

Algebra Vocabulary List

(Definitions for Middle School Teachers)

A

- **Absolute Value Function** – The absolute value of a real number x , $|x|$ is

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

- <http://www.math.tamu.edu/~stecher/171/F02/absoluteValueFunction.pdf>
- **Algebra Lab Gear** – a set of manipulatives that are designed to represent polynomial expressions. The set includes representations for positive/negative 1, 5, 25, x , $5x$, y , $5y$, xy , x^2 , y^2 , x^3 , y^3 , x^2y , xy^2 . The manipulatives can be used to model addition, subtraction, multiplication, division, and factoring of polynomials. They can also be used to model how to solve linear equations.
 - For more info:
 - <http://www.stlcc.cc.mo.us/mcdocs/dept/math/homl/manip.htm>
 - <http://www.awl.ca/school/math/mr/alg/ss/series/algstxt.html>
 - <http://www.picciotto.org/math-ed/manipulatives/lab-gear.html>
- **Algebra Tiles** – a set of manipulatives that are designed for modeling algebraic expressions visually. Each tile is a geometric model of a term. The set includes representations for positive/negative 1, x , and x^2 . The manipulatives can be used to model addition, subtraction, multiplication, division, and factoring of polynomials. They can also be used to model how to solve linear equations.
 - For more info:
 - <http://math.buffalostate.edu/~it/Materials/MatLinks/tilelinks.html>
 - <http://plato.acadiau.ca/courses/educ/reid/Virtual-manipulatives/tiles/tiles.html>
- **Algebraic Expression** – a number, variable, or combination of the two connected by some mathematical operation like addition, subtraction, multiplication, division, exponents and/or roots.
 - For more info:
 - http://www.wtamu.edu/academic/anns/mps/math/mathlab/beg_algebra/beg_alg_tut11_simp.htm
 - <http://www.math.com/school/subject2/lessons/S2U1L1DP.html>
- **Area Under the Curve** – suppose the curve $y=f(x)$ lies above the x axis for all x in $[a, b]$. The area under the curve is the area of the region bounded by the curve, the “ x ” axis and the lines $x=a$ and $x=b$. It equals $\int_a^b f(x)dx$.
 - For more info:
 - http://www.teacherschoice.com.au/Maths_Library/Calculus/area_under_a_curve.htm
 - http://www.mathwords.com/a/area_under_a_curve.htm
 - http://pathfinder.scar.utoronto.ca/~dyer/csc57/book_P/node39.html

- **Arithmetic Sequence** (arithmetic progression) – A sequence of numbers in which the difference of two consecutive terms is the same. A sequence with a general term $a_{n+1} = a_n + d$ or $a_n = a_1 + (n-1)d$ is called an arithmetic sequence.
 Example: let $d=2$ and $a_1 = 1$, then 1,3,5,7,... forms an arithmetic sequence with first term equal to 1 and common difference(difference between any two consecutive terms) equal to 2.
 - For more Info:
 - <http://primes.utm.edu/glossary/page.php?sort=ArithmeticSequence>
 - <http://www.ltconline.net/greenl/Courses/103B/seqSeries/ARITSEQ.HTM>

- **Arithmetic Series** – the indicated sum of the terms of an arithmetic sequence. Example of finite arithmetic series: $1 + 3 + 5 + 7 + 9$ (Note this is the sum of a finite arithmetic sequence whose first term is 1 and common difference is 2). In general, the sum of a finite arithmetic series is $\sum_{i=1}^n a_i = n(a_1 + a_n) / 2$
 - For more Info:
 - http://cne.gmu.edu/modules/dau/algebra/series/as_bdy.html
 - <http://www.mathsdirect.co.uk/pure/purtutserari.htm>
 - <http://www.ltconline.net/greenl/Courses/103B/seqSeries/ARITSEQ.HTM>

B

- **Binomial** – an expression consisting of two terms, such as $2x + 5y$ or $7x^2 + 4$
 - For more info:
 - <http://www.pinkmonkey.com/studyguides/subjects/algebra/chap3/a0303201.asp>

