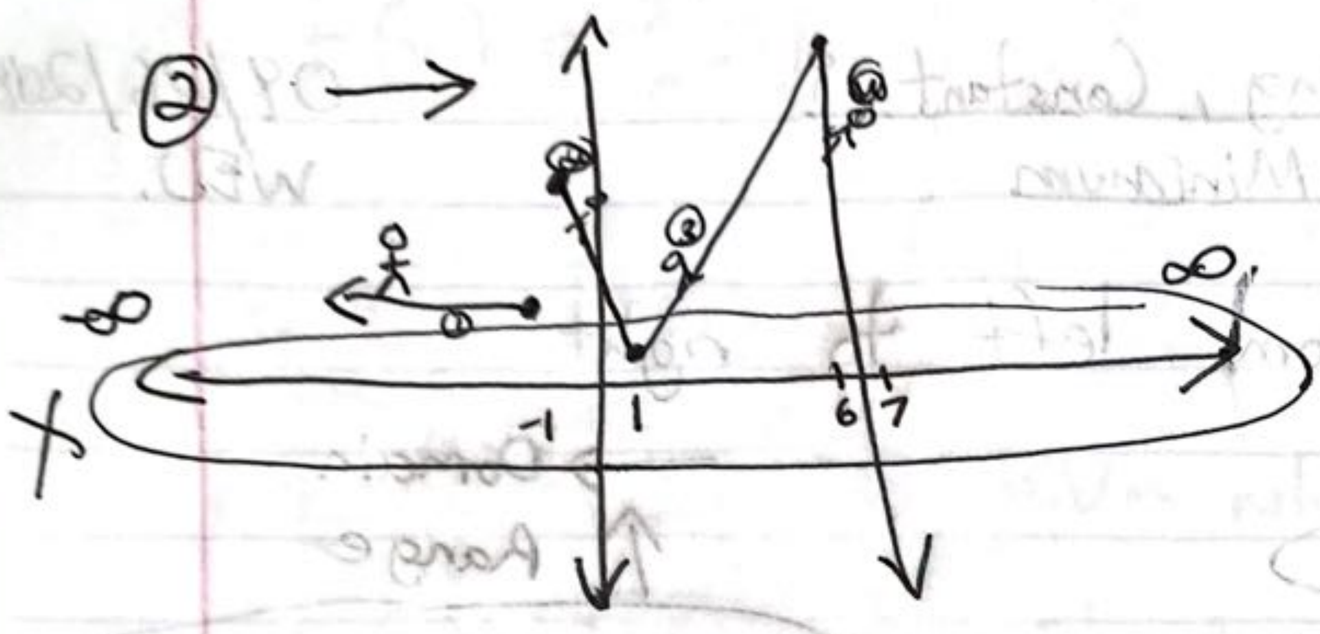


Increasing : $(0, \infty)$

Decreasing : $(-\infty, 0)$

Constant : — N/A

② →



Inc : ③ (1, 4)
Dec : ② (-1, 1) ④ (4, ∞)
Constant : ① (-∞, -1)

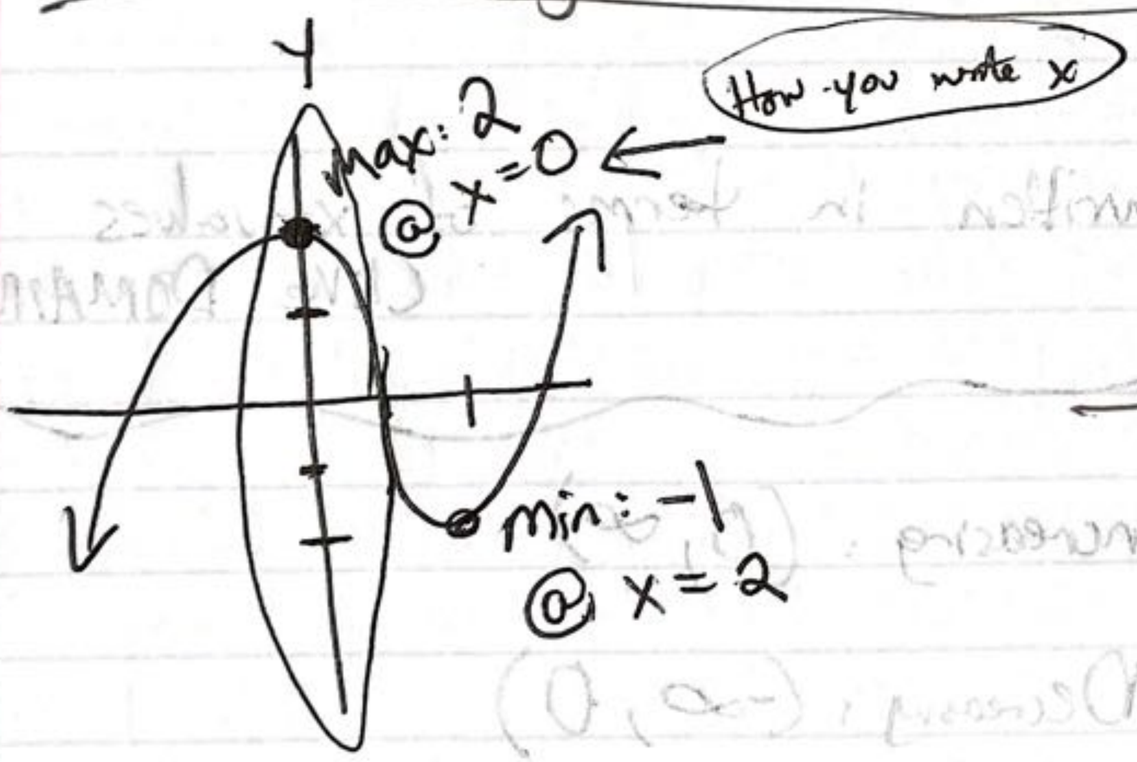
3.3

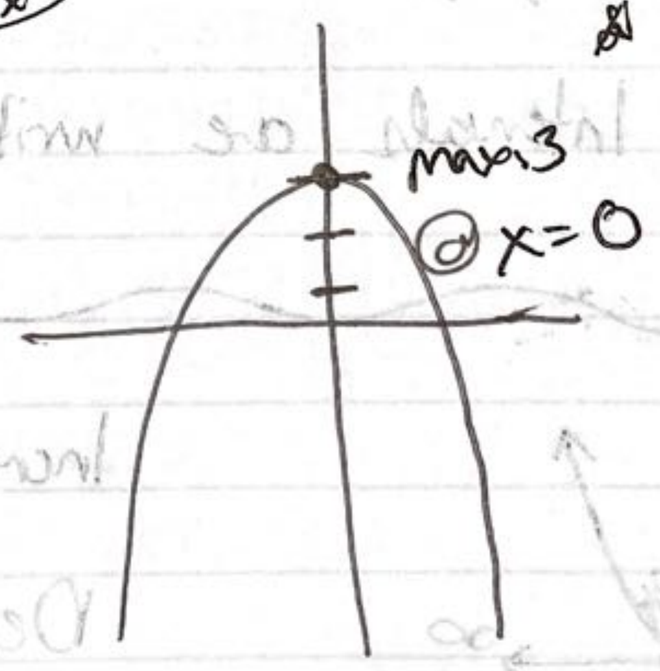
Maximum : The highest point in an open interval

Minimum : The lowest point in an open interval

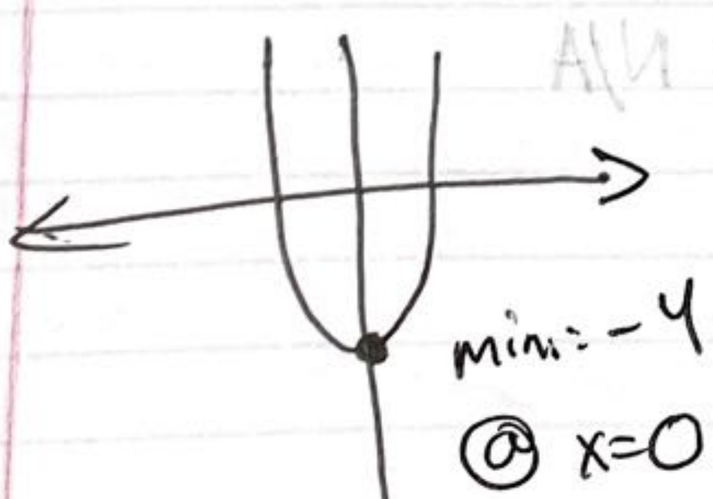
④ Maxima : plural
Minimum : plural

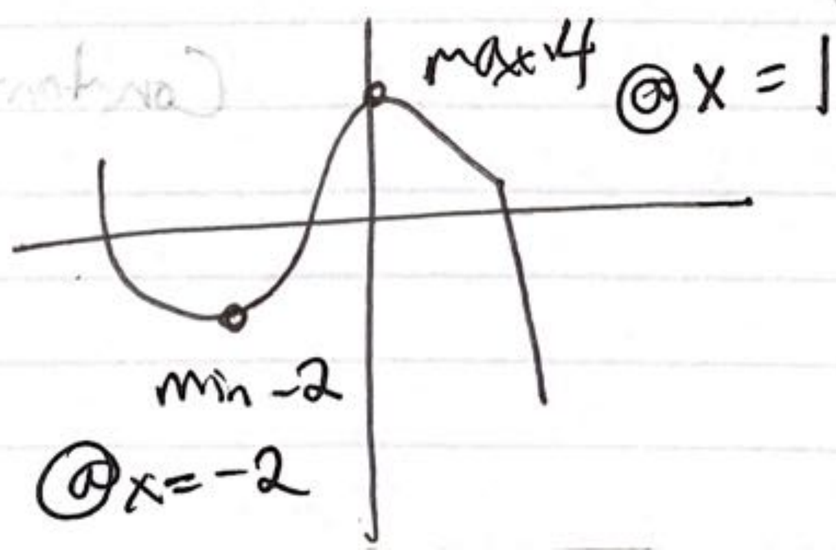
Determine any local maxima and minima of the functions





