Factoring

Always factor GCF 1st!

2 terms

Is it a difference of perfect squares?

- yes: (x^2-4) $(x-2)(x+2)$
- No: can't factor

3 terms

Factor by "busting the b" method

4 terms

Factor by grouping

Quadratic Formula

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

Discriminant

$$b^2-4ac$$

5 ways to solve Quadratics

1. Factoring
2. Quadratic Formula
3. Completing the Square
4. Square Roots (only for 2 terms)
5. Graphing

How many & What type

b^2-4ac

- Positive
  - perfect sq. → 2 real rational sol.
  - Not perfect sq. → 2 real irrational sol.
- zero → 1 real rational sol.
- Negative → 2 imaginary sol.

Completing the Square

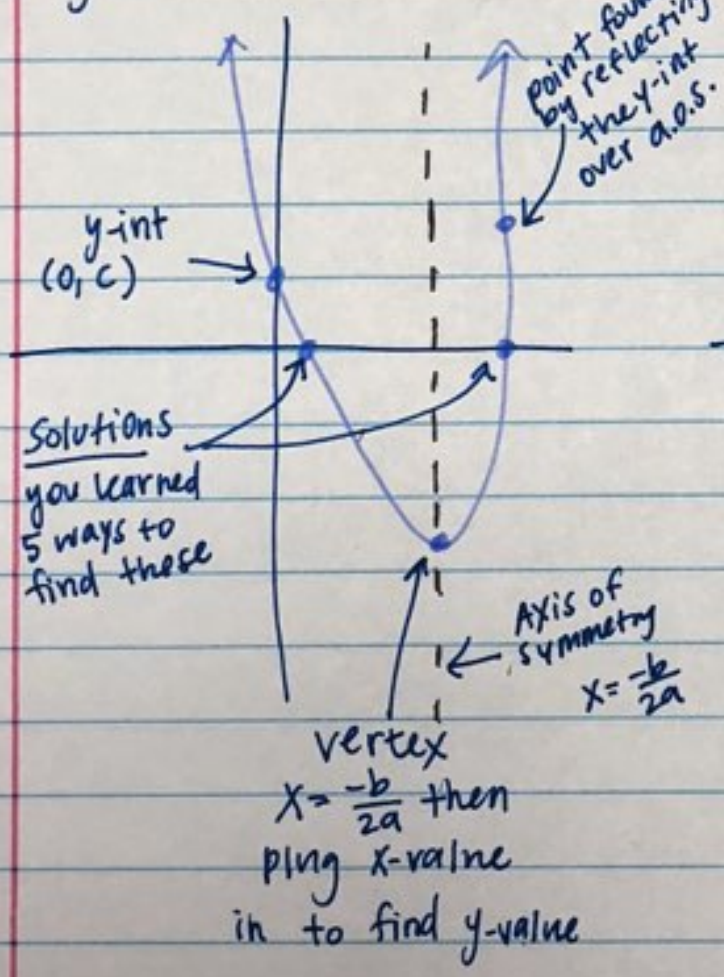
For steps & examples, please visit
www.LSCO.EDU/learningcenter/Completing_the_Square.pdf