C

- **Coefficient** – the numerical part of a term, usually written before the literal part, as 2 in $2x$ or $2(x + y)$. Most commonly used in algebra for the constant factors, as distinguished from the variables.
 - For more info:
 - <http://www.mathnstuff.com/math/spoken/here/1words/c/c21.htm>

- **Coefficient Matrix** (matrix of the coefficients) – the matrix of coefficients of the variables in a system of equations written in standard form. For example: the coefficient matrix for $2x - 3y = 8$ and $4x + 5y = 2$ is denoted by $\begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$.
 - For more info:
 - http://www.mathwords.com/c/coefficient_matrix.htm
 - <http://www.purplemath.com/modules/matrices.htm>

- **Compressed Graph** (vertical shrink) – a shrink in which a plane figure is distorted vertically. It's a transformation in which all distances on the coordinate plane are shortened by multiplying all y coordinates of a graph by a common factor less than 1.
 - For more info:
 - http://www.mathwords.com/c/compression_graph.htm
- **Constant** – a symbol representing a value that doesn't change.
 - For more info:
 - <http://www.bartleby.com/59/19/constant.html>
- **Continuous Curve** – can be depicted as, “path of a continuously moving point”. A line or curve that extends without a break or abrupt changes.
 - For more info:
 - <http://www.free-definition.com/Space-filling-curve.html>
 - <http://dictionary.reference.com/search?r=2&q=continuous>
- **Cramer's Rules** – a rule using determinants to express the solution of a system of linear algebraic equations for which the number of equations is equal to the number of variables.

For example: To solve x and y from $ax + by = e$; $cx + dy = f$; $x = \frac{\begin{vmatrix} e & f \\ b & d \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}$; $y = \frac{\begin{vmatrix} e & f \\ a & c \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}$,

where $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$.

- For more info:
 - <http://www.ies.co.jp/math/java/vector/renritsu/renritsu.html>
 - <http://mathworld.wolfram.com/CramersRule.html>
- **Cubic Function** – a polynomial function of degree 3, usually written in the form $y = ax^3 + bx^2 + cx + d$, where a, b, c and d are constants.
 - For more info:
 - http://www.acs.sch.edu.sg/acs_indep/departments/mathematics/IT/livemath/the/IT3EMGraphFnCubic.html
 - <http://jwilson.coe.uga.edu/EMT668/EMT668.Folders.F97/Wynne/Cubic/Cubic%20Functions.html>

D

- **Degree of a Monomial** – the degree of a term in one variable is the exponent of that variable; the degree of a term in several variables is equal to the sum of the exponents of its variables. For example, the degree of $4x^2$ is 2 and the degree of $4x^2y^3z^2$ is 7.

- **Degree of a Polynomial** – the degree of the monomial of largest degree belonging to that polynomial. For example, the degree of a polynomial, $4x^5 + 6x^2 + 8$ is 5.
 - For more info:
 - <http://www.themathpage.com/aPreCalc/polynomial.htm>

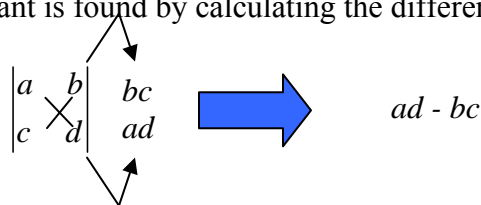
- **Determinant** – is a special set of mathematical operations associated with a square array. The result of the operation is a scalar value. The determinant below has two rows and two columns and is called a **second-order determinant**.

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$$

A second-order determinant is evaluated as follows.

Value of a Second-Order Determinant: $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

Notice that the value of the determinant is found by calculating the difference of the products of the two diagonals.