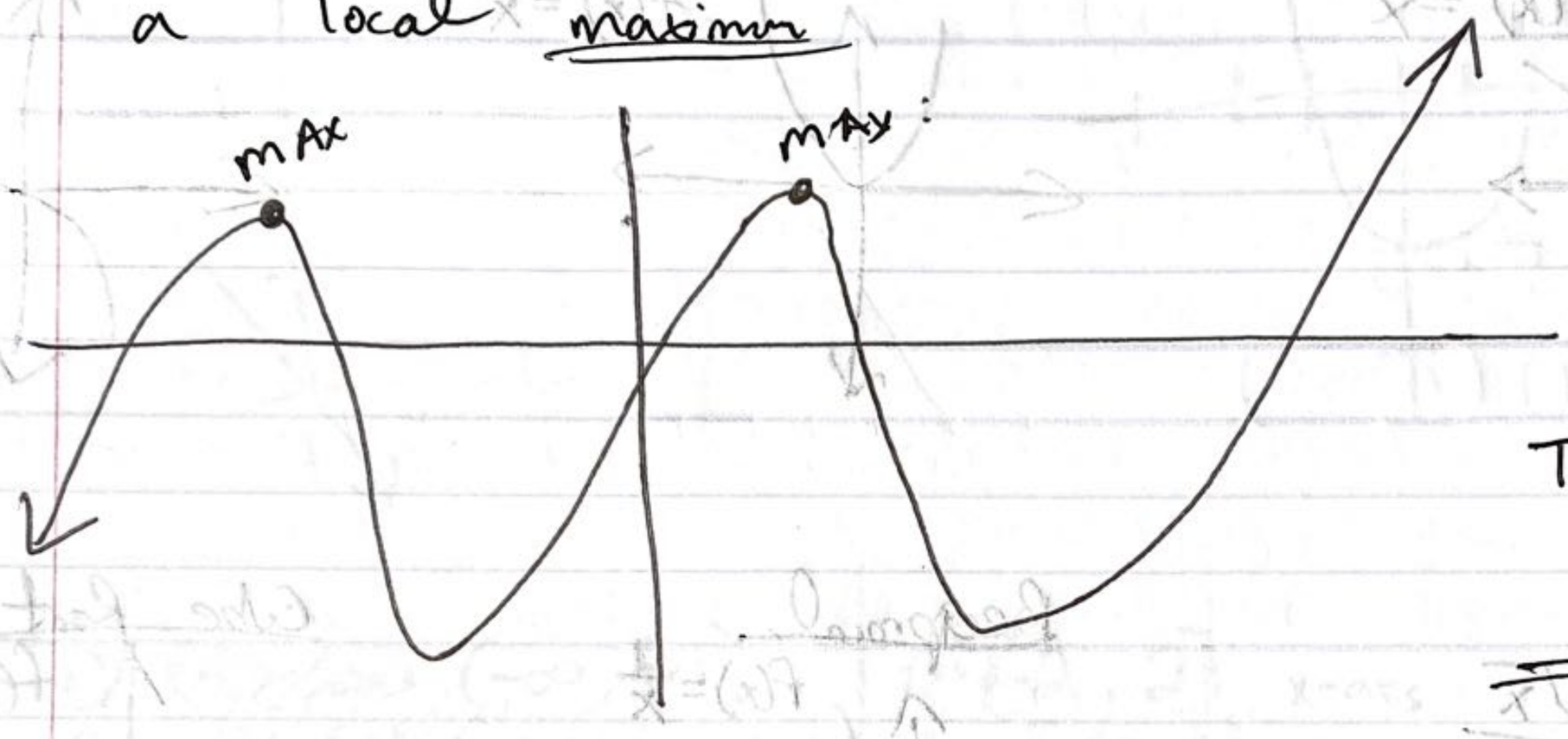
* Answer comes from looking at Y-axis





3.3 Max & Min

List the values of x at which the function has a local maximum

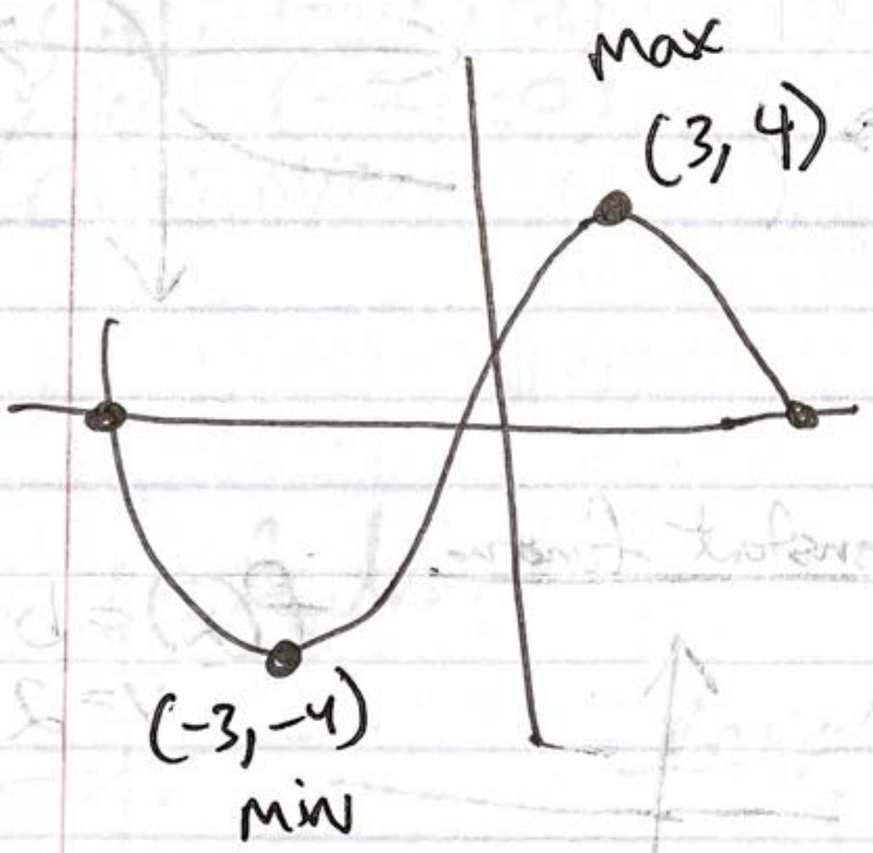


Values of x

$x = -6, 2$

The local maximum

$= 4, 4$



$x = 3$

Max = 4

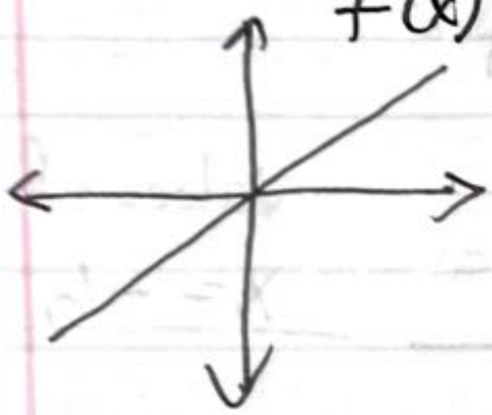
$x = -3$

min = -4

3.4 Library of functions & Piece wise functions

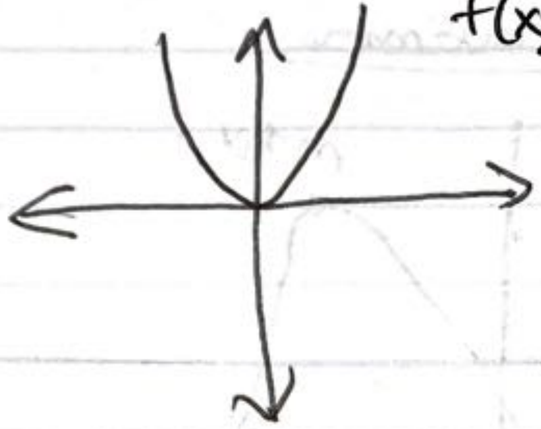
Identity function

$f(x) = x$



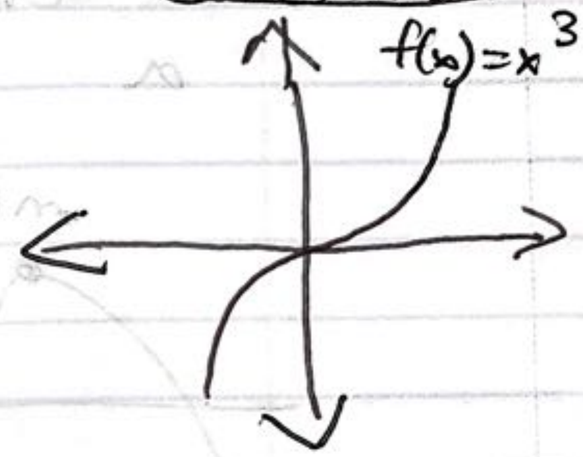
Square function

$f(x) = x^2$



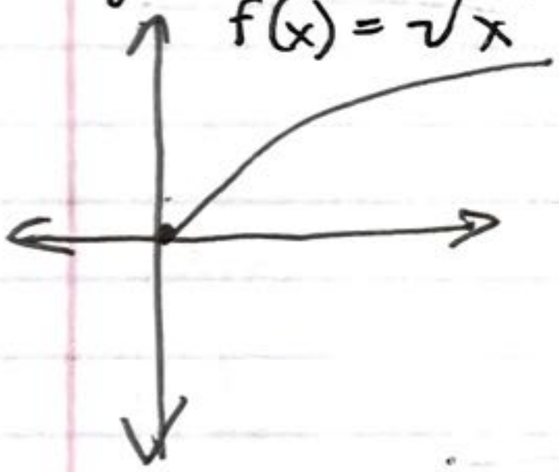
Cube function

$f(x) = x^3$



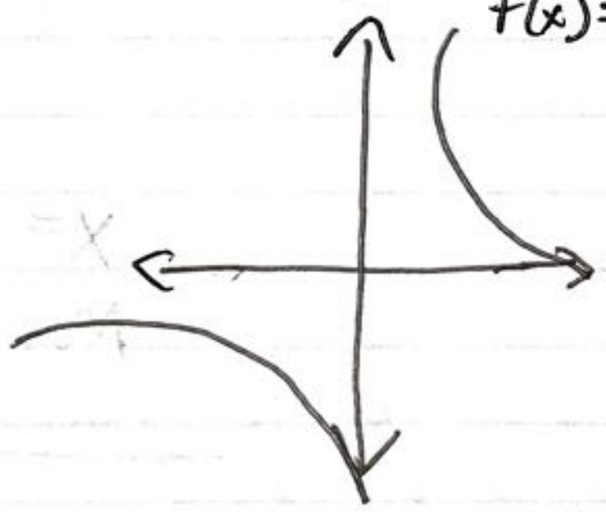
Square Root

$f(x) = \sqrt{x}$



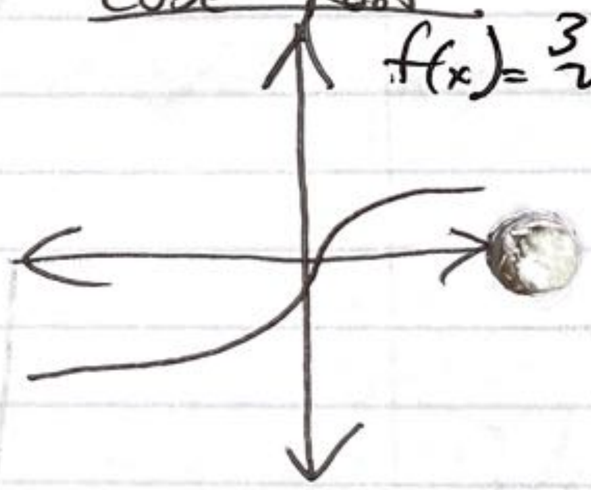
Reciprocal

$f(x) = \frac{1}{x}$



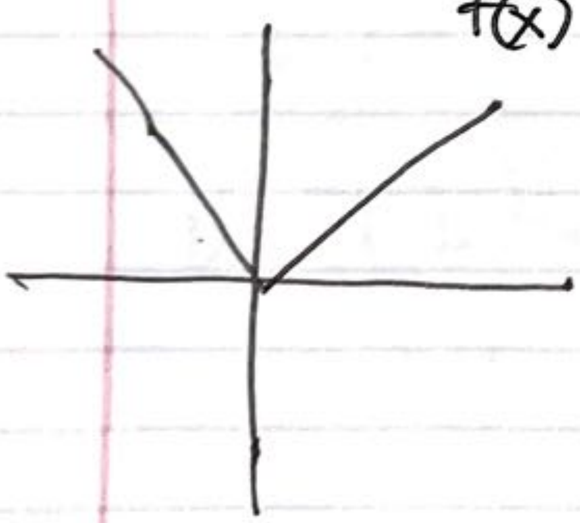
Cube Root

$f(x) = \sqrt[3]{x}$



Absolute Value

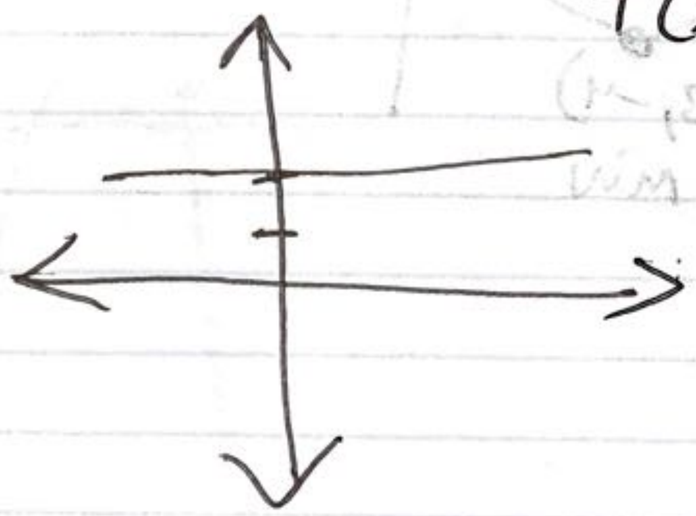
$f(x) = |x|$



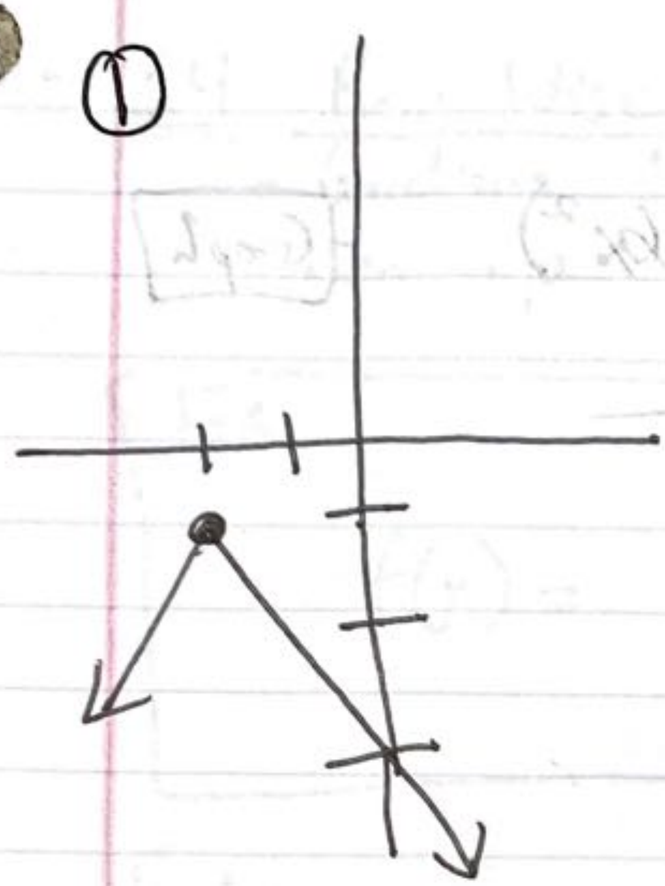
Constant function

$f(x) = b$

$y = 2$



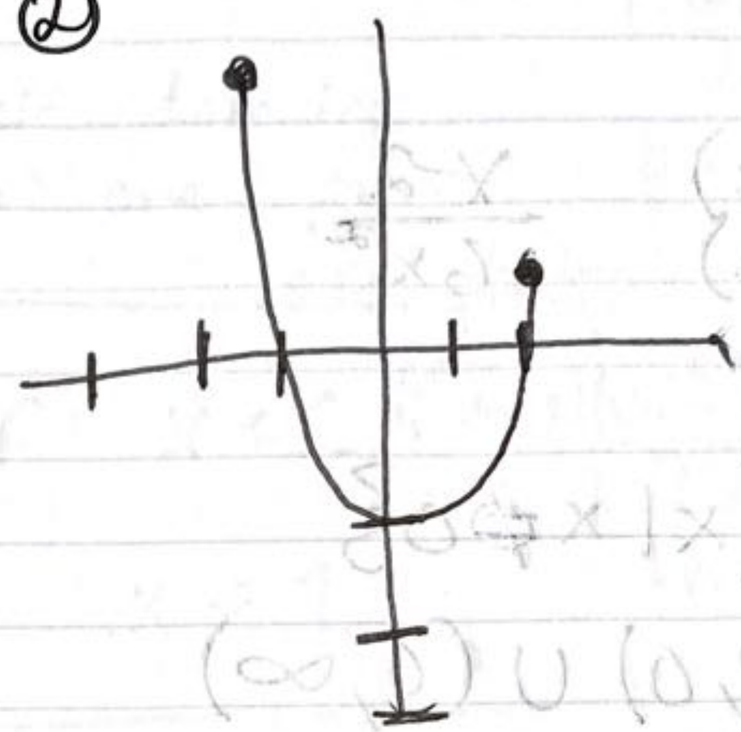
①



D: $(-\infty, \infty)$
R: $(-\infty, -1]$
Inc: $(-\infty, -2)$
Dec: $(-2, \infty)$
Conts: N/A

parenthesis

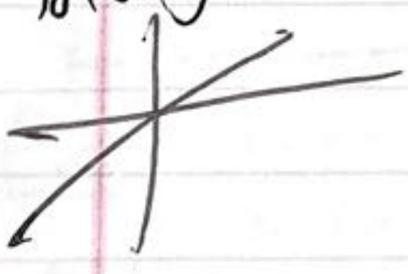
②



D: $[-2, 2]$ x-axis
R: $[1, 5]$ y=axis
Inc: $(0, 2)$
Dec: $(-2, 0)$
Conts. = NA

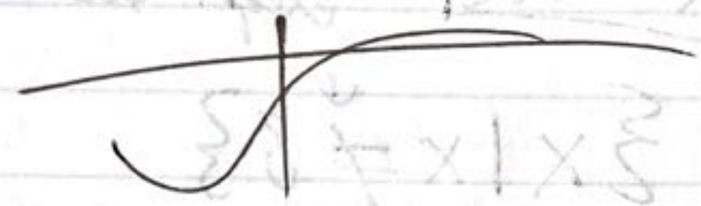
Dec. = x axis

Identity function

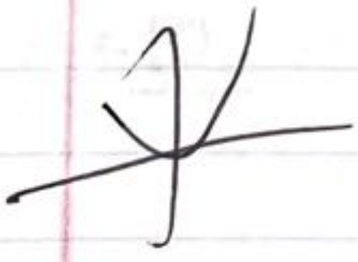


Reciprocal

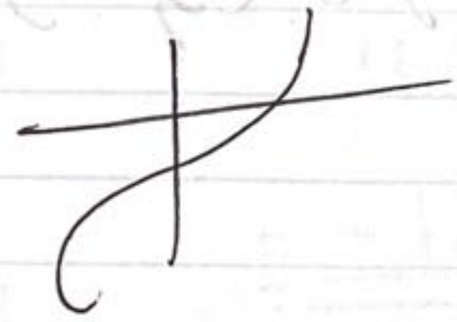
cube root



absolute value



cube ^{3}



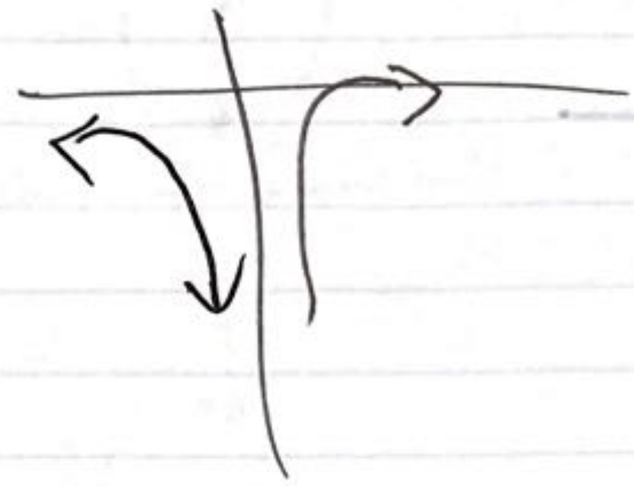
(13)(d)

$f(x)$ $\quad \frac{x-2}{6x^2}$

$g(x)$

G.

$Y_1 = (x-2)/(6x^2)$ $\boxed{\text{Graph}}$



<u>Domain:</u>

$\{x \mid x \neq 0\}$

$(-\infty, 0) \cup (0, \infty)$

(17)(c)

$y = 2$

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

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

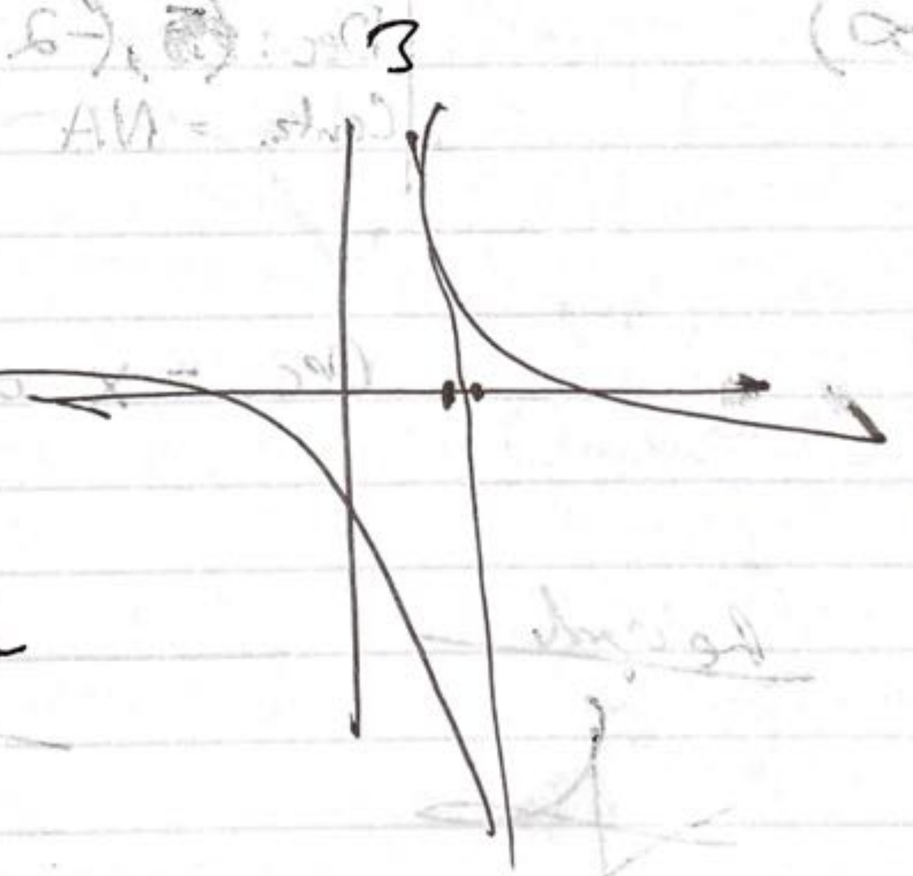
$2x - 6 = \cancel{x+6}$

$-x + 6 \quad -x + 6$

$\boxed{x = 12}$ except for

D: $\{x \mid x \neq 3\}$

$(-\infty, 3) \cup (3, \infty)$



3.4 Piece Wise Graphs

Oct. 1, 2018
Monday

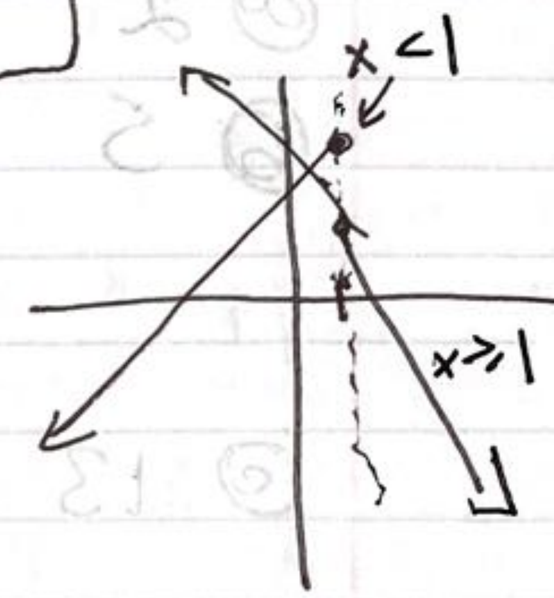
- functions that have their domains broken up into more than one piece.

Restriction

For

$$f(x) = \begin{cases} 2x+4 & \text{if } x < 1 \quad (x \text{ less than } 1) \\ 4-x & \text{if } x \geq 1 \end{cases}$$

only plug into one of these



find:

① $f(0)$
$= 2(0)+4$
$= 0+4$
$f(0) = 4$

② $f(5)$
$= 4-(5)$
$f(5) = -1$

$$f(x) \begin{cases} -2x & \text{if } x < -3 \\ 3x-1 & \text{if } -3 \leq x \leq 2 \\ -4x & \text{if } x > 2 \end{cases}$$

Between

find

ⓐ $f(-5)$
$-2(-5)$
$= +10$

ⓑ $f(-1)$
$3(-1)-1$
$-3-1$
$= -4$

ⓒ $f(0)$
$3(0)-1$
$0-1$
$= -1$

ⓓ $f(3)$
$-4(3)$
$= -12$

Tablet Service

Sprint monthly plan = \$34.99 , 3GB
\$15 per GB

$$C(x) = \begin{cases} 34.99 & \text{if } 0 \le x \le 3 \\ 15x - 10.01 & \text{if } x > 3 \end{cases}$$