- use completing the square to convert to vertex form

Graphing Quadratics

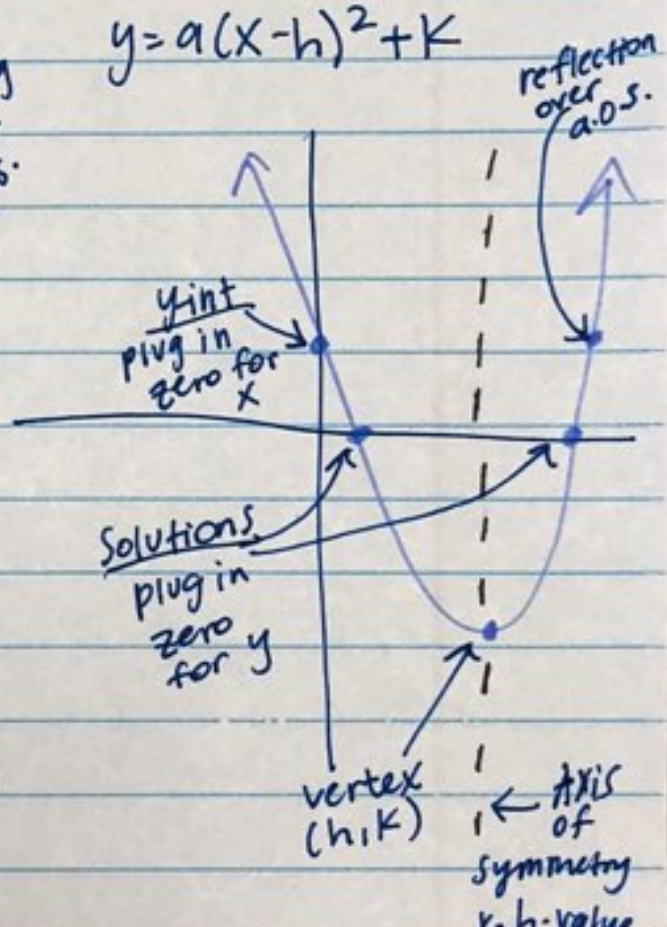
Standard Form

$y = ax^2 + bx + c$



vertex form

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



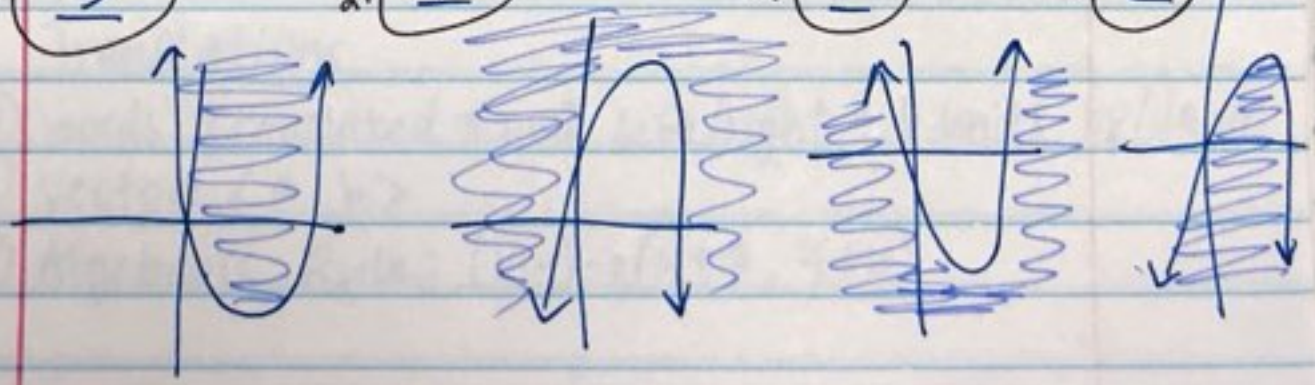
Create quadratic equation from graph

1. Find zeros
2. Write the zeros as 2 binomials
   $y = a(x-r)(x-s)$ r, s = root, solution
3. Substitute any coordinate pt for x & y, then solve to find the a-value.
4. Substitute "a" into the original equation to get factored form. Multiply the binomials & distribute "a" to get standard form

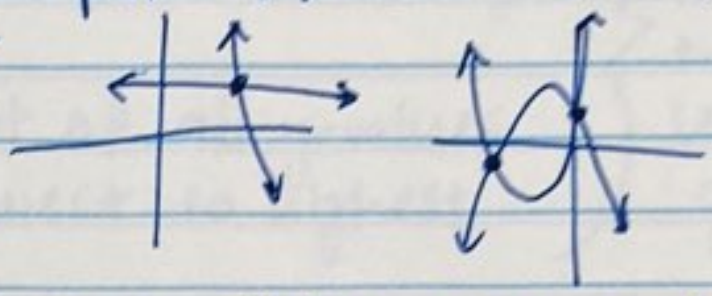
Quadratic Inequalities

1. Graph parabola with pts only
2. connect points with either a dashed or solid line
   $<$ or $>$ dashed
   $\leq$ or $\geq$ Solid
3. Shade accordingly
   $<$ or $\leq$ below
   $>$ or $\geq$ above

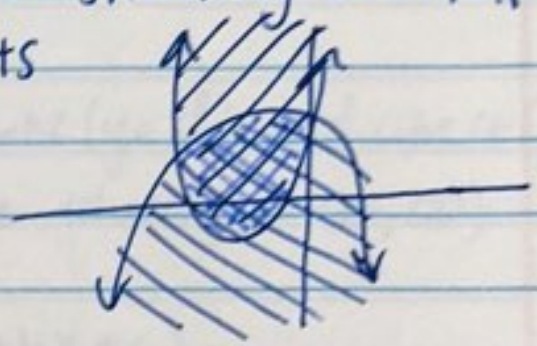
Scenarios 1. $\geq$ 2. $\geq$ 3. $\leq$ 4. $\leq$