- For more info:
 - <http://mathworld.wolfram.com/Determinant.html>
 - <http://en.wikipedia.org/wiki/Determinant>
- **Difference of Squares** – a difference of two squares can be represented in an expression of the form $a^2 - b^2$ and factors into the form $(a + b)(a - b)$.
 - For more Info:
 - <http://regentsprep.org/Regents/math/factor/Lfactps.htm>
- **Direct Variation** – a linear function of the form $y = cx$, where c is the constant of variation; $c \neq 0$. We say that y is directly proportional to x , i.e. y varies directly as x varies. If x is doubled, tripled or halved, then y is also doubled, tripled, or halved. If x increases one unit, then y increases c units.
 - For more info:
 - <http://regentsprep.org/Regents/math/math-topic.cfm?TopicCode=variation>
- **Domain of a Function** – The set of all possible input values of a function. Given a real valued function $f(x) = \frac{1}{x}$, its domain is the set of all real numbers excluding 0.
 - For more info:

- http://www.swt.edu/slac/math/domain_range/domain_and_range.htm
- http://earthmath.kennesaw.edu/main_site/review_topics/domain_and_range.htm

E

- **Equation** – A statement asserting the equality of two expressions that are separated into left and right sides and joined by an equal sign.
- **Exponential Function** – an equation of the form $f(x) = a \cdot b^x + k$ where $a \neq 0$, $b > 0$, $b \neq 1$ and x is any real number, is called an exponential function with base b .
 - For more info:
 - <http://mathworld.wolfram.com/ExponentialFunction.html>

F

- **FOIL method** – an application of the distributive property used to multiply two binomials. The product of the two binomials is found by multiplying the **F**irst, **O**uter, **I**nnner, and **L**ast terms.
 - For more info:
 - <http://www.algebrahelp.com/lessons/simplifying/foilmethod/pg2.htm>
 - http://www.mathwords.com/f/foil_method.htm
- **Function** – a set of ordered pairs such that no two ordered pairs have the same first member. A *relation*, such that each element of a set (the domain) is associated with a unique element of another (possibly the same) set (the co-domain not to be confused with the range).
 - For more info:
 - [http://en.wikipedia.org/wiki/Function_\(mathematics\)](http://en.wikipedia.org/wiki/Function_(mathematics))
- **Function Notation** – function notation uses $f(x)$ (or $g(x)$, $h(x)$, etc.), instead of y , to represent the dependent variable.
 - For more info:
 - <http://www.purplemath.com/modules/fennot.htm>

G

- **Geometric Sequence** (geometric progression) – is a sequence of numbers in which each term is obtained by multiplying the preceding term by the same number (common ratio). The following is a geometric progression: 1, 2, 4, 8, 16, 32... The common ratio for this geometric progression is 2.
 - For more info:
 - <http://colbycc.edu/www/math/algebra/sequen.htm>
 - <http://home.alltel.net/okrebs/page131.html>
- **Geometric Series** – The indicated sum of the terms of a geometric sequence. The geometric series corresponding to the geometric sequence: 1, 2, 4, 8, 16, 32... is $1 + 2 + 4 + 8 + 16 + 32 + \dots$
 - For more info:
 - <http://www.mathsyear2000.org/alevel/pure/purtutsergeo.htm>

- **Graphs** – a pictorial representation of some mathematical relationship. It can be a point on a number line, which is a graph of a real number.
 - For more info:
 - <http://nces.ed.gov/nceskids/graphing/>

H

- **Horizontal Asymptote** – if there exists a number c such that the curve $f(x)$ approaches c as x approaches ∞ or $f(x)$ approaches c as x approaches $-\infty$, then the line $y=c$ is called a horizontal asymptote of the curve $f(x)$.
 - For more info:
 - <http://archives.math.utk.edu/visual.calculus/1/horizontal.5/>