ⓐ 2 $= \underline{34.99}$

ⓑ 5 $= 15(5) - 10.01$
$= \underline{\$64.99}$

ⓒ 13 $= 15(13) - 10.01$
$= \$184.99$

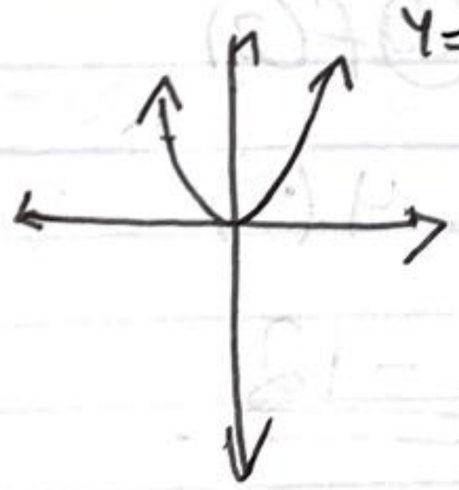
3.5 Transformations

Be familiar with library of functions

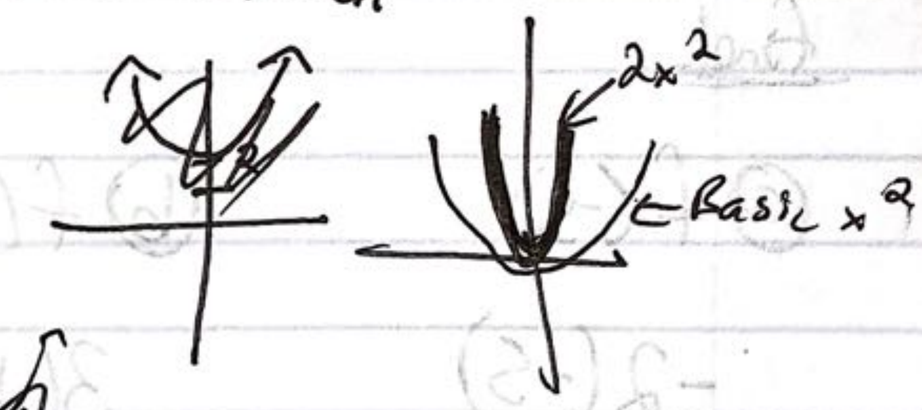
VERTICAL STRETCHING – gets more narrow

If $a > 1$ the graph will stretch

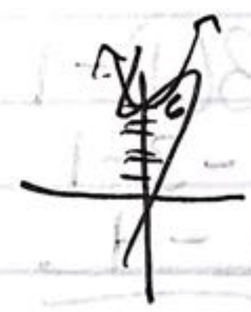
Basic function



Graph
$y = 2x^2$



$y = 6x^2$

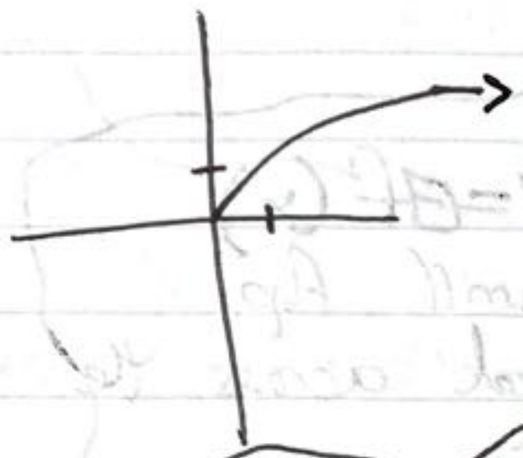


Answer = Stretched Vertically by a factor of 6

3.5 Transformations

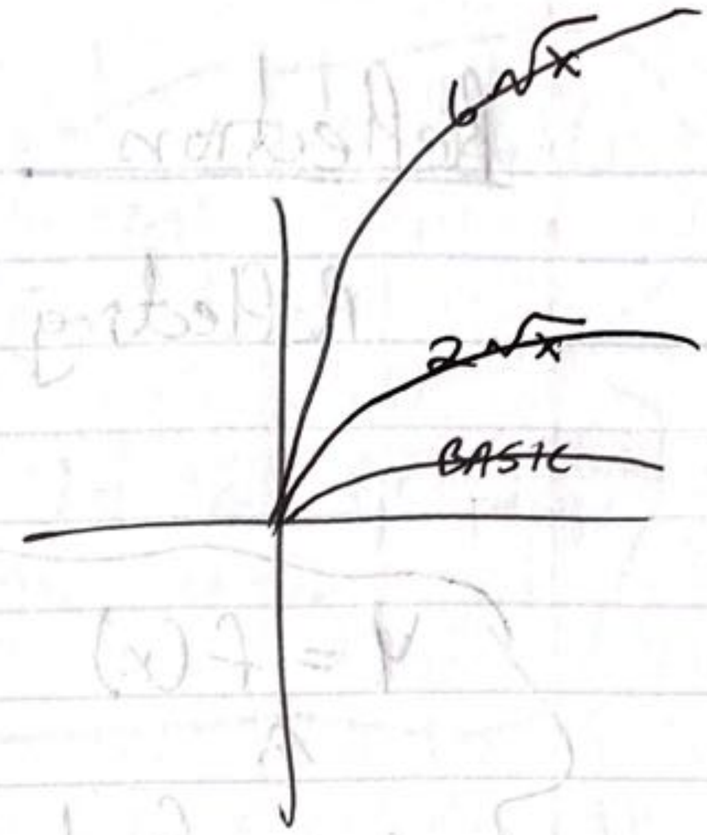
Basic functions

$y = \sqrt{x}$



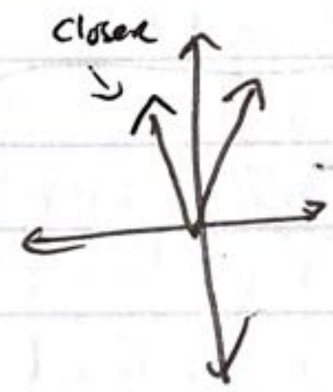
$y = 2\sqrt{x}$

$y = 6\sqrt{x}$



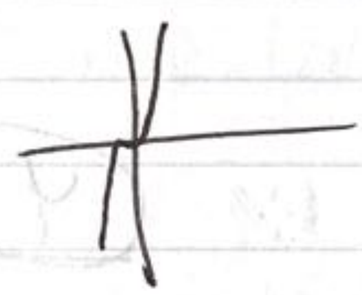
$y = |x|$

$y = 6|x|$



$y = x^3$

$y = 6x^3$



G.P.C

$\boxed{x} + \boxed{\frac{\ }{\ }} + \boxed{3}$

x^3

VERTICAL COMPRESSION - Gets wider

If $0 < a < 1$ the graph is compressed

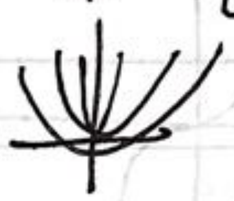
Basic function

$y = x^2$

$y = \sqrt{x}$

$y = |x|$

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



Pushes toward y-axis

Graph

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

$y = \frac{1}{4}x^2$

$y = (.125)|x|$

Description

Vertically compressed by a factor of $\frac{1}{2}$

Reflection about x-axis

Reflecting - forming the mirror image of the graph across a line.

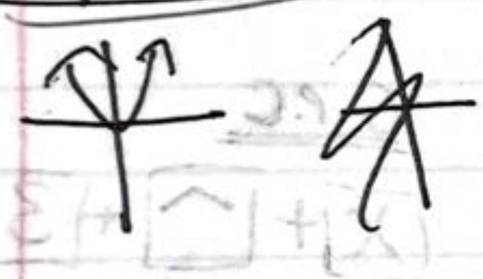
$Y = f(x)$ ↑ Basic funct

$Y = -f(x)$ ↳ it will flip

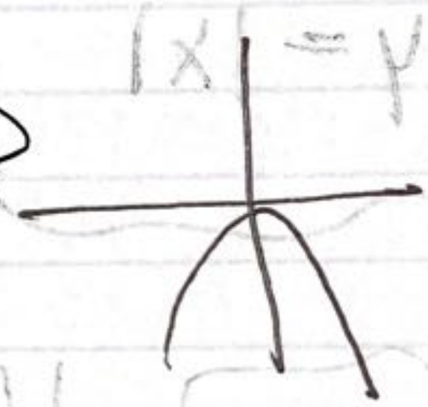
Will be reflected across the x-axis

Basic functions

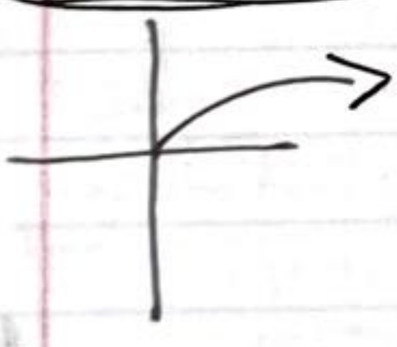
$Y = x^2$



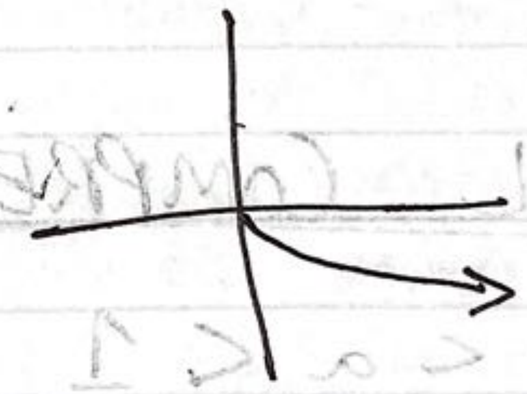
$Y = -x^2$



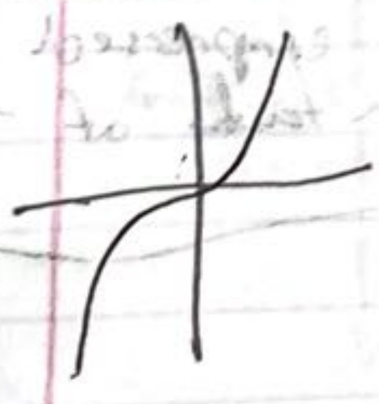
$Y = \sqrt{x}$



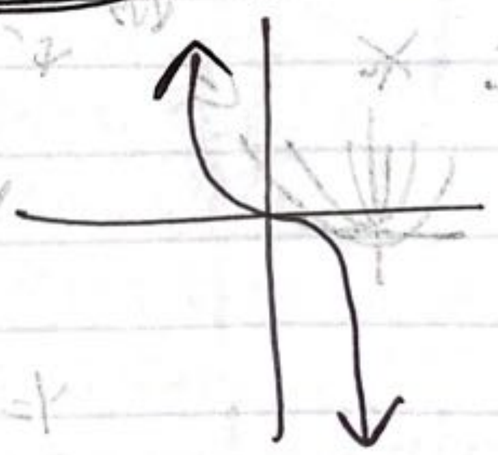
$Y = -\sqrt{x}$



$Y = x^3$



$Y = -x^3$



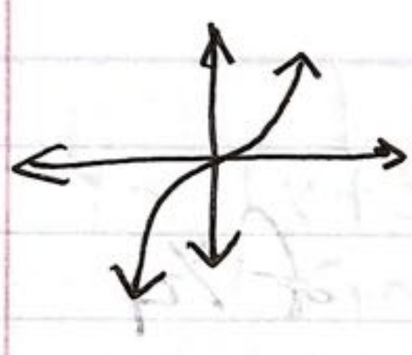
Reflection about the Y-axis

$Y = f(x)$ $\qquad$ $y = f(-x)$ ← within parenthesis

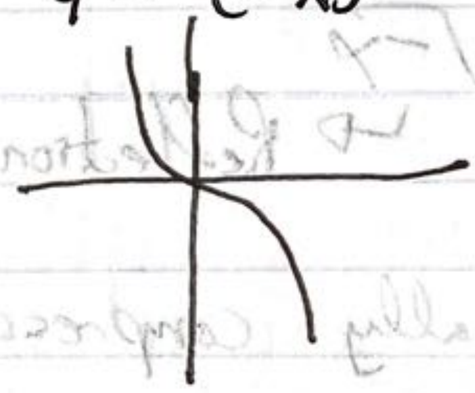
will be reflected over the y-axis

Basic functions

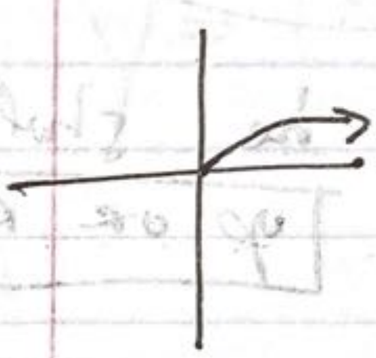
ⓐ $Y = x^3$



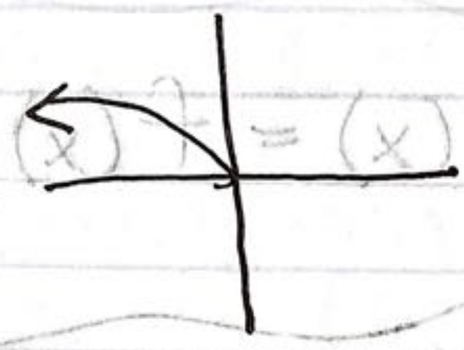
$y = (-x)^3$



ⓑ $h(x) = \sqrt{x}$



$f(x) = \sqrt{-x}$



ⓒ $(x) = |x|$

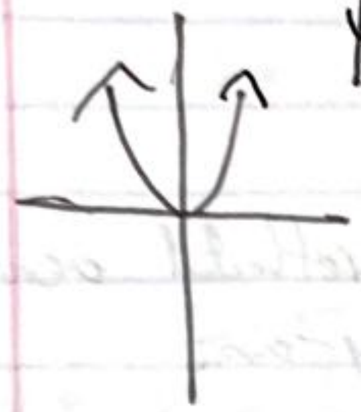
$g(x) = |-x|$

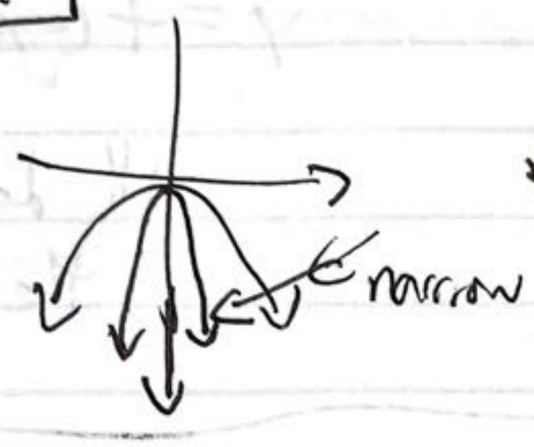
MATH → NUM

1: ABS

Graph - describe what happened in words

$\boxed{y=x^2}$





$y=-6x^2$ — VERTICALLY stretched factor of 6

* Reflection about the x-axis

Always start with basics

$y=\frac{1}{4}\sqrt{-x}$

↳ Reflection across about the y-axis

Vertically compressed by a factor of 1/4

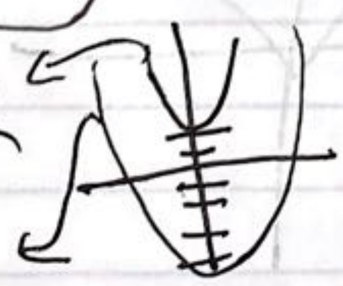
VERTICAL SHIFT — 5th movement

$g(x)=f(x)\boxed{+c}$ → Graph will be shifted c units $\boxed{\text{up or down}}$

Basic Functions + ↑ − ↓

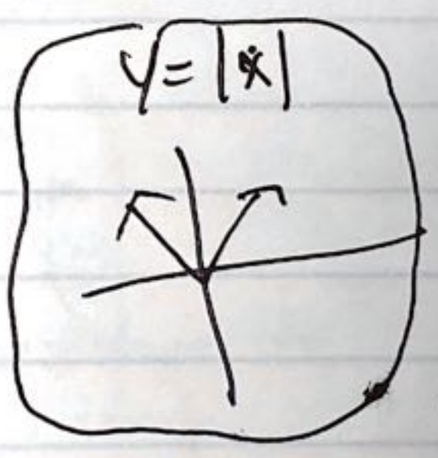
$y=x^2$

$y=x^2+2$

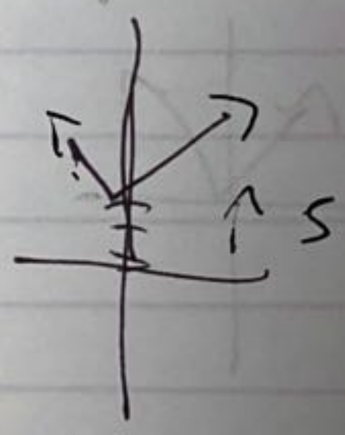


$y=x^2-6$

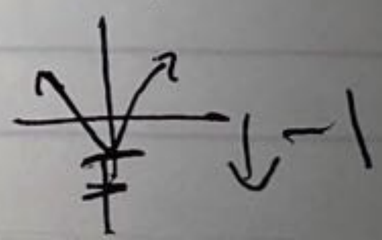
$y=|x|$



$y=|x|+5$



$y=|x|-1$



Horizontal Shift

within parenthesis or Base etc...

$$g(x) = f(x-c)$$

Graph will be shifted $\boxed{\text{left or right}}$ on the x-axis

Base function = $y = x^2$

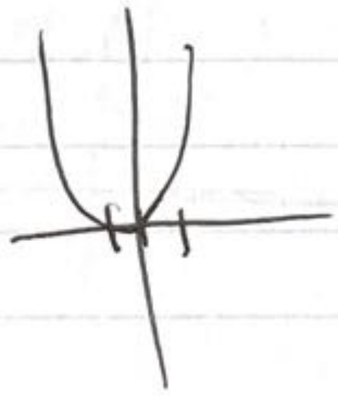
Graph

⊖ Not left to

MOVE THE opposite direction of sign

$y = (x-2)^2$

Rt 2

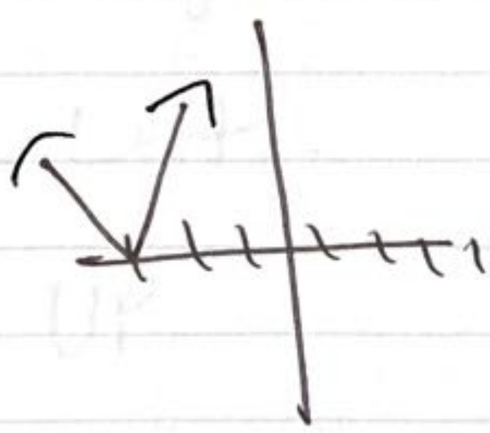


$y = (x+5)^2$

Left 5units

$y = |x-4|$

$y = |x+7|$



3.5 6 Transformations

Oct. 3, 2018
Wednesday

① Vertical Stretch — $y = 6x^2$ — closer
② Vertical Compression — $y = \frac{1}{4}x^2$ — wider
③ Reflection about x-axis — $y = -x^2$ — flip over
④ Reflection about y-axis — $y = (-x)^2$ — flip on y
⑤ Vertical (up/down) Shift — $y = x^2 + 5$
⑥ Horizontal (left/right) Shift — $y = (x+5)^2$

Opposite

To graph

$y = x^3 + 5$ — up ✓

$y = x^3 - 5$ — down ✓

$y = (x+5)^3$ — Left ✓

$y = (x-5)^3$ — Right ✓

G.C.

Always put in basic function first then formula

$y = x^2 - 7$ — Down

$y = (x-7)^2$ — Right

$y = (x+7)^2$ — Left

$y = x^2 + 7$ — UP

vertical compression

$\frac{1}{4}x^2$ — wide

$-x^2$ — flip

x^2 → move up

(left move)

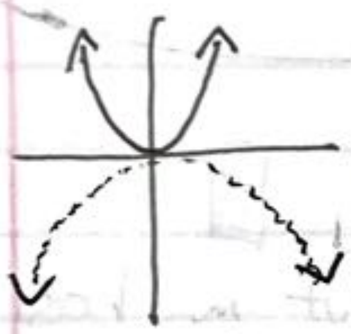
Sketch the basic function using a solid line and the $\boxed{\text{transformed}}$ function using a dotted line. and describe with words

reflection over x-axis

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

vertically compressed by a factor of $\frac{1}{3}$

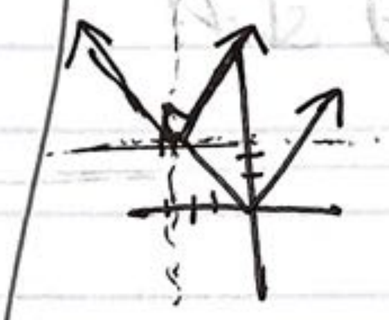
Negative Vertical compression?



left 3 units

up 2 units

$$y = |x+3| + 2$$



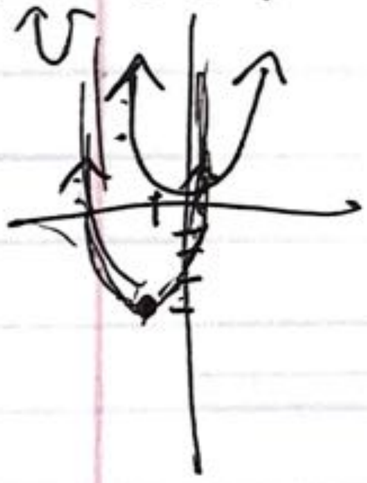
left 1 unit

down four

$$f(x) = 2(x+1)^2 - 4$$

vertically stretched by a factor of 2

x^2



Perpendicular $\ominus +1$

$y = mx + b$ Point slope formula

Determine the equation of a line that passes through $(-5, 1)$ and is perpendicular to $y = \frac{1}{4}x + 7$

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

$$y - 1 = -4(x+5)$$

$$= 4x - 20 + 1$$

$$y = -4x - 19$$

Parabola

4.3 Analyzing Quadratic Functions

Oct. 10, 2018
Wednesday

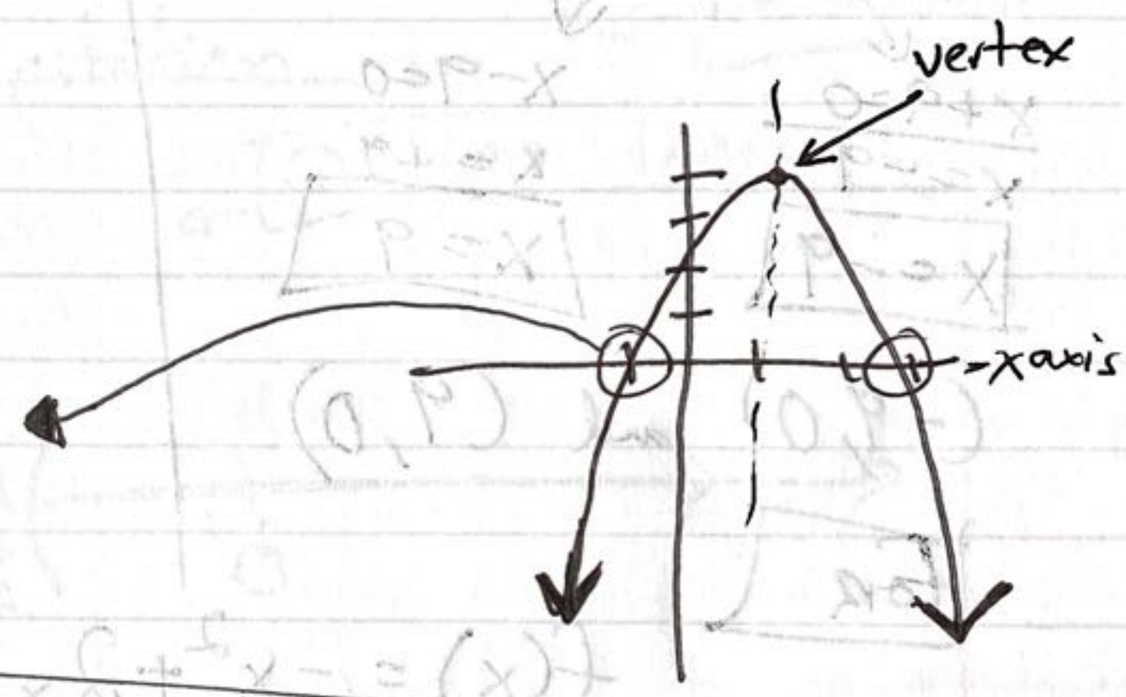
Vertex: the point (x,y) at which the graph turns

- The maximum or minimum value occurs at the vertex (y-axis tic mark)

Axis of symmetry: $x =$ The vertical line passing through the vertex.

