CCGPS Geometry
Spring Summary Sheet

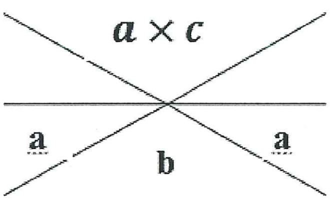
Monomial: number,variable,or product of a number and one or more variables with whole number exponents: (ex. $-6a^3b^2$)

Binomial: expression of the sum or the difference of two terms

Polynomial: is an expression consisting of variables and coefficients, that involves the operations of non-negative integer exponents.

Factoring Steps

1) Factor out GCF (greatest common factor)
2) **Star method** for expression in standard form of $ax^2 + bx + c$
3) Find a pair of numbers that multiply to be $a \times c$ and adds to be **b**



4) Put factors in the form (x)(x)
5) Reduce the fractions
6) Pull denominator in front of the x's

Steps for **Completing the square:**

1) Rearrange equation in standard form: $ax^2 + bx + c = 0$
2) divide each term in the equation by **a** if a ≠1 (We need the new **a** value to be 1)
3) Move the constant to the other side of the equation.
4) Add spaces "+___" to the equation: $x^2 + bx + \_\_\_ = c + \_\_\_$
5) Find $\left(\frac{b}{2}\right)^2$ and enter this value into the blank spaces ___ on both sides of the equation
6) Rewrite left side in factored form and add the numbers on the right side
7) take the square root ($\sqrt{\ }$) of both sides (don't forget ±)
8) solve for x

* A quadratic equation is as an equation of degree 2, **meaning** that the highest exponent of this function is 2.
* The quadratic formula is used to solve an equation of the form $ax^2 + bx + c = 0$
*This formula can solve any equation that can be solved by factoring and completing the square

Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

given $ax^2 + bx + c = 0$

The **Discriminant** is the number (from the expression) inside the square root of the quadratic formula.

Since the quadratic formula is $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, the discriminant is the $b^2 - 4ac$

The discriminant describes the **nature**, or the type, of solutions (or roots)

If the Discriminant is **positive**, there are 2 real answers (2 real roots or **solutions**)

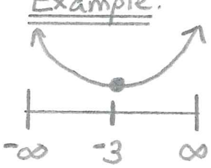
If the Discriminant is **negative**, there are 2 imaginary answers (2 imaginary roots)

If the Discriminant is **zero**, there is 1 real answer. (2 real answers being the same value) (1 real root)

Unit 5B: Graphing Quadratic Functions

1. **Standard form:** $y = ax^2 + bx + c$
   a. The x-coordinate of the vertex is located at $x = \frac{-b}{2a}$
   b. The axis of symmetry (AOS) is the vertical line $x = \frac{-b}{2a}$
   c. Make a T-table, put the vertex in the middle of the t-table.
   d. Fill in the rest of the values (use calculator)
   e. Graph the points with a smooth, U-shaped curve
   f. **Domain** : always all Real Numbers $(-\infty, \infty)$
   g. **Range**: lowest y-value to the highest y-value
   h. Determine **Increasing/Decreasing** Intervals
      *Determine the x-value of the vertex
      *Create number line with endpoints as $-\infty$ *and* $+\infty$
      *Sketch the parabola above number line
      * determine interval where graph is rising (increasing) and interval where graph is falling (decreasing)

Example:



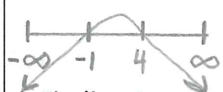
Increasing: $(-3, \infty)$

Decreasing: $(-\infty, -3)$

i. Determine **Positive/Negative** intervals
*Determines x-values of the x-intercepts
*Create number line with endpoints as $-\infty$ *and* $+\infty$ and x-values of intercepts
*Sketch the shape of parabola through the x-intercepts
* determine interval where graph is above the number line (positive) and interval where graph is below the number line(negative)

Example:

positive: $(-1, 4)$
negative: $(-\infty, -1) \cup (4, \infty)$



j. Finding **Average Rate of Change**
* Find the 2 ordered pairs using the x-values given in the interval
* Find the slope between the 2 ordered pairs: m $m = \frac{y_2 - y_1}{x_2 - x_1}$

2. **Intercept Form**: $y = a(x - p)(x - q)$
   a) If "a" is positive (> 0) the parabola opens up
   If "a" is negative (< 0) the parabola opens down.
   b) The x-intercepts are the points x = p and x = q. Set factors equal to 0 and solve to get *p* and *q*.
   c) The **x-coordinate of the vertex** is half way between the x-intercepts
   d) Make a T-table, put the vertex in the middle of the t-table.
   e) Fill in the rest of the values (use calculator)

3. **Vertex Form:** $y = a(x - h)^2 + k$
   a) If "a" is positive (> 0) the parabola opens up If "a" is negative (< 0) the parabola opens down.
   b) The **vertex** is the point (h, k)
   c) Make a T-table, put the vertex in the middle of the t-table.
   d) Fill in the rest of the values (use calculator)

Quadratic Function Transformations in Vertex Form $y = a(x - h)^2 + k$

1. If **a** is negative, there is a vertical reflection and the parabola will open downwards.
2. $|a|$ is the vertical stretch factor.
   - If $|a| > 1$, vertical stretch
   - $|a| < 1$, vertical compress
3. h is the horizontal translation (shift)
   " **–h**" means shift **right** h units
   " **+h**" means shift **left** h units
4. k is the vertical translation (shift)
   " **–k**" means shift **down** k units
5. " **+k**" means shift **up** k units