I

- **Identity Function** – is a function in the form $f(x) = x$. More generally, an identity function is one which does not change the domain values at all.
 - For more info:
 - http://www.mathwords.com/i/identity_function.htm
- **Inequality** – An inequality is a statement with the symbol $<$, \leq , $>$, or \geq between numerical or variable expressions.
 - For more info:
 - http://www.intermath-uga_gatech.edu/dictionary/descript.asp?termID=174
- **Infinite Series** – An infinite series is an infinite, ordered set of terms combined together by the addition operator. For example: $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$
 - For more info:
 - <http://www.math.utah.edu/~carlson/teaching/calculus/series.html>
- **Interval on a Real Number Line** – is the set containing all numbers between two given numbers (the end points of the interval) including one, both, or neither end point.
 - For more info:
 - <http://id.mind.net/~zona/mmts/miscellaneousMath/intervalNotation/intervalNotation.html>
 - <http://www.sosmath.com/algebra/inequalities/ineq02/ineq02.html>
- **Inverse Function** – if f is a one to one and onto function from a set X to a set Y , then the correspondence that goes back from Y to X is also a function and is known as the inverse function. For the definition of onto and one to one functions please look under “O”.
 - For more info:
 - <http://www.uncwil.edu/courses/mat111hb/functions/inverse/inverse.html>

- **Inverse Variation** – A variation stated in the form $y = \frac{k}{x}$, where k is the constant of variation. In this equation the values of y get smaller as the values of x get greater. It is said that x and y are inversely proportional.
 - For more info:
 - <http://www.purplemath.com/modules/variati.htm>
- **Iteration** – repetition of a sequence of instructions. Iteration is characterized by a set of initial conditions, an iterative step and a termination condition. For example, the set of Fibonacci numbers is generated by beginning with 1, 1, and using the iterative process of summing the two previous terms to determine all subsequent terms. The set of Fibonacci numbers is {1, 1, 2, 3, 5, 8, 13. . . }

L

- **Limit** (Limit of a function in one variable) – a limit is the value of the function as the variable approaches a particular point. For example the limit of the function \sqrt{x} as x approaches 4 is 2. The limit of $1/n$ as n approaches infinity is 0.
 - <http://mathworld.wolfram.com/Limit.html>
- **Linear Function** – a function whose graph is a straight line. A linear function of x can be written in the form $f(x) = mx + b$, where m and b are constants.
 - For more info:
 - <http://id.mind.net/~zona/mmts/functionInstitute/linearFunctions/linearFunctions.html>
- **Logarithmic Function** – The logarithmic function $f(x) = \log_b x$ is the inverse of the exponential function $f(x) = b^x$, where $b > 0$ and $b \neq 1$. A function defined by an expression of the form $\log f(x)$.
 - For more info:
 - <http://www.ma.utexas.edu/cgi-pub/kawasaki/plain/functions/2D.html>

M

- **Matrix** – a rectangular array of variables or constants in horizontal rows and vertical columns, usually enclosed in brackets.
 - For more info:
 - <http://easyweb.easynet.co.uk/~mrmeanie/matrix/matrices.htm>
- **Monomial** – an expression that can be a constant, a variable, or a product of a constant and one or more variable. Each of the following is a monomial.

5 (a constant)	3z (a product of a constant and one variable)
x (a variable)	6xyz (a product of a constant and more than one variable)

 - For more info:
 - <http://www.pinkmonkey.com/studyguides/subjects/algebra/chap3/a0303201.asp>

N

- **Natural Exponent** (e) – $e \approx 2.718281828\dots$ e is the limit of $(1 + \frac{1}{n})^n$ as n approaches infinity.
 - For more info:
 - http://archives.math.utk.edu/visual.calculus/0/exp_log.5/
- **Non-Linear Function** - A function whose graph is not a straight line. Example: Polynomials of degree two or higher, exponential function, sine, cosine functions etc.
 - For more info:
 - http://www.harcourtschool.com/glossary/math_advantage/definitions/nonlinear_f8.html

O

- **One-to-One Function** – a function f is said to be one to one (injective) if and only if $f(x) = f(y)$ implies $x = y$. i.e. no two distinct elements in the domain correspond to the same element in the Range.
 - For more info:
 - <http://www.analyzemath.com/OneToOneFunc/OneToOneFunc.html>

