



Algebra 1 Formulas

Operations

Algebraic properties

Reflexive	$a = a$	
Commutative	$a + b = b + a$	$ab = ba$
Associative	$(a + b) + c = a + (b + c)$	$(ab)c = a(bc)$
Distributive	$a(b + c) = ab + ac$	$(b + c)a = ba + ca$
Transitive	If $a = b$ and $b = c$ then $a = c$	
Symmetric	If $a = b$ then $b = a$	

Order of operations

Parentheses	(all grouping symbols)
Exponents	(powers and roots)
Multiplication/Division	(going through the expression from left to right and top to bottom, performing each multiplication/division as you come to it)
Addition/Subtraction	(going through the expression from left to right and top to bottom, performing each addition/subtraction as you come to it)



Equations

Balancing

Whatever operation is performed on one side of an equation must also be performed on the other side of the equation in order to keep it balanced.

Inverse operations

Addition and subtraction are inverse operations, because they undo each other.

Multiplication and division are inverse operations, because they undo each other.

Addition-subtraction rules

The same number can be added to or subtracted from both sides of an equation without changing the solution to the equation.

$$\text{If } a = b, \quad \text{then } a + c = b + c$$

$$\text{If } a = b, \quad \text{then } a - c = b - c$$



Multiplication-division rules

Both sides of an equation can be multiplied or divided by the same nonzero number without changing the solution to the equation.

$$\text{If } a = b, \quad \text{then } ac = bc$$

$$\text{If } a = b, \quad \text{then } \frac{a}{c} = \frac{b}{c} \quad (c \neq 0)$$

Polynomials and factoring

Polynomial multiplication

To multiply one polynomial by a second polynomial, each term of the first polynomial is multiplied by each term of the second polynomial and then the products are summed.

Definition of a factor

A factor is one of two or more expressions that are multiplied to form a product.

Greatest common factor (GCF)

The greatest common factor of two numbers is the largest number that divides evenly into both numbers.



Difference of two squares theorem

If p and q are real numbers and $p^2 = q^2$ then $p = q$ or $p = -q$

$$p^2 = q^2$$

Quadratic formula

The solutions to a quadratic equation of the form

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

can be found using the formula

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

The value of $b^2 - 4ac$ (called the discriminant) will determine the type(s) of solutions.