Quadratic Inequalities Steps

1. Determine x-values of the x-intercepts
2. Create number line with endpoints as $-\infty$ *and* $+\infty$ and x-values of intercepts
3. Sketch the shape of parabola through the x-intercepts (if a > 0, parabola opens up. If a < 0, parabola opens down)

* determine interval where graph is above the number line (positive) and interval where graph is below the number line(negative)

a) $f(x) > 0$ is everything ***above*** the x-axis, ***not including*** the intercepts (use parenthesis)
b) $f(x) < 0$ is everything ***below*** the x-axis, ***not including*** the intercepts (use parenthesis)
c) $f(x) \geq 0$ is everything ***above*** the x-axis, ***including*** the intercepts (use brackets)
d) $f(x) \leq 0$ is everything ***below*** the x-axis, ***including*** the intercepts (use brackets)

Projectile Motion for Quadratic Word Problems Projectile Motion Formula

$h(t) = \frac{1}{2}at^2 + v_i t + h_i$

$h(t)$ = final height (at the end of the problem)

a = acceleration due to gravity (-32 ft/s^2)

v_i = initial velocity

h_i = initial height (at the beginning of the problem)

t = time (from initial height to final height)

Unit 6: Modeling Geometry

Distance Formula:

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

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

Midpoint Formula:

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

A circle is the set of all points equidistant(same distance) from a fixed point called the **radius.** The standard equation for a circle with center (h,k) and radius r is $(x - h)^2 + (y - k)^2 = r^2$

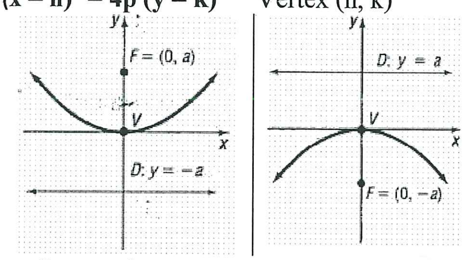
Circle: Converting from general form to standard form steps:

1. Group x's and y's on the left side, then move the constant to the other side of equation.
2. Complete the square with x's, using $\left(\frac{b}{2}\right)^2$ be sure to **balance** the equation.
3. Complete the square with y's, using $\left(\frac{b}{2}\right)^2$ be sure to **balance** the equation.
4. Express each perfect square trinomial as a binomial squared to become standard form $(x - h)^2 + (y - k)^2 = r^2$

Parabola: a conic section where the distance from 1 fixed point (focus) and a line (directrix) is equal.

If graph opens up or down: (Think $y = x^2$)

$(x - h)^2 = 4p\,(y - k)$ Vertex (h, k)



p: distance from vertex to focus (inside parabola)

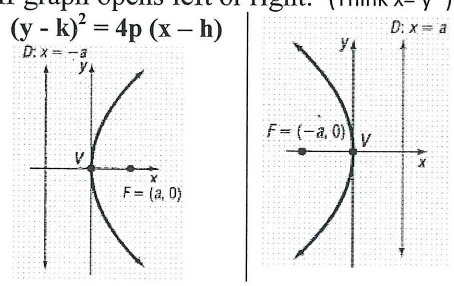
p: distance from vertex to directrix (line outside parabola)

Axis of Symmetry(AOS) : x = h

Focal Width $= |4p|$

If graph opens left or right: (Think $x = y^2$)

$(y - k)^2 = 4p\,(x - h)$



Vertex (h, k)

p: distance from vertex to focus (inside parabola)

p: distance from vertex to directrix (line outside parabola)

Axis of Symmetry(AOS) : y = k

Focal Width $= |4p|$

Parabola: Converting from general form to standard form steps:

1. Group the variable with the squared term on the left. The other variable is on the right.
2. Complete the square for the squared variable, using $\left(\frac{b}{2}\right)^2$ be sure to **balance** the equation
3. Write equation in standard form

Solving Systems of equations

Substitution Steps:

1. Choose one equation and solve for one variable on one side (either the x or the y)
2. Substitute the solution from step 1 into the second equation and solve for the variable in the equation.
3. Using the value found in step 2, substitute it into the first equation and solve for the second variable.
4. Substitute the values for both variables into both equations to show they are correct.

Unit 7: Probability Unit

1. **The Multiplication Counting Principle:** this is to find the total number of combinations given a number of ~~different~~ events:

If there are **m** ways to make a first selection and **n** ways to make a second selection, there are **m** × **n** ways to make the two selections.

2. **Pick one (card)** - Add and/or subtract probabilities (do not change denominator)

$\frac{\quad}{52} + \frac{\quad}{52}$ or $\frac{\quad}{52} + \frac{\quad}{52} - \frac{\quad}{52}$

a. Mutually exclusive: no overlaps

b. Overlapping events: There are shared events so we need to subtract overlapping events

3. **Pick more than one (card)**

Multiply probabilities

**Don't need to look for overlaps! These are Different events!

Independent	a) With replacement - $\frac{\quad}{52} * \frac{\quad}{52}$
Dependent	b)Without replacement $\frac{\quad}{52} * \frac{\quad}{51}$

Independent $P(A|B) = P(B|A)$

Dependent $P(A|B) \neq P(B|A)$