Find the vertex: (1, 4)

axis of symmetry: $x = 1$
x-intercepts (s): (-1, 0); (3, 0)
y-intercepts: (0, 3)
maximum: 4



MMU Graphing Calculator

$f(x) = 3x^2 + 12x$

① Is there a MAX OR MIN?
Guessing minimum is ~~11~~ -12
vertex = $\boxed{-1}$

② What is the Max or MIN?

G.C
2nd CALC
3: MIN
4: MAX
Left Bound?
Right Bound?
Enter

$f(x) = 3x^2 + 18x - 4$
= vertex = (-3, 31)
MIN = -31

$f(x) = -x^2 + 10x - 4$
(5, 21)

$\boxed{\text{Max} = 21}$ ← Just the y

List the intercepts:

$y = x^2 - 81$

To get x-intercepts.

$0 = x^2 - 81$

$(x+9)(x-9)$

$x+9=0$
$x=-9$
$\boxed{x=-9}$

$x-9=0$
$x=+9$
$\boxed{x=9}$

$(-9,0)$ and $(9,0)$

To get y intercept

$y = (0)^2 - 81$

$y = 0 - 81$

$y = -81$

$(0,-81)$

$\boxed{\text{For}}$

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

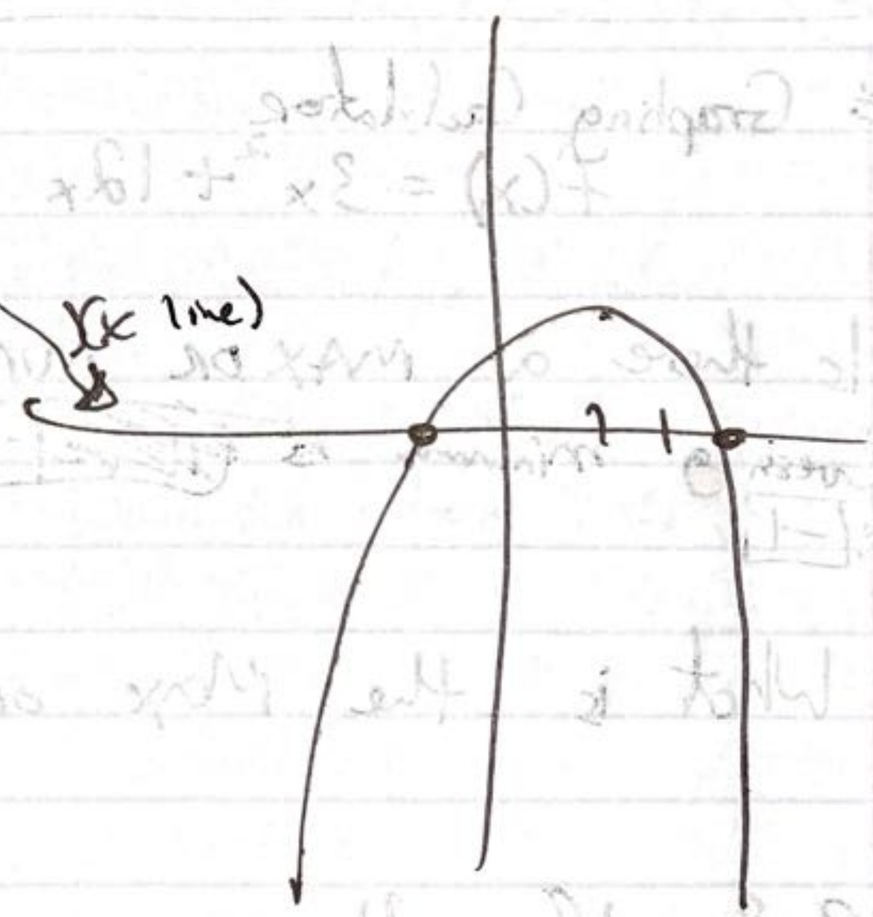
find open ups? down? opens downwar

zeros: $-1, -3$
max: 4
~~min~~:
Vertex: use G.C. $(1,4)$
axis symmetry: 1
Domain: $(-\infty, \infty)$
Range: $(-\infty, 4]$
increase $(-\infty, 1)$
decreasing $(1, \infty)$

} G.C

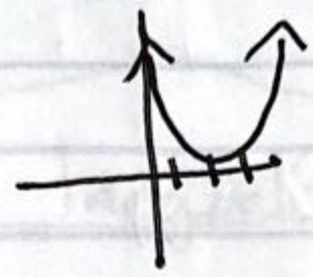
← starts

x = $(-1,0)$ $(3,0)$
y = $(0,3)$



1.) $f(x) = x^2 - 6x + 9$

$(-\infty, 3]$ $[3, \infty)$



ⓐ Opens Up

x line → ⓑ $(3, 0)$ (vertex)

ⓒ axis symmetry → $x = 3$

ⓓ ⓐ x-intercepts = 3

ⓑ y-intercept · 9 ← $\boxed{\text{Table}}$

$\boxed{4.5}$ · SOLVE Put in interval notation ← $\boxed{\text{Pre request}}$

Exception to rule ← $\boxed{\text{Quadratic Inequality}}$ Linear

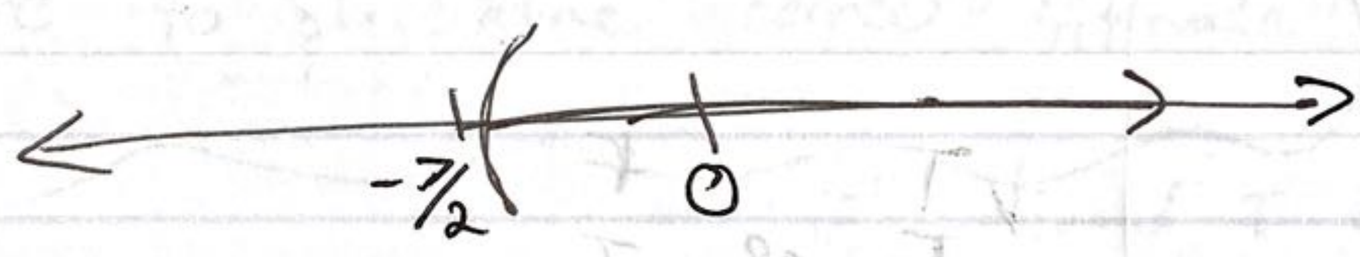
① $-8x - 24 < 4$

$+24 \quad +24$

$\frac{-8x}{-8} < \frac{28}{8}$

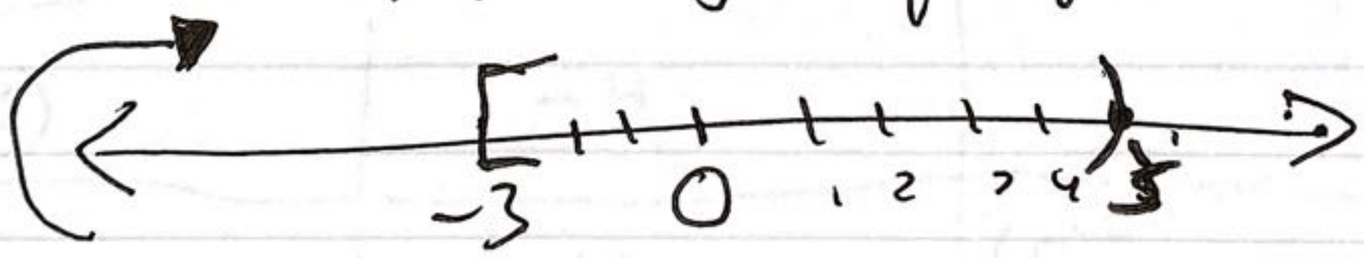
Sign flips with negative

$\boxed{x > -\frac{7}{2}}$



$(-7/2, \infty)$

② Write $[-3, 5)$ using inequality notation



$-3 \le x < 5$

Between Statment

4.5 Quadratic Inequalities

Solving a Polynomial Inequality

1) Set problem equal to zero
2) Get 2 (or 3) answers using:
   - ⓐ Factoring
   - ⓑ Quadratic formula
   - ⓒ Graphing Calc – where graph hits x-axis
3) Identify intervals on number line by using above answers
4) Use a test value to determine correct intervals

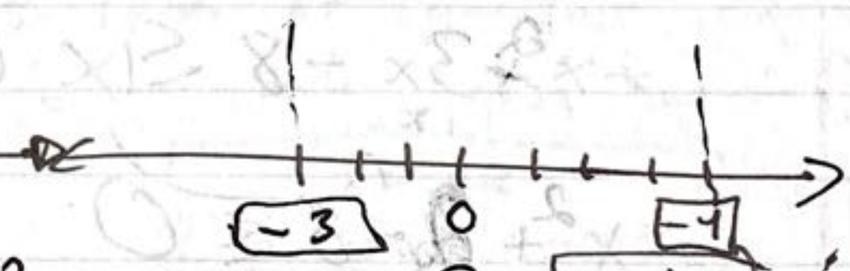
Solve

$x^2 - x - 12 < 0$

$x = -3 \quad x = 4$

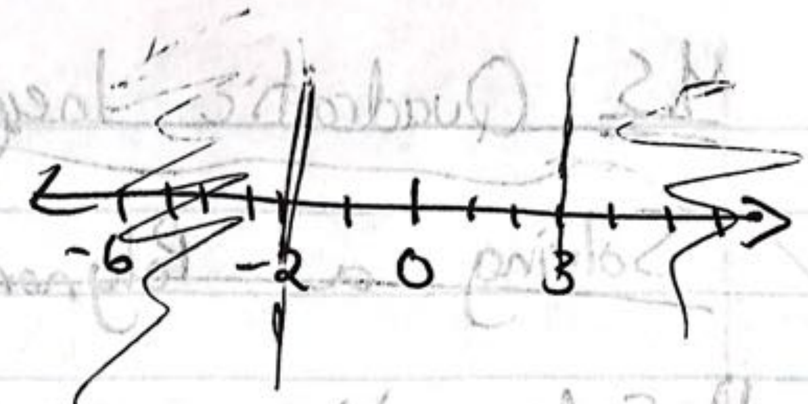
ANS $(-3, 4)$

If 2 correct T use $(\#, \#) \cup (\#, \#)$



Interval	Test Value	Is $x^2 - x - 12 < 0$?	T/F
$(-\infty, -3)$	-4		
$(-3, 4)$	0	$(0)^2 - (0) - 12 < 0$ $-12 < 0$	T
$(4, \infty)$	5	$(5)^2 - (5) - 12 < 0$ $25 - 5 - 12 < 0$ $20 - 12 < 0$ $8 < 0$	F

$x^2 - x - 6 > 0$



$x = -2$ $\quad$ $x = 3$

Interval	Test Value	Solution	
$(-\infty, -2)$	-3	$(-3)^2 - (-3) - 6 = 6 > 0$	T
$(-2, 3)$	0	$-6 > 0$	F
$(3, \infty)$	4	$(4)^2 - (4) - 6 > 0$ $6 > 0$	T

$\boxed{\text{Ans} = (-\infty, -2) \cup (3, \infty)}$

Solve

$x^2 + 3x - 5 \le x + 3$
$\quad -3 \qquad -3$

$x^2 + 3x - 8 \le 1x \; 0$
$\quad 1x$

$x^2 + 2x - 8 \le 0$

$x^2 + 2x - 8 \le 0$

Ans $[-4, 2]$

Interval	Test Value	Solution	
$(-\infty, -4)$		0	
$(-4, 2)$	0	$-8 \le 0$	T
$(2, \infty)$	3	$(3)^2 + 2(3) - 8$ $9 + 6 - 8$ $7 \le 0$	F

5.1 PARTS of a POLYNOMIAL

Oct. 15, 2018
MONDAY

$$p(x) = \underset{\text{coef}}{5}x^4 + \underset{\text{coef}}{3}x^2 + \underset{\text{coef}}{5}x + \underbrace{5}_{\text{constant}}$$

1.) Coefficents? Number sits infront of "x"

2.) Lead Coefficient? 5

3.) How many terms? 4 (the amount of numbers)

4.) Dominating (lead) Term? $5x^4$

5.) Constant Term? 5

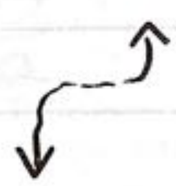
5.1) Polynomial Functions

The end behaviour of a polynomial graph is determined by the dominating term.

→ Term of greatest degree (Term with highest exponent)

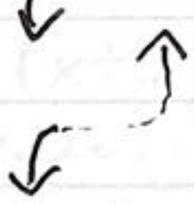
Graphing an odd function

$f(x) = x^3$



$f(x) = x^5$

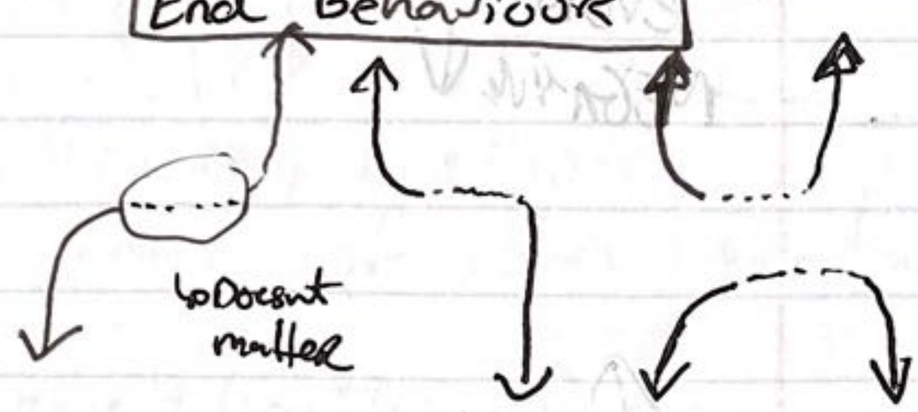
$f(x) = 2x^3$



$f(x) = \boxed{2x^3} - 8x^2 + 9$

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

Describe End Behaviour



example

Graphing an Even function

Describe END Behaviors

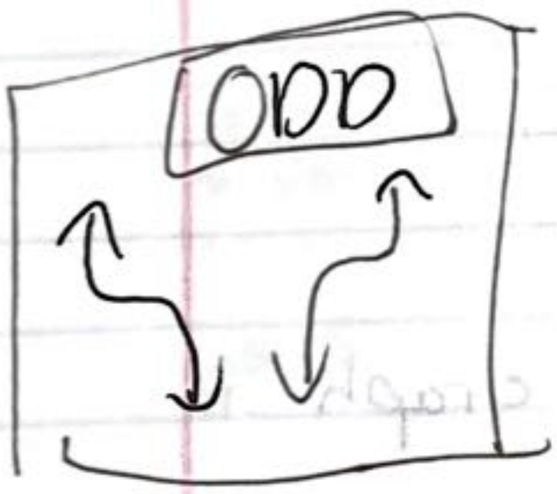
$f(x) = x^2$ ↑↑

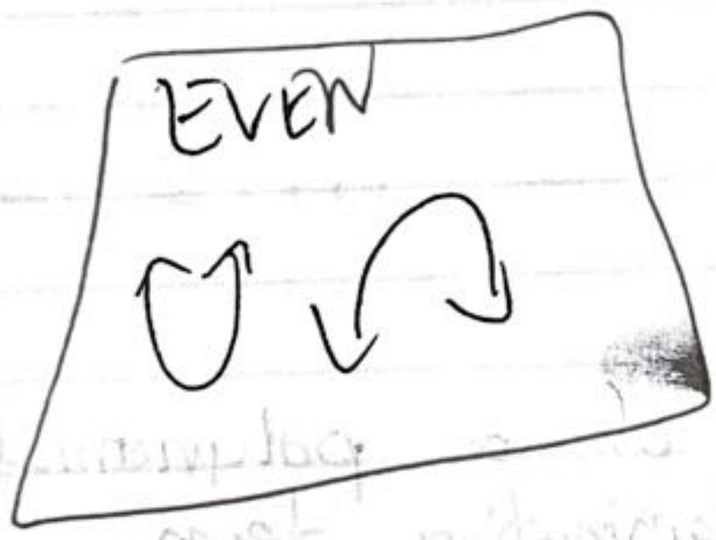
$f(x) = x^4$ ↑↑

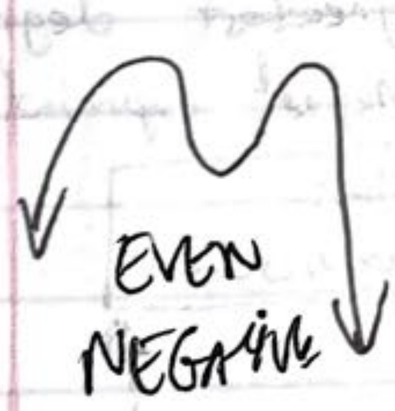
$f(x) = x^6$ ↑↑

$f(x) = -x^6$ ↓↓

$f(x) = \boxed{x^4} + x^3 - 6x^2 - x + 6$ ↑↑







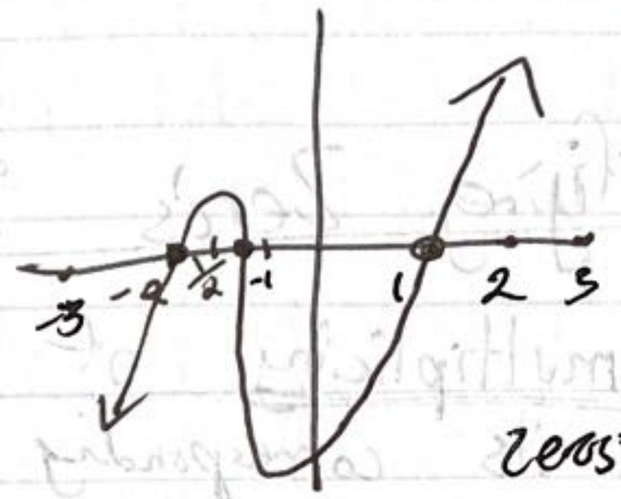
$\boxed{5.1}$

In the graph of a polynomial function, all x-intercepts represents <u>zeros of the function</u>

$f(x) = 2x^3 + 5x^2 - x - 6$

Factored form

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



zeros $= -2, -1\frac{1}{2}, 1$

<u>Find the zeros of this function</u>

How? 2 ways

1) Eye ball the graph

2) Set each factor to zero

$(x-1)\ (2x+3)\ (x+2)$

$x-1=0$ $\quad$ $2x+3=0$ $\quad$ $x+2=0$

$\underline{x=1}$ $\quad$ -3 $\quad$ $\underline{x=-2}$

$\underline{x=-\frac{3}{2}}$

Without graphing - what are the zeros of this function?