* <u>Systems of Equations</u> = Answer is the coordinate point(s) where the functions intersect



<u>System of Inequatities</u> = Answer is the region where the shading overlaps. Infinite amount of pts



Algebraic Rules

Rotation		Reflection	
90°	$(x,y) \to (-y,x)$	x-axis	$(x,y) \to (x,-y)$
180°	$(x,y) \to (-x,-y)$	y-axis	$(x,y) \to (-x,y)$
270°	$(x,y) \to (y,-x)$	$y=x$	$(x,y) \to (y,x)$
360°	$(x,y) \to (x,y)$	$y=-x$	$(x,y) \to (-y,-x)$

<u>Translations</u>

1. words: Translated a unit left/right & b units up/down
2. vector: $\langle a, b \rangle$
3. Algebraic Rule: $(x,y) \to (x+a, y+b)$

Domain Set of all x-values
Far left to far right

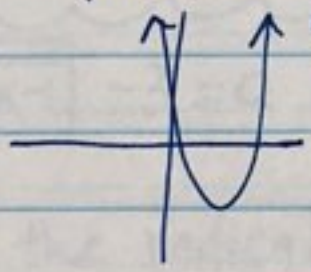
Range Set of all y-values
Lowest to highest

Always has to be least to greatest

( ) = not included or ∞
[ ] = included

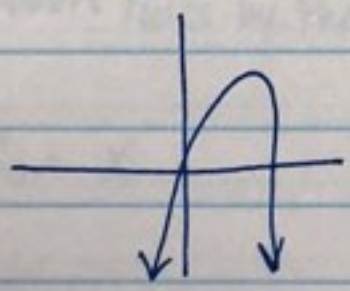
* Linear ($y = mx + b$), cube ($y = x^3$), and cube rt ($y = \sqrt[3]{x}$)
Domain and range are always $(-\infty, \infty)$

* Quadratic ($y = ax^2 + bx + c$)
Domain always $(-\infty, \infty)$
Range: positive [y-value of vertex, ∞)



included bracket

Negative ($-\infty$, y-value of vertex]



Rational Exponents

$$x^{\frac{a}{b}} \longleftrightarrow \left(\sqrt[b]{x}\right)^a$$

Remember,
"e over i, e over i,
e, i, e, i, o"

Exponent Rules

$x^a \cdot x^b = x^{a+b}$

$(x^a)^b = x^{a \cdot b}$

$\frac{x^a}{x^b} = x^{a-b}$

$x^{-a} = \frac{1}{x^a}$

Transformations

$f(x+2)$ left 2	$f(x-2)$ right 2
$f(x)+2$ up 2	$f(x)-2$ down 2

$-f(x)$ Reflected over x-axis

$f(-x)$ Reflected over y-axis

$2f(x)$ vertical stretch of 2

$\frac{1}{2}f(x)$ vertical compression $\frac{1}{2}$

Solving Radical Equations

(A) $\boxed{\sqrt{2x-1}} - 3 = 0$

(B) $2\boxed{(2x)^{\frac{1}{3}}} + 1 = 5$

	(A)	(B)
1st	Isolate the radical	Isolate the rational exp.
2nd	Raise both sides by the index	Raise both sides by the reciprocal
3rd	Solve for x	Solve for x
4th	Check for extraneous	Check for extraneous

Inverses Switch x & y
For graphing, reflect over $y=x$

Direct variation $y=kx$
Inverse variation $y=\frac{k}{x}$

1. write equation
2. Solve for k
3. plug back in to equation from 1 to find missing variable