P

- **Parabola** – The general shape of the graph of a quadratic function. The set of all points in a plane that are the same distance from a given point called the focus and a given line called the directrix.
 - For more info:
 - <http://mathworld.wolfram.com/Parabola.html>
 - <http://www.punahou.edu/acad/sanders/geometrypages/GP19Parabola.html>
- **Parent Function** – the basic function for a family of functions. For instance, $y = x^2$ is the parent function of the family of quadratic functions.
- **Polynomial** – Sum and/or difference of terms: example: $3x - 2$ and $4x^2 - 5x + 3$
A polynomial with two terms is a binomial. A polynomial with three terms is a trinomial
- **Polynomial Function** – a function of the form $P(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$ for all real x , where the coefficients are real numbers and n a non negative integer. If $a_n \neq 0$, $P(x)$ is called a real polynomial of degree n .
 - For more info:
 - <http://id.mind.net/~zona/mmts/functionInstitute/polynomialFunctions/definition/definition.html>

- **Proportion** – the statement of equality of two ratios; an equation stating that two ratios are equal.
 - For more info:
 - <http://www.algebrahelp.com/lessons/proportionbasics/index.htm>
 - <http://www.purplemath.com/modules/ratio.htm>

Q

- **Quadratic Function** – a polynomial function of degree 2, and in the form $f(x) = ax^2 + bx + c$.
 - For more info:
 - <http://jwilson.coe.uga.edu/EMT668/EMAT6680.Folders/Barron/unit/Lesson%206/6.html>
 - <http://members.shaw.ca/ron.blond/QFA.GF.APPLET/>

R

- **Range** (range of a function) – The set of possible values which a function's output can be. Given the function $\{(1, 5), (2, 10), (13, 15), (4, 20)\}$ its range is $\{5, 10, 15, 20\}$.
 - For more info:
 - http://cne.gmu.edu/modules/dau/calculus/domains_ranges/dom2_bdy.html
- **Rate of Change** – the ratio of the change in one quantity to a corresponding unit change in another quantity.
 - For more info:
 - <http://www.ugrad.math.ubc.ca/coursedoc/math100/notes/derivative/slope.html>
- **Rational Function** – division of two polynomial functions in the form $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomial functions and $q(x) \neq 0$. (The domain of f consists of all real numbers x such that the denominator $q(x)$ is not equal to 0.)
 - For more info:
 - <http://id.mind.net/~zona/mmts/functionInstitute/rationalFunctions/rationalFunctions.html>
 - <http://archives.math.utk.edu/visual.calculus/0/rational.1/>
- **Recursive Formula** – a recursive formula has two parts: the value(s) of the first term(s), and a recursion equation that shows how to find each term from the term(s) before it.
- **Recursive Sequence** – a recursive sequence is an ordered list of numbers defined by a starting value and a rule, applying the rule again to the previous value, and repeating this process.
 - For more info:
 - <http://www.purplemath.com/modules/nextnumb2.htm>

- **Relation** – A relation is any subset of a Cartesian product. For instance, a subset of $A \times B$, called a "binary relation from A to B ," is a collection of ordered pairs (a, b) with first components from A and second components from B , and, in particular, a subset of $A \times A$ is called a "relation on A ."
- **Root** – a solution of an equation.
- **Roots of the Equation** – a number which, when substituted for the variable in the equation satisfies the equation. For example: 2 is a root for the equation $x^2 - 4 = 0$, but 3 is not.
 - For more info:
 - <http://users.erols.com/andresho/tutor/mapleV3/TUTroots.htm>