$f(x) = x\ (x+2)\ (x-5)$

$x+2=0$ $\quad$ $\underline{x=5}$

0 $\quad$ $\underline{x=-2}$

$\underline{\text{zeros}} = \underline{0, -2, 5}$

$f(x) = -9\ (x-7)(x+1)$

$\underline{x=7}$ $\quad$ $\underline{x=-1}$

$\underline{\text{zeros} = 7, -1}$

$f(x) = -9x(x-7)(x+1)$

Zeros = 0, 7, −1

5.1 Identifying Zero's & Their Mutiples

The multiplicity of a zero is the number of times its corresponding factor occurs.

$f(x) = 5x^2(x+2)(x-\frac{1}{4})^4$

Zero of 0 with mutplicity of 2.
Zero of −2 with " " 1
Zero of $\frac{1}{4}$ " " 4

Zeros:
$0, 0, -2, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}$

If R is a real zero of even multpilicity, then the graph touches the x-axis at R.

$f(x) = x^2(x-5)$
zero = 0, 5 ← will cross at 5

$f(x) = x^1(x+3)^2$
0 @ cross ← touch at −3

A zero of odd multiplying crosses the x-axis

How do you work this? | H.W

Oct. 17, 2018
Wednesday

$f(x) = x^2 + 4x$

VERTEX = $(-2, -4)$ ← Graphing calculator

The axis of the symmetry? $x = -2$

MIN: -4

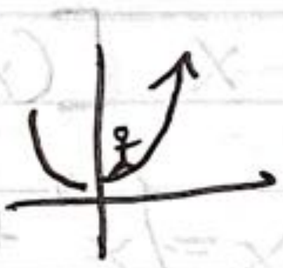
The x-intercepts? $0, -4$

The y intercepts? 0

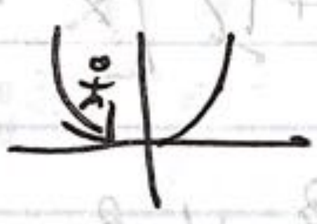
Domain: $(-\infty, \infty)$

Range: $[-4, \infty)$

Increasing: (means all x lines axis) $(-2, \infty)$



Decreasing: $(-\infty, -2)$



The zero's of a function are $0, 2, -5$.

Form a polynomial function of degree 3. means there are 3 x's

(Reverse)

Polynomial Form → $f(x) = \overset{0}{x}\left[(x-\overset{2}{2})(x+\overset{5}{5})\right]$ ← Factored form

FOIL

$= (x-2)(x+5)$

$= x[x^2 + 5x - 2x - 10]$

$= x(x^2 + 3x - 10$

$$\boxed{f(x) = x^3 + 3x^2 - 10x}$$

Find a polynomial function of degree 5 with

-1 as a zero of multiplicity of $\underline{3}$

4 as a zero of multiplicity of $\underline{1}$

and 0 as a zero of multipicity of $\underline{1}$.

$-1, -1, -1, 4, 0$

$$f(x) = x\,[(x+1)(x+1)][(x+1)(x-4)]$$

$$x = [x^2 + 2x + 1][x^2 - 3x - 4]$$

$$x\,[x^4 - 3x^3 - 4x^2 + 2x^3 - 6x^2 - 8x + x^2 - 3x - 4]$$

$$[x^4 - x^3 - 9x^2 - 11x - 4]$$

$$f(x) = x^5 - x^4 - 9x^3 - 11x^2 - 4x$$

ON G.P.C

$\frac{3}{0}$ = undefined
No solution

ξ 0 = ERROR

§2 Rational Functions

Reciprocal Function

$f(x) = \frac{1}{x}$

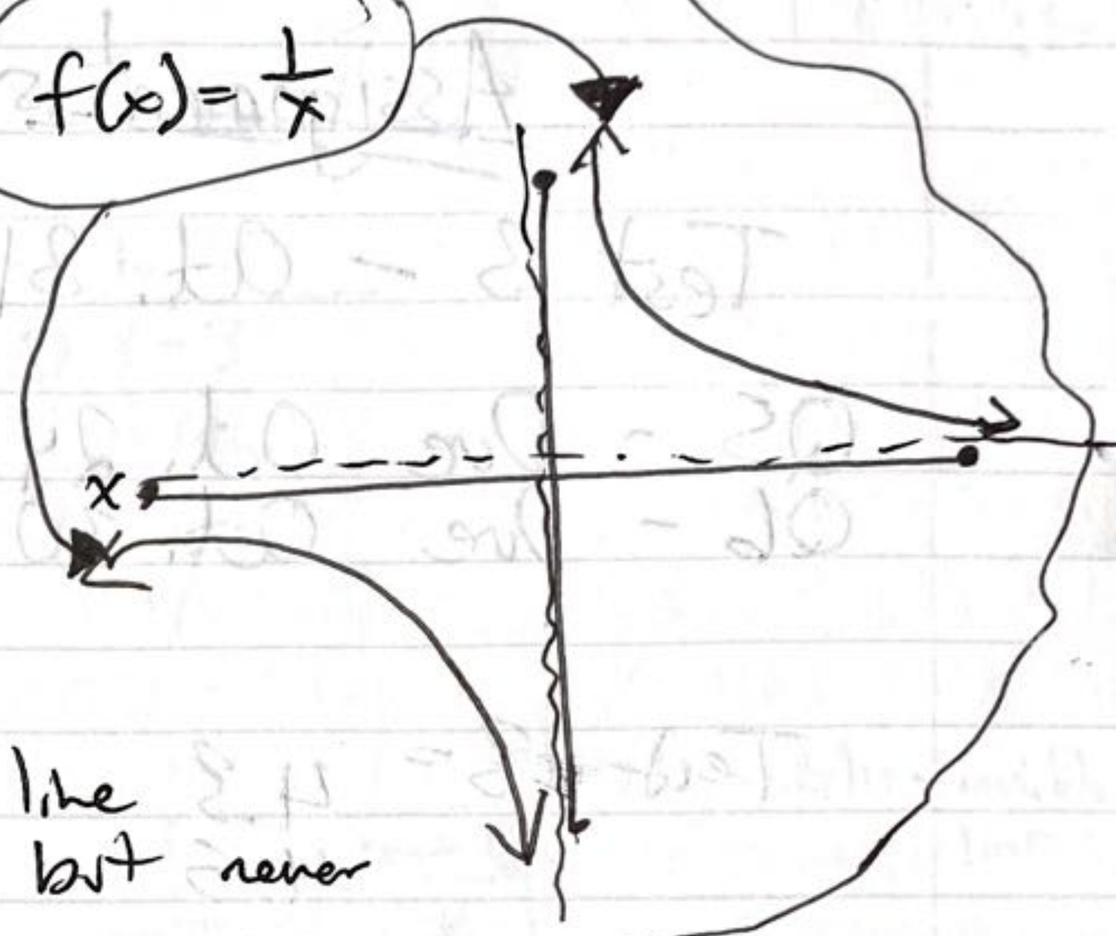
(Interval notation) (Inequality notation)

Domain : $(-\infty, 0) \cup (0, \infty)$ $\{x \mid x \neq 0\}$

Range : $(-\infty, 0) \cup (0, \infty)$ $\{y \mid y \neq 0\}$

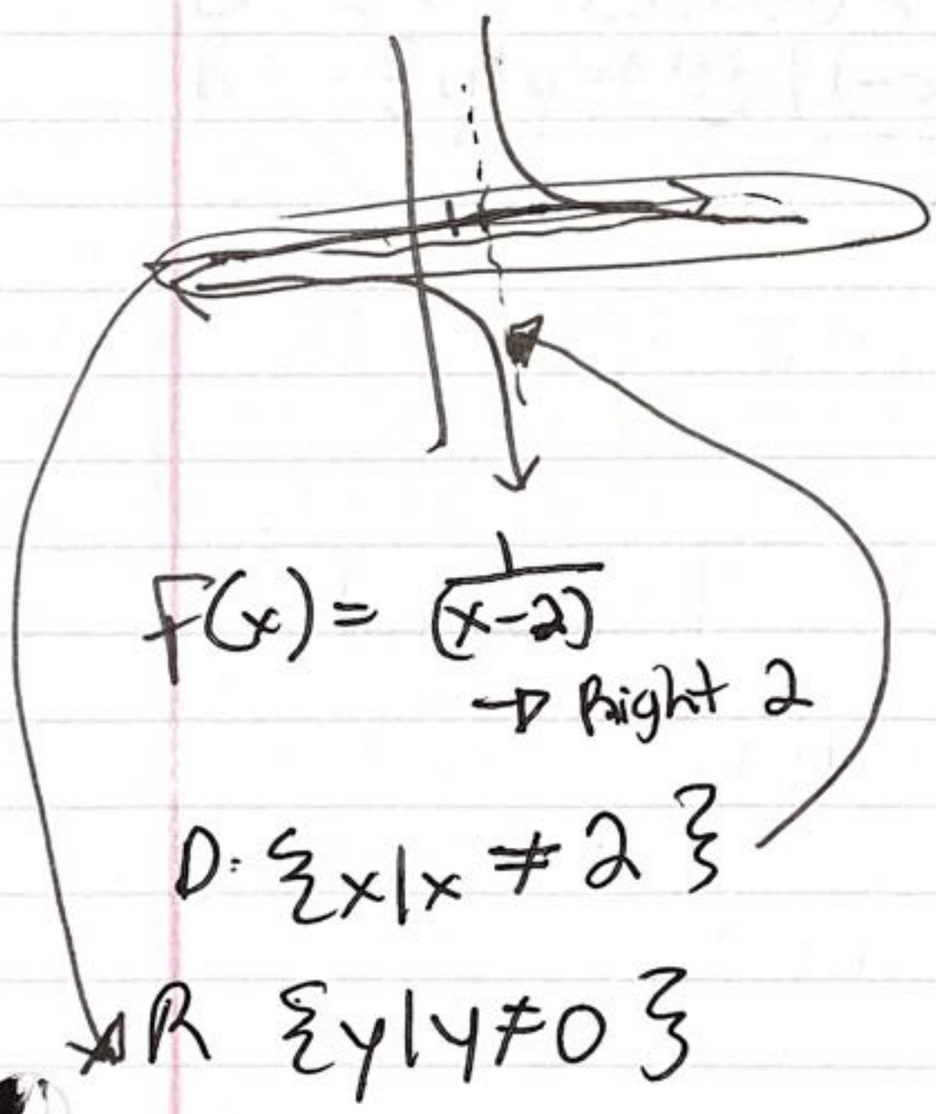
Vertical Asymptote $x = 0$

Horizontal Asymptote $y = 0$



Asymptote – the invisible line the graph approaches but never touches.

Give the domain & range of these graphs.



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

→ Right 2

D: $\{x \mid x \neq 2\}$

R $\{y \mid y \neq 0\}$

F

Review #10

Oct. 22, 2018
Monday

Form a Polynomial with:
zeros $= \underbrace{-3, 0, 6}_{\text{Basically Y's}}$ degree $=3$

on Table

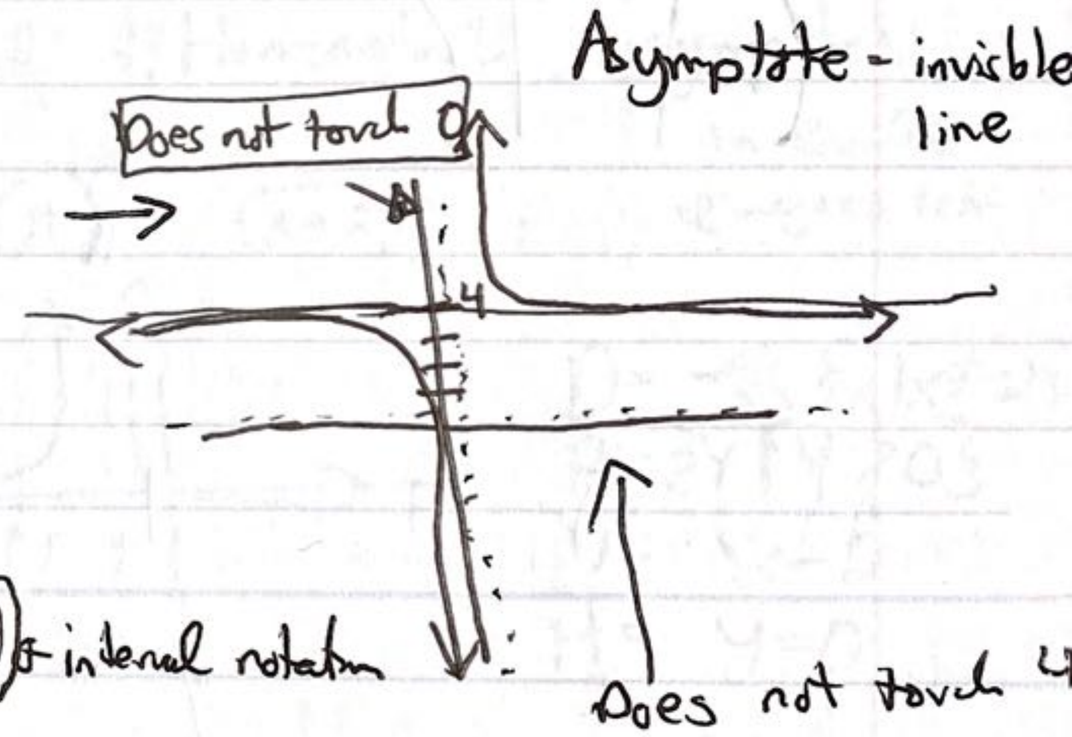
0	-3
0	0
0	6

$f(x) = x(x+3)(x-6)$

$= x[x^2 - 6x + 3x - 18]$
$= x[x^2 - 3x - 18]$
$= x^3 - 3x^2 - 18x$

5.2

$f(x) = \left(\frac{1}{x}\right) + 4$ $\boxed{\uparrow \text{ moved up}}$



D: $\{x \mid x \neq 0\}$
R: $\{y \mid y \neq 4\}$ $\boxed{(-\infty, 4) \cup (4, \infty)}$ ← interval notation

Rational Function - 5.2

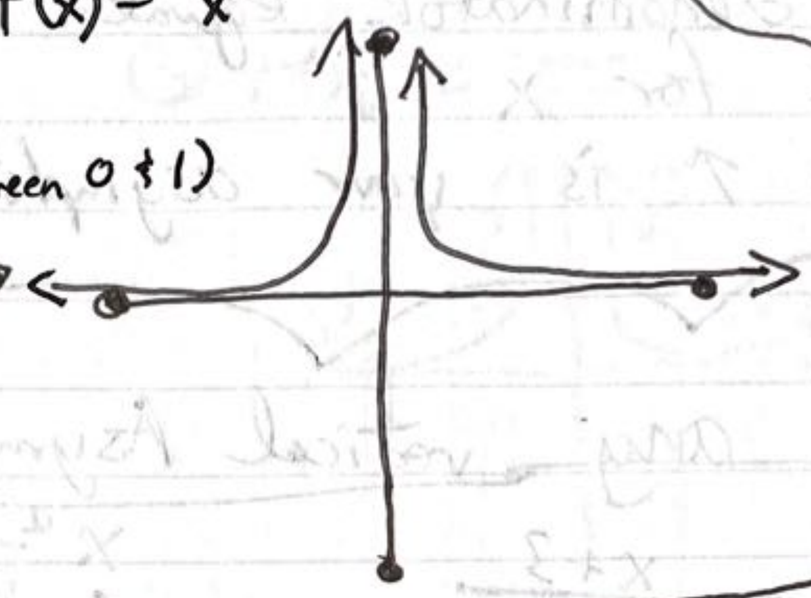
Oct. 22, 2018
Monday

Domain : $\{x \mid x \neq 0\}$
Range : $\{y \mid y > 0\}$

Vertical Asympote : $x = 0$
Horizontal Asympote : $y = 0$

$f(x) = \frac{1}{x^2}$

(Between 0 & 1)

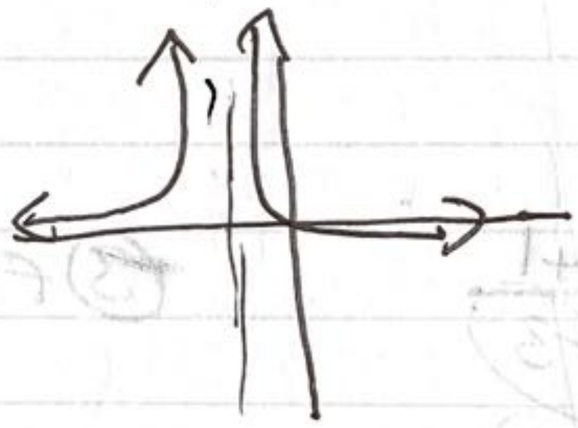


* Graph, give domain & range & vertical & Horizontal asymptotes.

① $f(x) = \left(\frac{1}{x^2}\right) - 5$

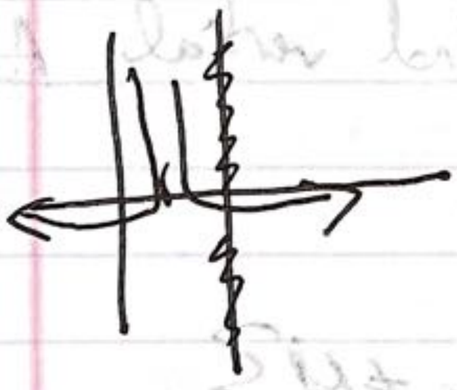
② $f(x) = \frac{1}{(x+2)^2}$

In Brackets
← goes left



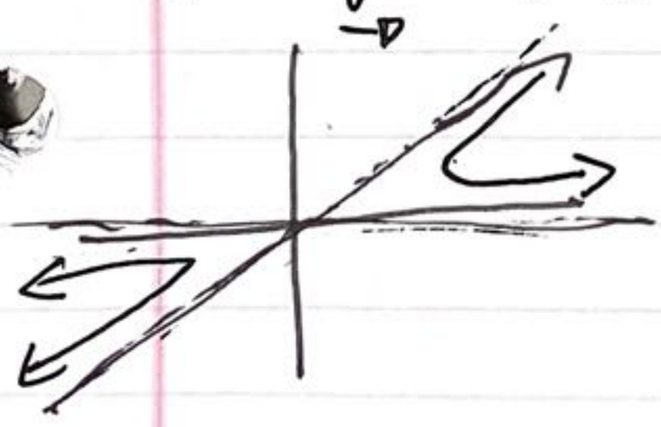
D = $\{x \mid x \neq -2\}$
R = $\{y \mid y > 0\}$
V = $x = -2$
H = $y = 0$

Graph
$R(x) = \frac{1}{(x-1)^2}$ opposite in domain



D - $\{x \mid x \neq +1\}$
R - $\{y \mid y > 0\}$
V - $x = +1$
H - $y = 0$
O.A = None
↳ $\boxed{\text{will be always none}}$

Oblique Asymptote



H.A = $y = 0$
OB. $y = mx + b$ - (slope)

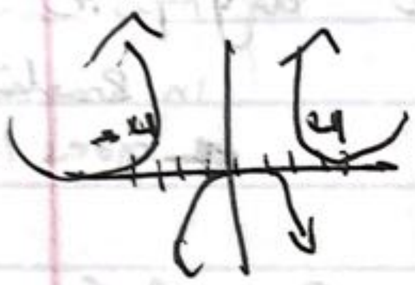
How to find a vertical asymptote without graphing.