Rational Functions

$$y=\frac{a}{x-h}+k$$

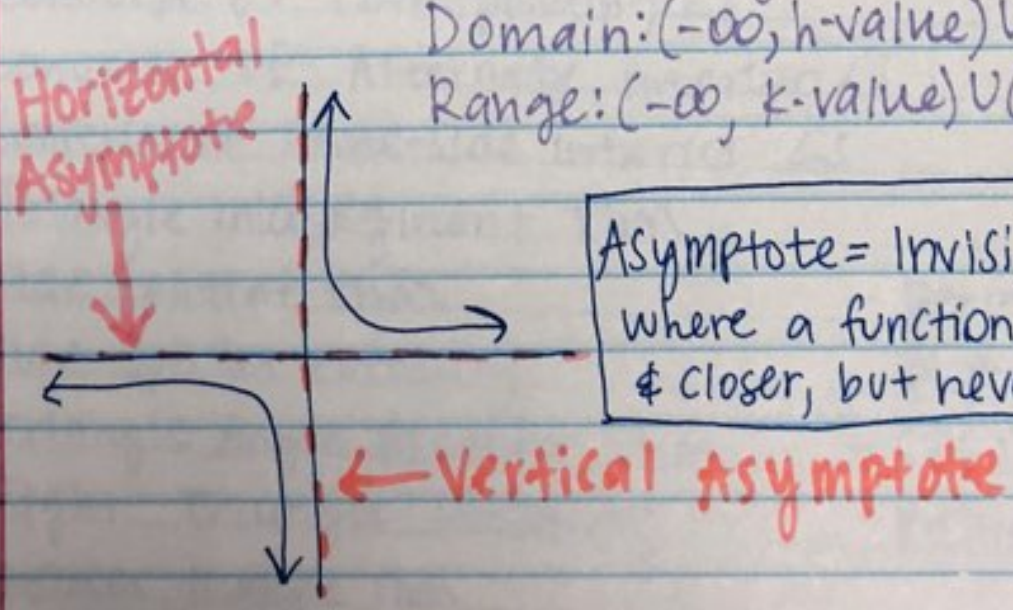
a → moves farther from origin

h → moves it left/right

k → moves it up/down

Vertical Asymptote
$x=$ h-value
Horizontal Asymptote
$y=$ k-value

Domain: $(-\infty, \text{h-value}) \cup (\text{h-value}, \infty)$
Range: $(-\infty, \text{k-value}) \cup (\text{k-value}, \infty)$



Asymptote = Invisible line(s) where a function gets closer & closer, but never touches

Similarity

AA ~
SAS ~
SSS ~

Angles congruent
sides proportional

Congruence

SAS ≅
SSS ≅
ASA ≅
AAS ≅
HL ≅

Angles congruent
sides congruent

Postulates & Theorems

- Angle Addition Postulate
- Segment Addition Postulate
- vertical Angle Thm
- complementary vs. supplementary
- Triangle Sum Thm
- EXterior Angle Thm
- corresponding ∠'s, Alternate Interior ∠'s, Same-side interior ∠'s
- converse of corresponding ∠'s
  converse of Alternate interior ∠'s
  converse of same-side interior ∠'s
- Triangle midsegment Thm
- side splitter Thm
- side splitter corollary
- Triangle Angle Bisector Thm
- Right Triangle Similarity
- Isosceles Triangle Thm
- Perpendicular Bisector Thm
- CPCTC
- Pythagorean Thm

Classifying Triangles

1st Determine if it is a triangle
↳ Add up 2 smaller sides. If greater than the third (largest) side, then it <u>IS</u> a triangle

2nd Always keep c^2 on left
$c^2 = a^2 + b^2$ RIGHT
$c^2 > a^2 + b^2$ OBTUSE
$c^2 < a^2 + b^2$ ACUTE

Special Right Triangles

45-45-90

Leg → Hyp: multiply $\sqrt{2}$
Hyp → Leg: Divide $\sqrt{2}$

30-60-90

SL → LL: Multiply $\sqrt{3}$
LL → SL: Divide $\sqrt{3}$
SL → Hyp: Multiply 2
Hyp → SL: Divide 2
* Cannot go from LL ↔ Hyp

SOH CAH TOA

$\sin = \frac{opp}{hyp}$

$\cos = \frac{Adj}{hyp}$

$\tan = \frac{opp}{Adj}$

only for <u>right</u> triangles

<u>Finding an angle?</u>
click 2nd sine, 2nd cosine, <u>or</u> 2nd tangent

*Make sure you are in degree mode!

Remember

Angle of elevation = Angle of depression due to alternate interior angles

Counting

- Repetition? Fundamental Counting Principal
  choosing one per category? Fund. counting Principal

Permutation	combination
order matters	order does not matter
${}_nP_r$ $\quad \frac{n!}{(n-r)!}$	${}_nC_r$ $\quad \frac{n!}{(n-r)!\,r!}$

$\cup$ **Or** mutually inclusive - overlap

$P(A) + P(B) - P(A \cap B)$

mutually exclusive - no overlap

$P(A) + P(B)$

$\cap$ **And** independent events - do not affect each other

$P(A) \cdot P(B)$

Dependent events - First event effects 2nd event

$P(A) \cdot P(B \text{ after event } A)$

Conditional "given"; A limitation applied

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Venn diagrams

Make sure you subtract overlap

Tree Diagrams

Make sure you multiply along branches