When $b^2 - 4ac = 0$, the solution is one real number

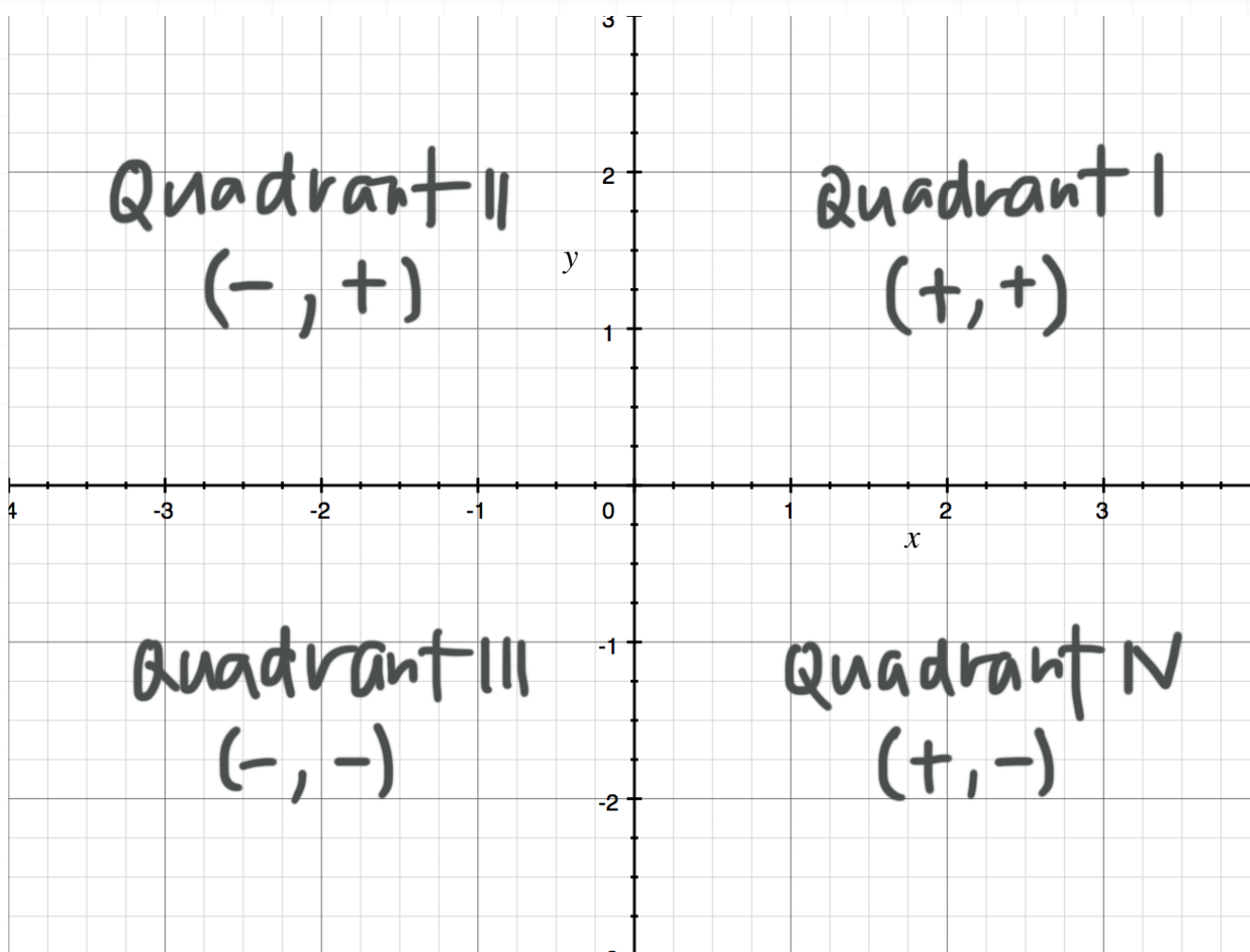
When $b^2 - 4ac > 0$, the solutions are two real numbers

When $b^2 - 4ac < 0$, the solutions are two real complex numbers



Graphing

Cartesian coordinate system



Slope

The slope of any line can be defined by the formula

$$m = \frac{\text{change in the } y\text{-coordinate}}{\text{change in the } x\text{-coordinate}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Equation of a line, point-slope form

The point-slope form of the equation of a line is



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

where m is the slope of the line, defined as

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

Equation of a line, slope-intercept form

The slope-intercept form of the equation of a line is

$$y = mx + b$$

where m is the slope of the line, defined as

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

and where b is the point at which the line crosses the y -axis.

Inequalities

Trichotomy axiom

For any real numbers a and b , exactly one of the following is true:

$$a < b \quad \text{or} \quad a = b \quad \text{or} \quad a > b$$



Transitive axiom

For any real numbers a , b and c ,

If $a > b$ and $b > c$, then $a > c$

If $a < b$ and $b < c$, then $a < c$

If $a = b$ and $b = c$, then $a = c$

Functions

Three definitions of a function

1. A **function** is a **mapping** between two sets that associates with each element of the first set a **unique** (one and only one) element of the second set. The first set is called the **domain** of the function. For each element x of the domain, the corresponding element y of the second set is called the **image** of x under the function. The set of all images of the elements of the domain is called the **range** of the function.
2. A **function** is a **set of ordered pairs** in which no two pairs have the same first element and different second elements.
3. A function is something that has for every value of x exactly one answer.



Vertical line test

A graph on the coordinate plane represents the graph of a function provided that any vertical line intersects the graph in at most one point.

Even, odd, or neither

Even	$f(-x) = f(x)$
Odd	$f(-x) = -f(x)$