1) Set denominator equal to zero.
2) Solve for x
3) This ↑ is your asymptote

Find any vertical Asymptotes.

① $f(x) = \frac{x+3}{x^2-16}$

$x^2 - 16 = 0$
$(x+4)(x-4) = 0$
$x = -4 \quad x = 4$



T-table = G.P.C ±4, ERROR.

② $f(x) = \frac{2x+1}{x-3}$

$x - 3 = 0$
$+3 = +3$
$x = 3$ = ERROR

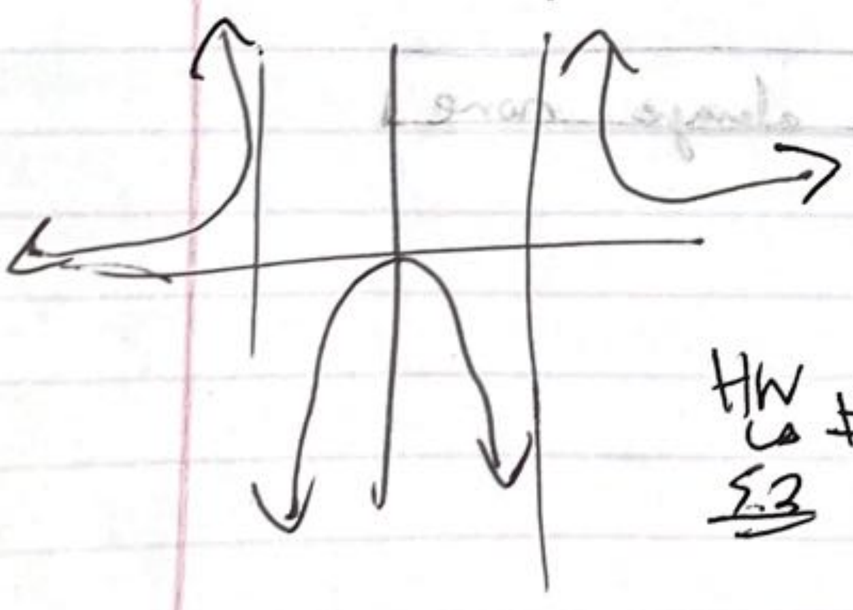
③ $f(x) = 3x - 4$
$2x - 1$

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

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

Find the domain of Hint: find vertical Asymptotes

$f(x) = \frac{1}{x^2 - x - 12}$



Domain = $\{x \mid x \neq -3, x \neq 4\}$

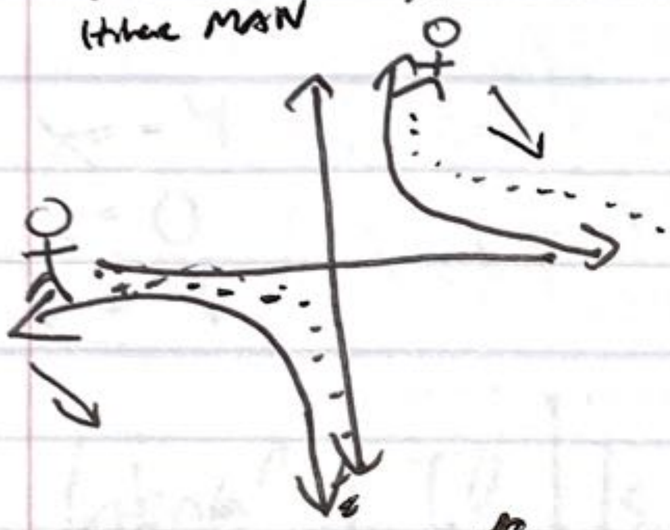
Range

HW 5.3 #8 Vertical = $x = -3, 4$

1) Over what interval is the graph increasing, decreasing OR constant.

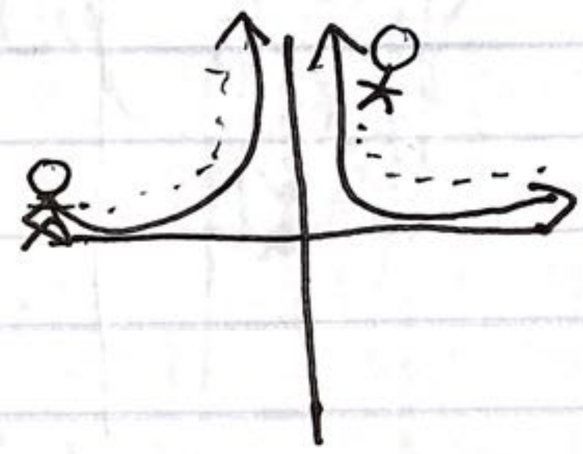
ⓐ $f(x) = \frac{1}{x}$

(Hike MAN



Decreasing = $(-\infty, 0), (0, \infty)$

ⓑ $f(x) = \frac{1}{x^2}$



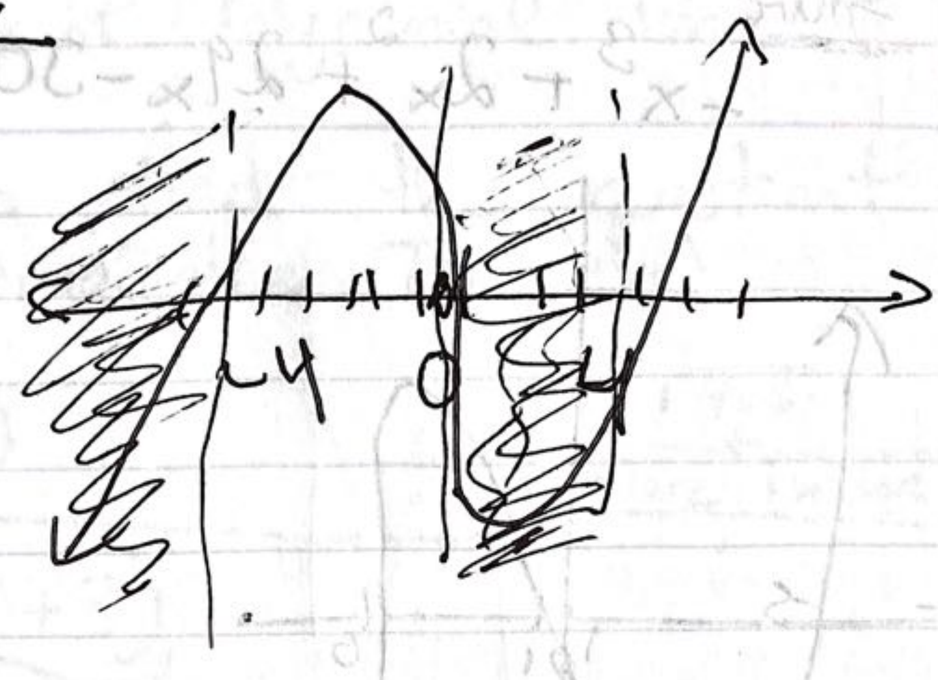
Inc: $(-\infty, 0)$
Dec: $(0, \infty)$

x^3 or x^4

5.4 Polynomial Inequalities

Solve $x^3 - 16x \le 0$

use G.C.



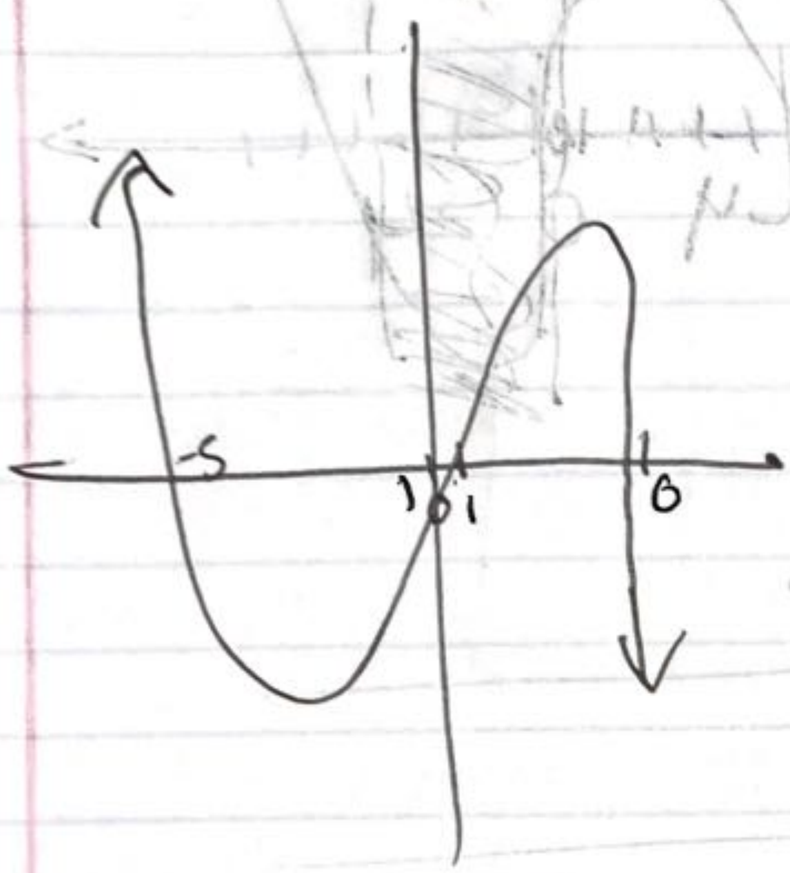
$x = -4$
$x = 0$
$x = 4$

Interval	T.V.	Is $x^3 - 16x \le 0$ T/F?
$(-\infty, -4]$	-5	T
$[-4, 0]$	-1	F
$[0, 4]$	1	$(\ )^3 - 16(1) \le 0$ $1 - 16 \le 0$ $-15 \le 0$ T
$[4, \infty)$	5	$(5)^3 - 16(5) \le 0$ $125 - 80 \le 0$ $45 \le 0$ F

Ans = $(-\infty, 4] \cup [0, 4]$

Solve

$$-x^3+2x^2+29x-30<0$$



A) $(-5,1)\cup(6,\infty)$

~~B) $(6,\infty)$~~

C) $(-\infty,-5)\cup(1,6)$

~~D) $[-5,1]\cup[6,\infty)$~~

Int	TV
$(-\infty,-5)$	-6
$(-5,+1)$	0
$(1,6)$	2
$(6,\infty)$	7

$-x^3+2x^2+29x-30<0$

$(0)^3+2(0)^2+29(0)-30<0$ $\quad -30$ $\quad$ T

F

T

(A) $(-5,1)\cup(6,\infty)$

Oct. 24, 2018

5.5 Synthetic Divison & Zeros of Polynomial Functions

Use Synthetic division to find the quotient and remainder (the Remainder Theorem)

$$(2x^3 + 7x^2 - 5) \div (x+3)$$

$x^3 \quad x^2 \quad x \quad c$

$3 \overline{)405}$ Place holder

$$(2x^3 + 7x^2 + 0x - 5) \div (x+3)$$

$x^3 \quad x^2 \quad x \quad c$

Add vertically

-3	2	7	0	-5
		-6	-3	9
	2	1	-3	4

Last digit is Remainder.

when putting in form it will always be 1 less

$2x^2 + 1x - 3$ Rem 4

Quotient

Remainder

Check $(x+3)(2x^2+x-3) \quad +4$ ← add Last

$2x^3 + x^2 - 3x + 6x^2 + 3x - 9 \quad +4$

$\boxed{2x^3 + 7x^2 - 5}$ $\boxed{\text{checks out!}}$

Use Synthetic Division to find the quotient and remainder.

$(x^3 - 7x^2 + 13x + 3) \div (x-2)$

add

$+2 \,\big|\; 1 \;\; -7 \;\; +13 \;\; +3$

$\downarrow \;\; 2 \;\; -10 \;\; 6$

$1 \;\; -5 \;\; 3 \;\; \boxed{9}$ → Remainder

Remember -1x one x less

↳ $1x^2 - 5x^1 - 3$ Rem: 9

$(x^3 - 3x + 10) \div (x-2)$

$2 \,\big|\; 1 \;\; -3 \;\; +10$

$\downarrow \;\; 2 \;\; -2$

$1 \;\; -1 \;\; \boxed{+8}$

$x^2 - 1x$

$(x^3 - 3x + 10) \div (x-2)$

$x^3 \;\; x^2 \;\; x \;\; c$

$2 \,\big|\; 1 \;\; 0 \;\; -3 \;\; +10$

$\cdot \;\; 2$

$1 \;\; 2 \;\; 1 \;\; \boxed{12}$

$x^2 + 2x + 1$ · $\boxed{\text{REM. } 12}$

Oct. 24, 2018
WEDNESDAY

Use Synthetic division to determine whether the numbers are zeros of the polynomial
-4, 2

If you get a remainder of zero, then the number you divided by is zero.

$f(x) = 3x^3 + 11x^2 - 2x + 8$

-4 | 3 +11 -2 +8
↓ -12 4 -8
3 -1 2 | 0

-4) 3 +11 -2 +8
↓ -12 4 -8
3 -1 2 | 0

Yes -4 is a zero of $f(x)$

2) 3 +11 -2 +8
↓ 6 34 64
3 17 32 | 72

NO, 2 is not a zero of $f(x)$

Remainder

5.5 #8 -4 is a zero b/c $f(-4) = 0$
2 is not a zero b/c $f(2) = 72$

"The factor Theorem" says if you get a remainder of zero then $(x+4)$ or $(x-2)$ are a factor of the function

Yes a factor of $f(x)$

No, Not a factor of $f(x)$

2, -1

$g(x) = x^4 - 6x^3 + x^2 + 24x - 20$

2)

1	-6	+1	+24	-20
↓	2	-8	-14	20
1	-4	-7	10	0

Yes 2 is a zero
OR $(x-2)$ is a factor

-1)

1	-6	1	24	-20
	-1	7	-8	-16
1	-7	8	16	-36

No -1 is not a factor
or $(x+1)$ is not a factor

Find all the zeros of the given function, then write the function in factored form

$f(x) = x^3 - 8x^2 - 31x - 22$

use G.C
- zoom out
- T - Table

-2, -1, 11 → Put in factored form

$f(x) = (x+2)(x+1)(x-11)$ ✓ done

means this one has sim non-real zero's

S.5 #4 Find the real zeros.

$f(x) = x^4 - x^3 + 2x^2 - 4x - 8 = 0$

3 ways

Is $(x+3)$ a factor of $f(x) = -4x^3 + 5x^2 + 8$?

Use factor Theorem →

~~zero: 3~~

Is $(x+3)$ a factor of

$f(x) = -4x^3 + 5x^2 + 8$?

3 ways

Use factor Theorem (Substitution – to see if it resets to/is zero)

G.C	Synthetic Division	Plug $f(-3)$ into $f()$
NO	$-3 \mid -4 \quad 5 \quad 0 \quad 8$ $\quad\quad +12 \; -52 \; 156$ $\quad -4 \; 17 \; -51 \mid 164$ NO – -3 is not a zero $(x+3)$ is not a factor	$f(-3) = 4(-3)^3 + 5(-3)^2 + 8)$ $= 4(-27) + 5(9) + 8$ $= 164$ NO b/c it doesn't equal zero

Is $(x-2)$ a factor of

$f(x) = 3x^4 - 6x^3 - 5x + 10$?

2)

3	-6	0	-5	10
↓	6	0	0	-10
3	0	0	5	$\boxed{0}$

Use the Rational Zero Test to find all the potential zero's of the function.

Rational Zeros Test – Your possible zeros.
Look at last constant and lead coefficient

$$\text{Potential factors} = \pm \frac{\text{factors of ending constant}}{\text{factors of Leading coefficent}}$$

List potential zeros:

last constant

$$f(x) = x^3 - 8x^2 - 31x - \underline{22}$$

Lead coefficient

Potential Factors $= \pm \dfrac{\text{factors of leading constant}}{\text{factors of leading coefficient}}$

Ending constant : 22 : 1, 22, 11, 2

factors of lead coefficient : 1 : 1

Potential factors (zeros) $= \pm\frac{1}{1}$ $\pm\frac{22}{1}$ $\pm\frac{11}{1}$ $\pm\frac{2}{1}$

$\boxed{\pm 1}$ $\boxed{\pm 22}$ $\boxed{\pm 11}$ $\boxed{\pm 2}$

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

Ending constant 1 : 1

coefficient = 2 : 1, 2

Potential $= \pm\frac{1}{1}, \frac{1}{2},$

$+1, +\frac{1}{2}$ $\boxed{4 \text{ potential zeros}}$

Sample Test

Oct. 29, 2018
Monday

5.6 Complex Zeros

Fundamental Theorem of Algebra

- Irrational and non-real zeros always
  i $\sqrt{}$

OCCUR in pairs, (CONJUGATE PAIRS)

$\boxed{\text{Ex}}$ $7 \oplus 4i$ and $7 \ominus 4i$

$5 \ominus \sqrt{3}$ and $5 \oplus \sqrt{3}$

Suppose that a polynomial of degree 6 $\to x^6$ (6 zeros) has $-2+5i$, $-2i$ and $1-\sqrt{3}$ as three of its zeros. Find the other zeros.

$-2-5i$ $\quad +2i \quad 1+\sqrt{3}$

Suppose a polynomial function of degree 4 has the given zeros. Find the remaining zeros.

1.) $-\sqrt{2}$, -1, $4/5$, $+\sqrt{2}$
$\cancel{+\sqrt{2}}$, $\cancel{+1}$, $\cancel{-4/5}$

2) i, $-3+\sqrt{3}$
$-i$, $-3-\sqrt{3}$

3) 3, 0, $-2i = +2i$
$\cancel{-3}$, $\cancel{-0}$, $+2i$

4) $6-5i$, $-1+\sqrt{7}$
$6+5i$, $-1-\sqrt{7}$

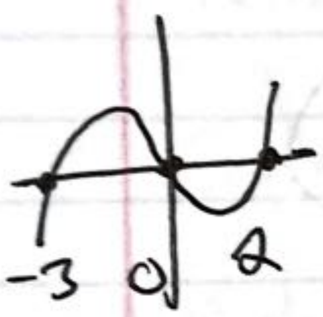
remember $i^2 = -1$

Find a polynomial function of lowest degree that has given as some of its zeros.

$\boxed{-5i,\ 5i}$

$f(x) = (x - -3)(x - 0)(x - 2)$ Goes in front

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



$f(x) = (x - -5i)(x - 5i)$

$(x + 5i)(x - 5i)$

$= x^2 \cancel{- 5ix} \cancel{+ 5ix} - 25i^2$

$= x^2 - 25(-1)$

$f(x) = \underline{\underline{x^2 + 25}}$

Find a polynomial function of lowest degree that has the given zeros.