S

- **Sequence of Numbers** – An ordered arrangement of numbers. We denote a sequence as $\langle a_n \rangle_{n=1}^{\infty}$ where its n^{th} term is a_n . For example: consider the sequence $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots$ it can also be expressed as $\langle \frac{1}{n} \rangle_{n=1}^{\infty}$.
 - For more info:
 - <http://www.intermath-uga.gatech.edu/dictionary/descript.asp?termID=326>
- **Slope** – the ratio of rise to run for a line in the coordinate plane. The slope of a line described by $f(x) = mx + b$ is m .
 - For more info:
 - <http://www.math.com/school/subject2/lessons/S2U4L2GL.html>
 - <http://www.intermath-uga.gatech.edu/dictionary/descript.asp?termID=336>
- **Slope of the Tangent Line** – the slope of the line that is tangent to the function graph at a certain point $(c, f(c))$. (The line that passes through the point $(c, f(c))$ with slope $f'(c)$ is called the tangent line at the point $(c, f(c))$).
 - For more info:
 - <http://www.fact-index.com/t/ta/tangent.html>
- **Stretched Graph** – A transformation in which all distances on the coordinate plane are lengthened by multiplying either all x -coordinates (horizontal dilation) or all y -coordinates (vertical dilation) of a graph by a common factor greater than 1.
 - For more info:
 - http://www.mathwords.com/d/dilation_graph.htm
- **Symmetry about the X-axis** – if for any point (x, y) on a graph, the point $(x, -y)$ is also on the graph, then the graph is said to be symmetric with respect to the X -axis. Also, if the equation of the curve is unaltered when y is replaced by $-y$. *i.e.* $f(x, y) = f(x, -y)$.
 - For more info:
 - <http://home.alltel.net/okrebs/page43.html>

- **Symmetry about the Y-axis** – if for any point (x, y) on a graph, the point $(-x, y)$ is also on the graph, then the graph is said to be symmetric with respect to the Y -axis. Also, if the equation of the curve is unaltered when x is replaced by $-x$.i.e. $f(x, y) = f(-x, y)$
 - For more info:
 - <http://home.alltel.net/okrebs/page43.html>
- **System of Equations** – two or more equations in two or more variables considered together or simultaneously. The equations in the system may or may not have a common solution.
 - For more info:
 - <http://www.purplemath.com/modules/systprob.htm>

T

- **Table of Values** (Table) – a systematic listing of results already worked out.
- **Translation** – a transformation in which a figure is moved from one location to another on the coordinate plane without changing its size, shape, or orientation.
 - For more info:
 - <http://www.intermath-uga.gatech.edu/dictionary/descript.asp?termID=360>
- **Trinomial** – a polynomial with three unlike terms. For example, $x^2 - 3x + 2$.
 - For more info:
 - <http://www.intermath-uga.gatech.edu/dictionary/descript.asp?termID=374>
- **Two-Color Counters** – a disk-shaped manipulative that is generally white on one side and red on the other side. These counters are often used for introducing integer concepts. The white side represents a positive one value, and the red side represents a negative one value.

V

- **Variable** – A variable is a symbol on whose value a function, polynomial, etc., depends. For example, the variables in the function $f(x,y)$ are x and y . A function having a single variable is said to be univariate, one having two variables is said to be bivariate, and one having two or more variables is said to be multivariate.
 - For more info:
 - <http://www.intermath-uga.gatech.edu/dictionary/descript.asp?termID=379>
- **Vertical Asymptote** – The line $x=c$ is a vertical asymptote for a function f , if any of the following condition holds:
 1. f approaches ∞ or $-\infty$ as x approaches c .
 2. f approaches ∞ or $-\infty$ as x approaches c from the left.
 3. f approaches ∞ or $-\infty$ as x approaches c from the right.
 - For more info:
 - <http://www.purplemath.com/modules/asymtote.htm>

X

- **X-intercept** – the x -coordinate of the point at which a graph crosses the x -axis.
 - For more info:
<http://www.purplemath.com/modules/intcept.htm>

Y

- **Y-intercept** - the y -coordinate of the point at which a graph crosses the y -axis.
 - For more info:
 - http://www.harcourtschool.com/glossary/math_advantage/definitions/y_intercept8.html

Z

- **Zero** (of a function) – for any function $f(x)$, if $f(a) = 0$, then a is a zero of the function. The value(s) of x for which the value of the function is zero. The real zeros of a function are the x -intercepts of its graph in the coordinate plane.
 - For more info:
http://www.mathwords.com/xyz/zero_of_a_function.htm