$2 + i,\ 4$

$(2 - i)$

$f(x) = (x - 4)(x - (2+i))(x - (2-i))$

$= (x - 4)(x + (2+i))(x - (2-i))$

$= x - 4\ [x - 2 - i][x - 2 + i]$ → Triple distribute

$= (x - 4)[x^2 \cancel{- 2x} \cancel{+ ix} - 2x + 4 \cancel{- 2i} \cancel{- ix} \cancel{+ 2} - i^2(-1)]$

$[= x^2 - 4x + 4 - i^2]$

$= (x - 4)[x^2 - 4x + 4 - (-1)]$

$[x^2 - 4x + 5]$ Double distribute

$x^3 - 4x^2 - 5x - 4x^2 + 16x - 20$

$= x^3 - 8x^2 + 21x - 20$

Find a polynomial function of degree 3, having these zeros 1, 3i and -3i

$f(x) = (x-1)(x-3i)(x--3i)$

$(x-1)[x-3i](x+3i)$

$x^2 \cancel{+3ix} \cancel{-3ix} - 9i$

$(x-1)[x^2-9i]$

$-9ix$

$x^3 - \cancel{9ix} - 1x^2 + 9i$

$x^3 - x^2 + 9x - 9$

$(x-1)[(x-3i)(x+3i)]$

$= (x-1)[(x-3i)][(x+3i)]$

$(x-1)[x^2 \cancel{+3ix} \cancel{-3ix} - 9i^2]$

$(x-1)[x^2 - 9(-1)]$

$(x-1) = [x^2+9]$

$x^3 + 9x - x^2 - 9$

6.1 Composition of functions

Nov. 5, 2018
Monday

If f and g are functions, the compositions of f and g is:

$$(f \circ g)(x) = f(g(x))$$

"f composed with" g

Let $\boxed{f(x) = 2x-1}$ $\boxed{g(x) = \frac{4}{x-1}}$

1) Find: $(f \circ g)(2)$

$\boxed{f(g(2))}$

$(f \circ g) = f(g(2))$

1st find

$g(2) = \frac{4}{\boxed{2}-1} = \frac{4}{1} = g(2) = 4$

2nd

$f(4) = 2(4)-1$
$= 8-1$
$f(4) = 7$ ← second answer is final answer

$(f \circ g)(2) = 7$

Ex: The amount a person pays state income tax usually depends on the amt. of adjusted gross income on the federal tax return (Accountant)

2) $(g \circ f)(-3) = g(f(-3))$

1st

$f(-3) = 2(-3)-1$
$= -6-1$
$f(-3) = -7$

2nd

$g(-7) = \frac{4}{-7-1}$
$= \frac{4}{-8}$
$= -\frac{1}{2}$

$f(x) = 2x - 1$ $\qquad$ $(g)(x) = \frac{4}{x-1}$

~~$(f \circ f)(2)$ $\quad f(f(2))$ $\quad f(2)(2) - 1$~~

$(f \circ f)(2) = f(f(2))$ $\qquad$ $f(2) = 2(2) - 1$

$= 4 - 1$

$= 3$

$f(3) = 2(3) - 1$

$= 6 - 1$

$= 5$

Examples

$f(x) = 2x - 5$ $\qquad$ $g(x) = x^2 - 3x + 8$

Rewrite

$(g \circ f)(x) = g(f(x))$

$g(2x-5) = (2x-5)^2 - 3(2x-5) + 8$

$= (2x-5)(2x-5) - 6x + 15 + 18$

$= 4x^2 - 10x - 10x + 25 - 6x + 15 + 8$

ANS $= 4x^2 - 26x + 48$

For $f(x) = x^2$ $\qquad$ $g(x) = x^2 + 7$

Find $(g \circ f)(x) = g(f(x))$ $\qquad$ $f(x^2)$

$g(x^2)$

$= g(x^2) = (x^2)^2 + 7$

ANS $= x^4 + 7$

order of operations

6.1

Given $\boxed{f(x) = 5x^2 - 4}$ and $\boxed{g(x) = 6 - \frac{1}{2}x^2}$

find @ $(f \circ g)(4) = f(g(4))$

1st

$g(4) = 6 - \frac{1}{2}(4)^2$

$= 6 - \frac{1}{2}(16)$

$= 6 - 8$

$\boxed{\text{ANS} = -2}$

$f(-2) = 5(-2)^2 - 4$

$= 5(4) - 4$

$= 20 - 4$

$\boxed{\text{ANS} = 16}$

Show that

$(f \circ g)(x) = (g \circ f)(x) = x$ for:

$f(x) = 4x$ $\boxed{g(x = \frac{1}{4}x}$

2nd

Rewrite

$(f \circ g)(x) = f(g(x))$

$= f(\frac{1}{4}x) = 4(\frac{1}{4}x)$

$= x$ (or 1)

$(g \circ f)(x) = g(f(x))$

$g = (4x)$

$= \frac{1}{4}(4x)$

$= x$

$\boxed{6.2}$

6.2 Inverse Functions

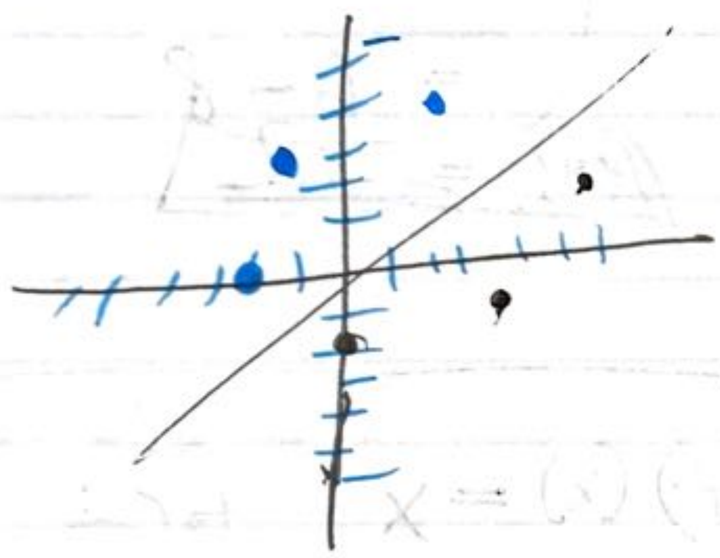
Inverse Relation: Interchanging the 1st & 2nd coordinates of each ordered pair produces the inverse

Find the inverse & then graph it:

Are-Ran.

$g = \{(2,4)\ (1,3)\ (-2,0)\}$

$g^{-1} = \{(4,2)\ (3,-1)\ (0,-2)\}$



Inverses are symmetrical (Mirror image) (to the $y=x$ line

Are $= \boxed{f(x) = 2x - 3}$ and $g(x) = \frac{x+3}{2}$

Inverses of each other?

(Use G.C. and compare T-tables

$Y_1 = x$
$Y_2 = 2x - 3$
$Y_3 = (x+3)/2$

→ Use T-table

$f(x) = 2x - 3$

X	Y
-1	-5 ✓
0	-3 ✓
4	5 ✓

$g(x) = \frac{x+3}{2}$

X	Y
-5	-1 ✓
-3	0 ✓
5	4 ✓

YES ARE INVERSES

6.2

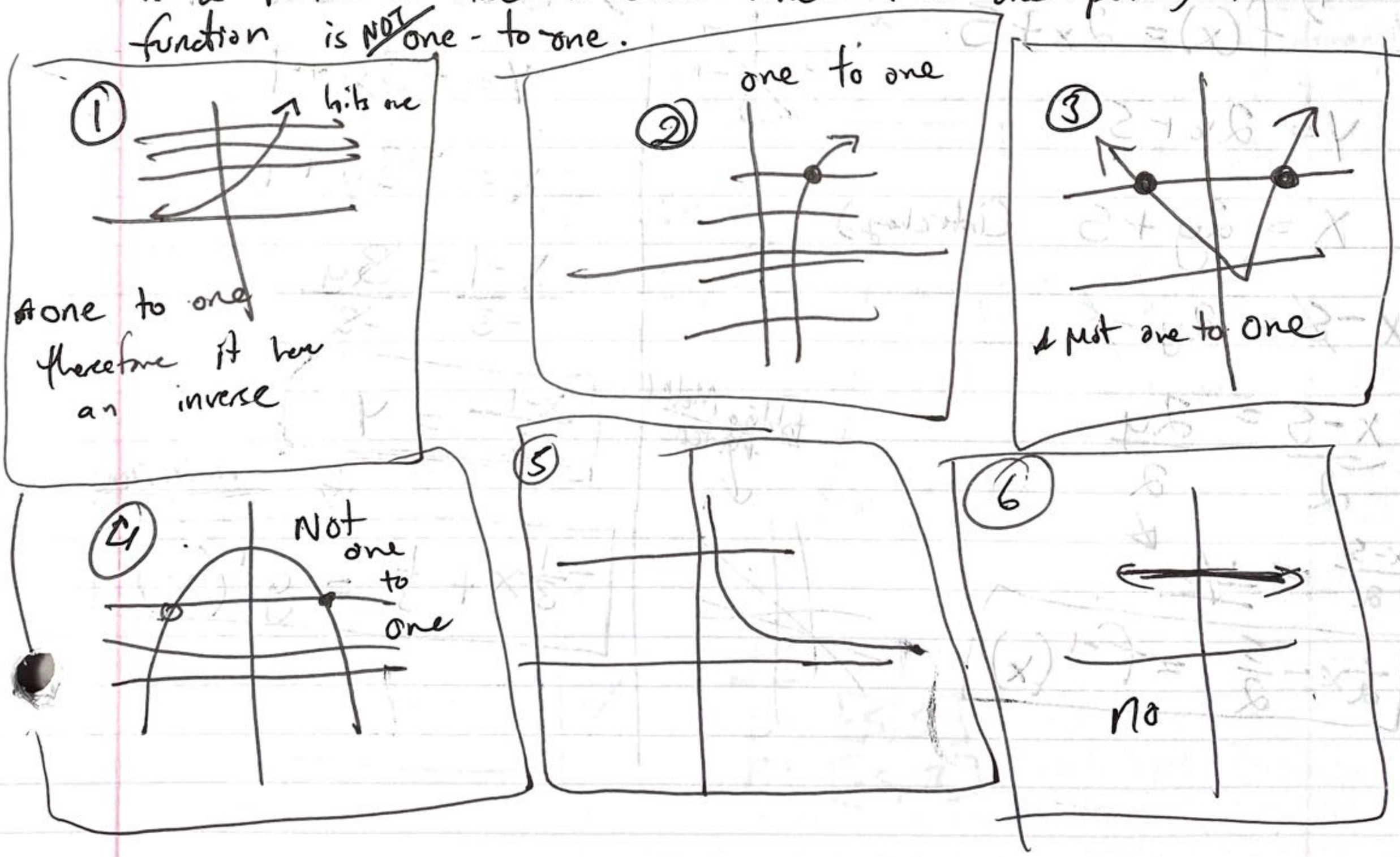
For a function to have an inverse - it **MUST** be one-to-one.

ONE-TO-ONE FUNCTIONS - each x-value corresponds to one y-value and each y-value corresponds to each x-value.

How do we decide if a function is one to one?

Horizontal line Test: If every horizontal line intersects the graph of a function f in at most one point, then f is one to one.

If a horizontal line intersects more than one point, then the function is NOT one-to-one.



6.2 Obtaining the formula for an inverse

1) Replace $f(x)$ with y.
2) Interchange x and y.
3) Solve for y.
4) Replace y with $f^{-1}(x)$.

- If the function is one to one, find the equation of the inverse

---

1) $f(x) = 2x+5$

PA in G.P.C

$y = 2x+5$

$x = 2y+5$ (interchange)

$x - \cancel{5} = 2y - \cancel{5}$

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

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

$\boxed{\frac{1}{2}x - \frac{5}{2} = f^{-1}(x)}$

Folding Method MATLETS

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

$y = -3x+1$

$x = -3y+1$

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

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

NOTATION

$\boxed{-\frac{1}{3}x + \frac{1}{3} = g^{-1}(x)}$

Find the inverse of the following
- Then state the domain & Range of f and f^{-1}

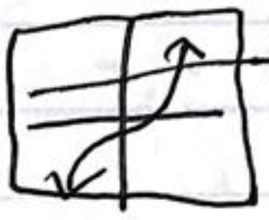
Nov. 7, 2018
Wednesday

① $\boxed{f(x) = x^3 + 1}$

$\boxed{\text{G.P.C}}$ $Y_1 = X^3 + 1$

Passes inverse test

Fn's Domain - All reals



hits once

$Y = x^3 + 1$

$X = y^3 + 1$

$X - 1 = Y^3$ ← Cube Root

$\sqrt[3]{x-1} = \sqrt[3]{y^3}$

$\boxed{\sqrt[3]{x-1} = y}$

$\boxed{\text{Notation} = \sqrt[3]{x-1} = f^{-1}(x)}$

D: $(-\infty, \infty)$
R: $(-\infty, \infty)$

inverse would require flip of answers

② $\boxed{f(x) = 3x - 2}$

Draw the inverse: Then state the domain & Range of f & f^{-1}

$Y = 3x - 2$

$X = 3y - 2$

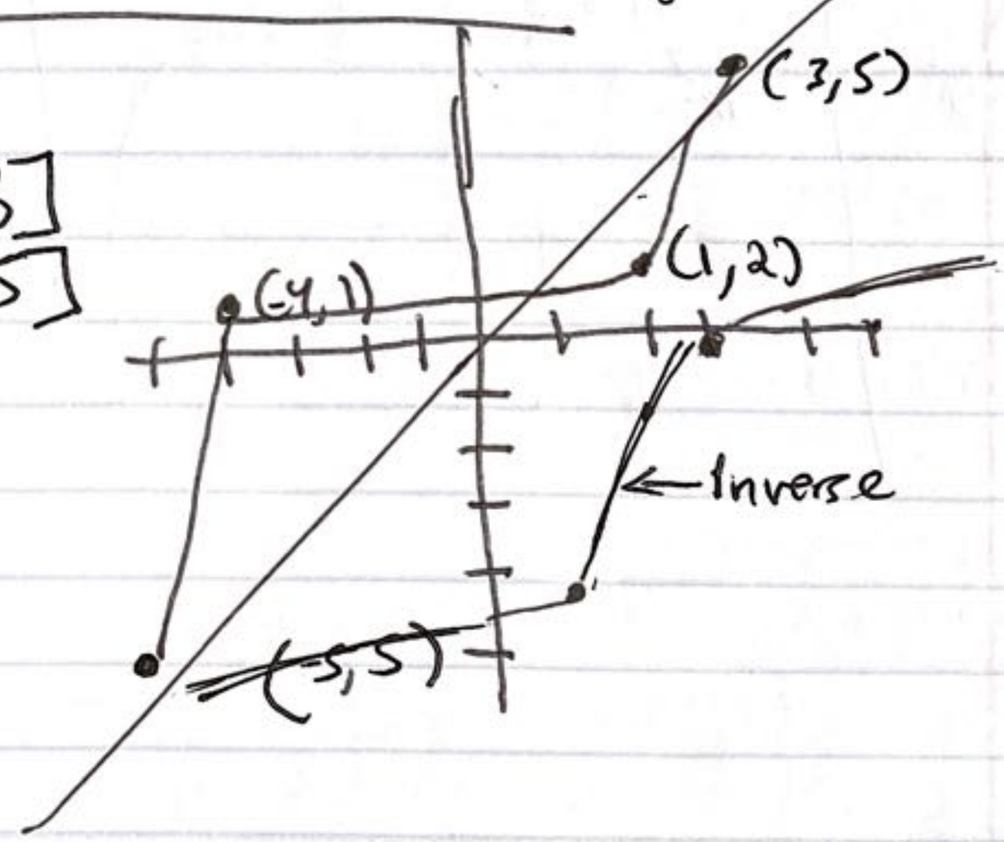
$\frac{x+2}{3} = \frac{3y}{3}$

$\frac{x+2}{3} = Y$

$\boxed{= \frac{1}{3}x + \frac{2}{3} = f^{-1}(x)}$

$\boxed{f^{-1}(x) = \frac{1}{3}x + \frac{2}{3}}$ ✓

f:
D: [-5, 3]
R: [-5, 5]



f^{-1}
D: [-5, 5]
R: [-5, 3]

6.3 Review of Exponent Rules

Nov. 7, 2018
Wednesday

① $3^{-2} = \frac{1}{3^2} = \underline{\underline{\frac{1}{9}}}$

flips and makes positive

② $2^{-4} = \frac{1}{2^4} = \underline{\underline{\frac{1}{16}}}$

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

④ $2^0 = \underline{\underline{1}}$

is always $\underline{\underline{1}}$

⑤ $\left(\frac{1}{3}\right)^0 = 1$

always one $\underline{\underline{1}}$

⑥ $\left(\frac{1}{2}\right)^{-3} = 8$

⑦ $2^4 = 16$

⑧ $2^5 = 32$

6.3 Graphing Exponential Functions

Nov. 7, 2018

Graph $\boxed{f(x) = 2^x}$

X	Y
-3	$\frac{1}{8}$
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8

negative equals fractions

$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

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

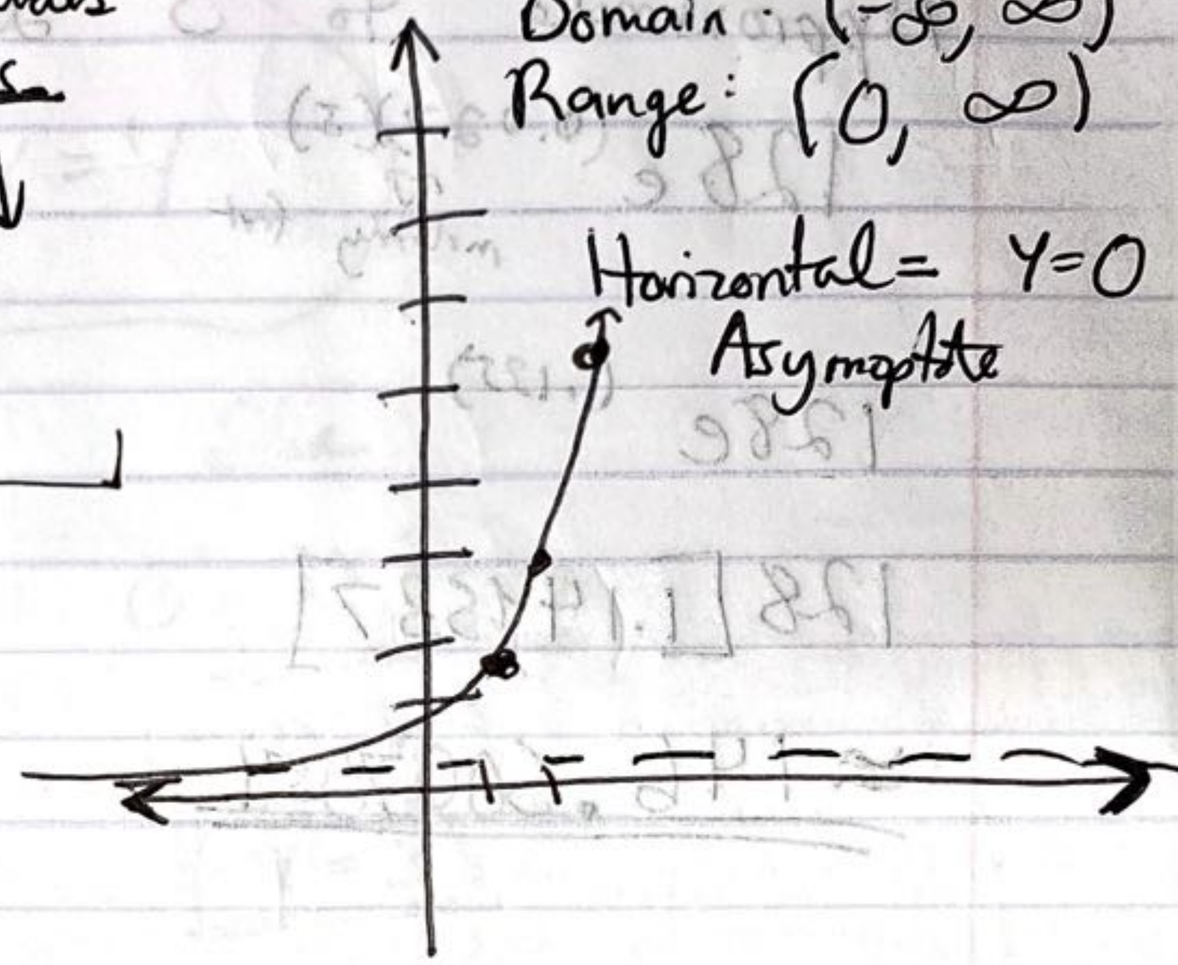
$2^{-1} = \quad = \frac{1}{2}$

$2^0 = 1$

$2^1 = 2$

$2^2 = 4$

$2^3 = 8$



Domain: $(-\infty, \infty)$

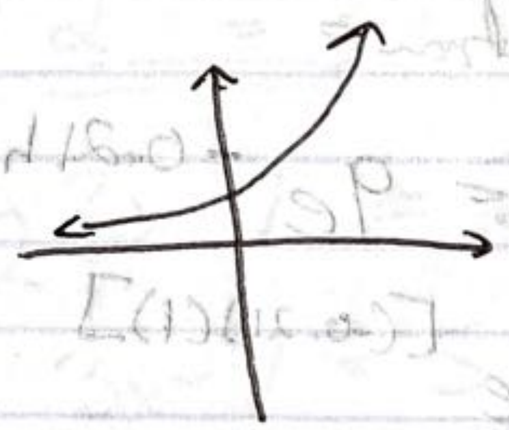
Range: $(0, \infty)$

Horizontal = $Y=0$ Asymptote

Inverse? = YES

BASE FUNCTION

$Y = 2^x$



Graph

① $Y = 2^x + 1$

$\boxed{\text{up} \uparrow 1}$

② $Y = 2^x - 5$

$\boxed{\text{down} \downarrow 5}$

③ $Y = 2^{x+3}$

$\boxed{\text{Left 3 units}}$

upper power means left/Right

④ $Y = 2^{x-4}$

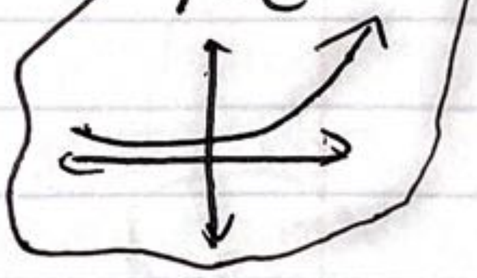
$\boxed{\text{Right 4 units}}$

$Y = e^{-x}$ ← means flips over y access

$Y = -e^x$ ← flip over x access

BASE FUNCTION

$Y = e^x$



$\boxed{e = \text{used in economics \& nature}}$

$e = 2.71828$

Approximate to 3 decimals

$128e^{(0.027)(5)}$

multiply first

$128e^{(.135)}$

$128[1.144537]$

≈ 146.5007084

Practice:

$e^3 = 20.086$

Example

The function =

$D(h) = 9e^{-0.21h}$

Hours

$D(1) = 9e^{[(-0.21)(1)]}$

$= 9[.81058...]$

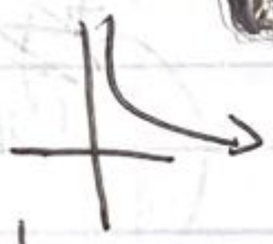
$= 7.30$ milligrams

$D(5) = 9e^{[(-0.21)(8)]}$

$= \underline{1.68}$ milligrams (mg)

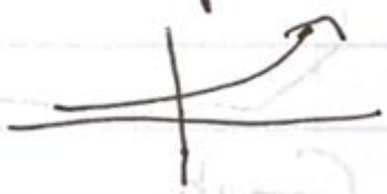
$\boxed{\text{Which is increasing?}}$

$f(x) = (\frac{1}{4})^x$ No



$f(x) = 0.8^x$

$f(x) = (\frac{6}{5})^x$



$f(x) = 0.4^x$

6.3 Exponential Equations

Base → 2^{Exponent}

Base - Exponent Property

$a^x = a^y$ then $x = y$

Solve

① $2^x = 2^4$

Same Base

$x = 4$

GOAL:

Get bases the same

Solve

② $3^x = 27$

$3^x = 3^3$

$\boxed{x = 3}$

④ $3^{8-2x} = 3^4$

$8 - 2x = 4$

$-8 \quad -8$

Same Base

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

$\boxed{x = 2}$

⑤ $2^{3x-7} = 32$

$2^{3x-7} = 2^5$

$3x - 7 = 5$

$+7 \quad +7$

$3x = 5 + 7$

$\frac{3x}{3} = \frac{12}{3}$

$\boxed{x = 4}$

⑥ $5^{x+3} = \frac{1}{5}$

$5^{x+3} = 5^{-1}$

$x + 3 = -1 - 3$

$x = -1 - 3 = (-4)$

⑦ $3^{2x+1} = 243$

$3^{2x+1} = 3^5$

$2x + 1 = 5$

$2x = 5 - 1$

$\frac{2x}{2} = \frac{4}{2}$

$\boxed{x = 2}$

6.4 Logarithmic Function & Graphs

Nov. 12, 2018 (Monday)

The inverse of an exponential function is a log function

LOGARITHM

$\log_a x = y$ if and only if $a^y = x$

A logarithm is an exponent and you must be able to switch back & forth between them.

$\log_2 8 = 3$ $\quad$ $2^3 = 8$

LOGARITHM FORM	Exponential Form
$\log_3 81 = 4$	$3^4 = 81$
$\log_{1/2} 16 = -4$	$\frac{1}{2}^{-4} = 16$
$\log_{10} 100{,}000 = 5$	$10^5 = 100{,}000$
$\log_3 \frac{1}{81} = -4$	$3^{-4} = \frac{1}{81}$
$\log_5 1 = 0$	$5^0 = 1$

Exponential Form	LOGARITHMIC Form
$2^5 = 32$	$\log_2 32 = 5$
$3^{-3} = \frac{1}{27}$	$\log_3 \frac{1}{27} = -3$
$7^2 = 49$	$\log_7 49 = 2$
$9^{\frac{1}{2}} = 3$	$\log_9 3 = \frac{1}{2}$

64 Solve a logarmthic Equation

* Convert to exponential form

Solve	
$\log_3 9 = x$	$\log_5 25$ (can insert $= x$)
$3^x = 9$	$5^x = 25$
$3^x = 3^2$ $\boxed{x=2}$	$5^x = 5^2$ $\boxed{x=2}$
$\log_3 x = -2$	$\log_4 x = 3$
$3^{-2} = x$	$4^3 = x$
$\frac{1}{3^2} = x$ $\boxed{x = \frac{1}{9}}$	$\boxed{64 = x}$
$\log_x 16 = 4$	$\log_2 (x-7) = 1$
$x^4 = 16$ $\boxed{x=2}$	$2^1 = x-7$
$\log_5 (8-7x) = 3$	$+7 = x$
$5^3 = 8-7x$	$\boxed{9 = x}$
$125 = 8-7x$	
$-8 \quad -8$	
$\frac{117}{7} = \frac{7x}{7}$	
$-17 = x$	

6.5 Logarithmic Functions & Graphs

You can use the graphing calculator for $\log_{10}$ $\boxed{\text{LOG}}$ Button.

Find using G.C.

$\log_{10} 1000 = 3$

$\log_{10} 5 = .6990$

understood 10

$\log_{10} 10 = 1$

$\log_{10} 100 = 2$

Exponential form

$10^3 = 1000$

$10^{.6990} \approx 5$

$10^1 = 10$

$10^2 = 100$

$\log_{10}$ = called a common logarithm

You can use the GC for Natural Logarithm

$\log_e x = \ln x$ $\boxed{\text{LN}}$ Button

Find Using G.C.

$\ln 2 = .6931$

$\ln 7 = 1.9460$

$\log_e 7 = 1.9460$

$e^{(1.9460)} \approx 7$

6.5 Change of Base Theorem

For any real positive numbers x, a and b

$$\log_a x = \frac{\log_b x}{\log_b a}$$

You will always change the base to $\boxed{\log_{10}}$ or $\boxed{LN}$ because you can use the graphic calculator.

Use the change of Base theorem to find an approximation to four decimal places

$\log_5 17 = \frac{\log_{10} 17}{\log_{10} 5}$ $= 1.7604$ or $\frac{LN\ 17}{LN\ 5} = 1.7604$

$\log_2 0.1 = \frac{\ln 0.1}{\ln 2}$ $= -3.3219$

$\log_4 20 = \frac{\ln 20}{\ln 4}$ $= 2.1610$

G.P.C

MATH A

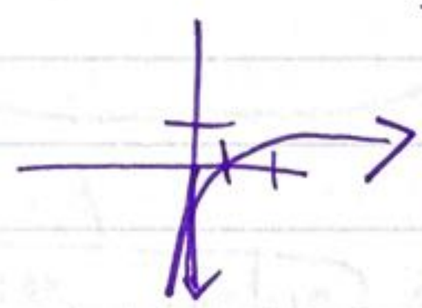
6.5 Graphing a logarithmic function

1.) If its $\boxed{\log_{10}}$ or $\boxed{LN}$ just use G.C

2) If not, use the change of Base Theorem and plug into g.c

Graph

1) $f(x) = \ln x$



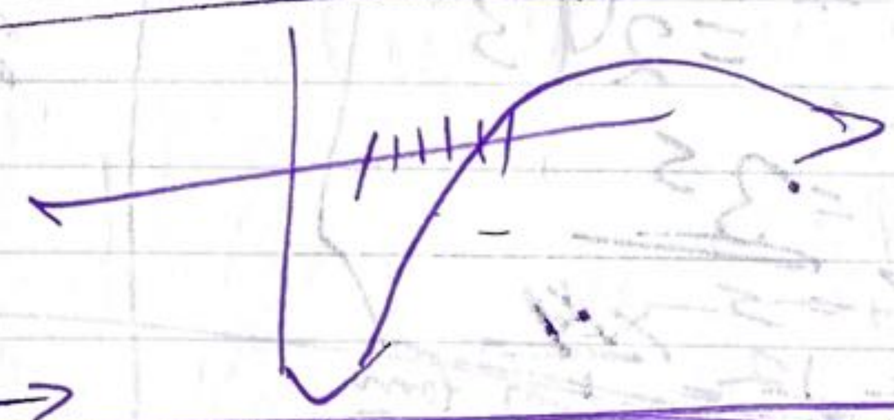
$Y =$

$Y_1 = \ln(x)$

2) $f(x) = \log_5 x = 1.4310$

3) $f(x) = \log_5 (x-4)$

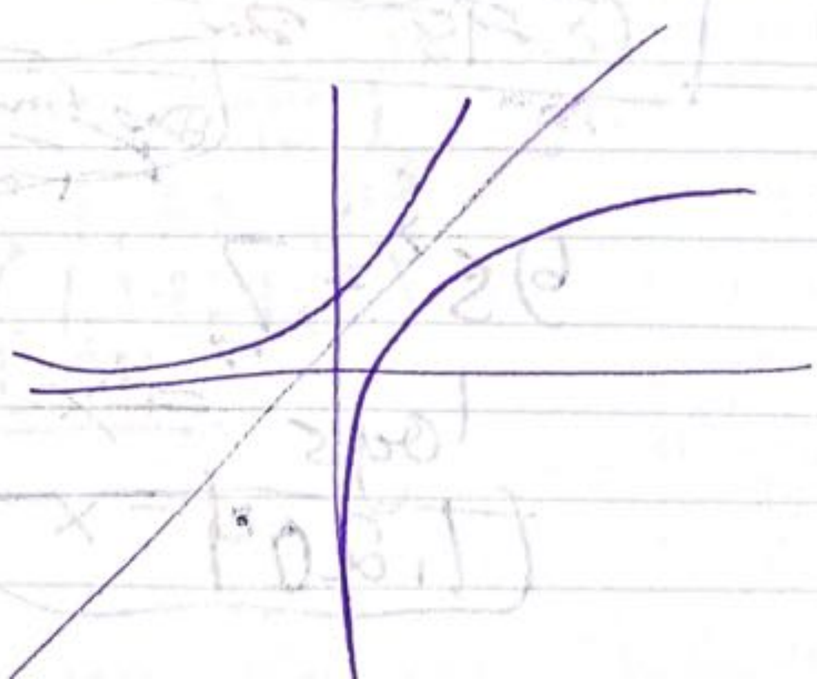
$Y = \dfrac{\ln(x-4)}{\ln 5} \rightarrow$



Graph BOTH

$Y_2 = f^{-1}(x) = \log_2 x$

$Y_1 = f(x) = 2^x$



Solve

in exp form

$5^x = 8$

~~Log form~~

$\log_5 8 = x$ Log form

convert to Log Form

-ve change of base theorem

$2^x = 10$

$\frac{\ln 10}{\ln 2} = x$

$= 3.3220$

Jumbo Gets same base

1.) $3^{3x-7} = 243$

$3^{3x-7} = 3^5$

$3x - 7 = 5$

$3x = 12$

$x = 4$

Log form

Exp Form

2) $\log_2 32 = 5$

$\frac{\ln 32}{\ln 2} = \boxed{5}$ OR $2^x = 32$

$\boxed{x = 5}$

G.P.C

3) $\log_3 x = -3$

$3^{-3} = x$ $= x = \frac{1}{27}$

$\frac{1}{27} =$

Use G.P.C

4) $\log_5 (2x+7) = 2$

$5^2 = 2x + 7$

$25 = 2x + 7$

$-7 \quad -7$

$\frac{18}{2} = \frac{2x}{2}$

$x = 9$

Exp form

Log form

5) $\log_5 17 = x$

$= 1.7604$

6) $5^x = 7$

$\log_5 7 = x$

$1.209 = x$

6.7 Compound Interest Problems

Nov. 14, 2018
Wednesday

Compound Interest Formula

$$A = P \cdot \left(1 + \frac{r}{n}\right)^{nt}$$

A = future Value
P = Present Value
r = annual interest rate ← move 2 decimal places to the LEFT
n = times per year compounded
t = years

n
Quartly $n=4$
Monthly $n=12$
Daily $n = 365$

Quiz 7 DUE SUNDAY
Quiz 8 DUE MONDAY
DEC 2 LAST DAY
★ DO BONUS TEST ★

① Calculate the future value (A) of investing ($1000) (P) at an annual rate of (10%) ($R = .1$) compound (quarterly) ($n=4$) after (1 year) ($t=1$).

$$A = 1000 \cdot \left(1 + \frac{0.1}{4}\right)^{(4)(1)}$$

$$A = 1000\,(1 + .025)^4$$
$$A = 1000\,(1.025)^4$$
$$A = 1000 \times (1.1038\ldots)$$
$$= \$1103.81$$

② $300 invested at 12% compounded monthly after a period of $1\frac{1}{2}$ years.

$$A = 300 \cdot \left(1 + \frac{.12}{12}\right)^{(12)(1.5)}$$
$$300\,(1.01)^{18}$$
$$300\,(1.1961\ldots)$$

Ans = $358.84

③ Find present value given future Value

unknown ← How much \$ do we need now to get \$800 after $3\frac{1}{2}$ years at 7% compound mthly?

$$800 = P \cdot \left(1 + \frac{.07}{12}\right)^{12(3.5)}$$

$$800 = P \cdot (1 + .005833)^{42}$$

$$\frac{800}{1.2767} = \frac{P \cdot (1.2767\ldots)}{1.2767}$$

$$\$626.61 = P$$

FIND TIME

$$\frac{A}{P} = \left(1 + \frac{R}{N}\right)^{nt}$$

$$\ln\left(\frac{A}{P}\right) = \ln\left[\left(1 + \frac{R}{n}\right)^{nt}\right]$$

$$\frac{\ln\left(\frac{A}{P}\right)}{n\ln\left(1+\frac{R}{n}\right)} = \frac{nt\ \ln\left(1+\frac{R}{n}\right)}{n\ln\left(1+\frac{R}{n}\right)}$$

$$t = \frac{\ln(A/P)}{n\ln(1+R/n)} = \frac{\ln(5)}{12\ln\left(1+\frac{0.12}{12}\right)}$$

$$\boxed{= 13.47\text{ yrs}}$$

(8.1)

12.1 System of equations

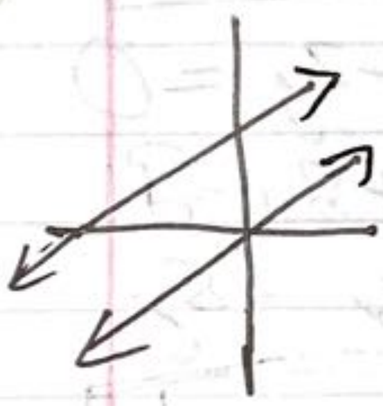
System of equations - when two or more linear equations are considered simultaneously.

Three ways to solve
1. By Graphing
2. By Elimination
3. ~~By substitution~~ (not going to be taught)

GRAPHING

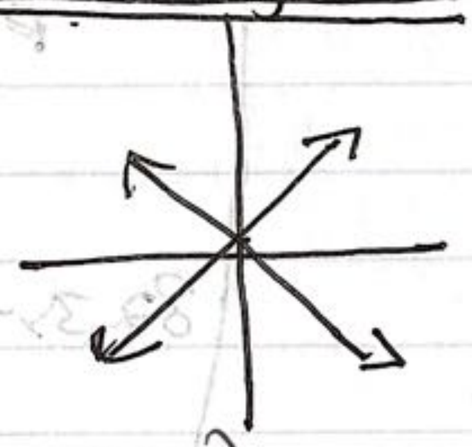
Three thing can happen when you graph two linear equations at the same time.

Parallel



no solution
(inconsistent system)

Intersecting line



(-1, 1)

Lines that coincide

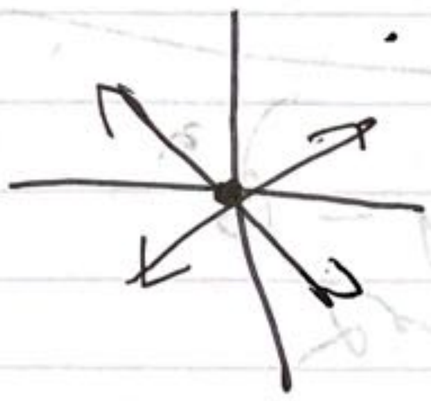
infinite ∞ # of solutions

The answer to a system of equations where do they ~~do~~ 2 lines touch.

Solve by Graphing

$y = -x + 3 =$

$y = x - 1 =$



Put in Ftable
Y_1 = formula

1.8

Solve Graphically

$x - y = 5$
$2x + y = 1$

- Get y by itself
- Use GC

$x - x = 5 - x$
$x - y = 5$

$y = x - 5$

$2x + y = 1$
$y = -2x + 1$

2nd Calculator (TRACE)
intersect

$(2, -3)$

Graph

$3x = 9$

$x = 3$

$7x - 3y = 0$
$x + 3y = 8$

$\frac{8x}{8} = \frac{8}{8}$

$x = 1$

Hold vertically

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

need to clear

$-2x + 3y = 16$
$x = 3y - 13$

Elimination Method
Matrix

$2x - y = 2$

last to check