Algebra I
<mark>Algebraic Applications</mark>

Units- a quantity used as a standard of measurement. Ex: Inches, feet, hours, and year.

Conversion- a change in the form of a measurement, different units, without a change in the size or amount.

Dimensional Analysis - is a problem-solving method that uses the fact that any number or expression can be multiplied by one without changing its value

Algebraic Expressions- Numbers, symbols and operators (such as + and ×) grouped together that show the value of something. No equal sign or inequality symbols

Terms- either a single number or variable, or numbers and variables multiplied together. Terms are separated by + or − signs

Factors- numbers you can multiply together to get another number:
Example: 2 and 3 are factors of 6, because 2 × 3 = 6.

Variable- A symbol for a number we don't know yet. It is usually a letter like x or y.
Example: x + 2 = 6, x is the variable.

Coefficients- A number used to multiply a variable.
Example: 6z means 6 times z, and "z" is a variable, so 6 is a coefficient.
Sometimes a letter stands in for the number.
Example: In $ax^2 + bx + c$, "x" is a variable, and "a" and "b" are coefficients

Verbal Expressions- a translation into words of an algebraic expression that can consist of different operations, numbers and variables**.** An example of this is translating the mathematical equation or phrase "90 - 4(a + 8)" to the verbal expression "90 decreased by 4 times the sum of a number "a" and 8."

Factoring - Finding what to multiply to get an expression.

Greatest Common Factor- *The highest number that divides exactly into two or more numbers.*

Difference of Perfect Squares- Two terms that are squared and separated by a subtraction sign like this: $a^2 - b^2$ it can be factored into (a+b)(a−b)

Factoring Trinomials- trinomials consist of three terms. The factors of $x^2 + 3x - 4$ are :(x+4) and (x−1)

Factor by grouping- grouping terms of a polynomial that can be factored so that those groups then have a common factor

Completing the Square-
A technique for solving quadratic equations; to complete the square means to add a constant to a binomial to create a perfect square

Quadratic Formula

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

Quadratic Formula-

Zeros/Roots/Solutions/X-intercepts- is an input value that produces an output of zero (0). If the function maps real numbers to real numbers, its zeroes are the x-coordinates of the points where its graph meets the x-axis. An alternative name for such a point (x,0) in this context is an x-intercept.

Polynomials- an expression of more than two algebraic terms, especially the sum of several terms that contain different powers of the same variable(s).

Equation- a statement that the values of two mathematical expressions are equal (indicated by an equal sign).

Inequality- a < b says that a is less than b
a > b says that a is greater than b
a ≤ b means that a is less than or equal to b
a ≥ b means that a is greater than or equal to b.

Systems of Equations- is a collection of two or more equations with a same set of unknowns. In solving a system of equations, we try to find values for each of the unknowns that will satisfy every equation in the system.

Literal Equations- an equation where variables represent known values. Literal equations allow use to represent things like distance, time, interest, and slope as variables in an equation.

Inverse Operation- are opposite operations that undo each other. Addition and subtraction are inverse operations. Multiplication and division are inverse operations.

Function

Function- pairs each element of the domain with one and only one element of the range.

Function Notation- most often, functions are portrayed as a set of x/y coordinates, with the vertical y-axis serving as a function of x, for example y = f(x)

Linear Function- is any function that graphs to a straight line
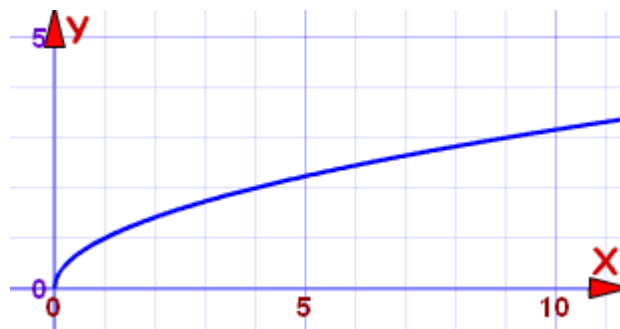
Quadratic Function- is a second-degree polynomial function of the form, where a, b, and c are real numbers. Every quadratic function has a "u-shaped" graph called a parabola.

Exponential Function- A function that contains a variable as an exponent

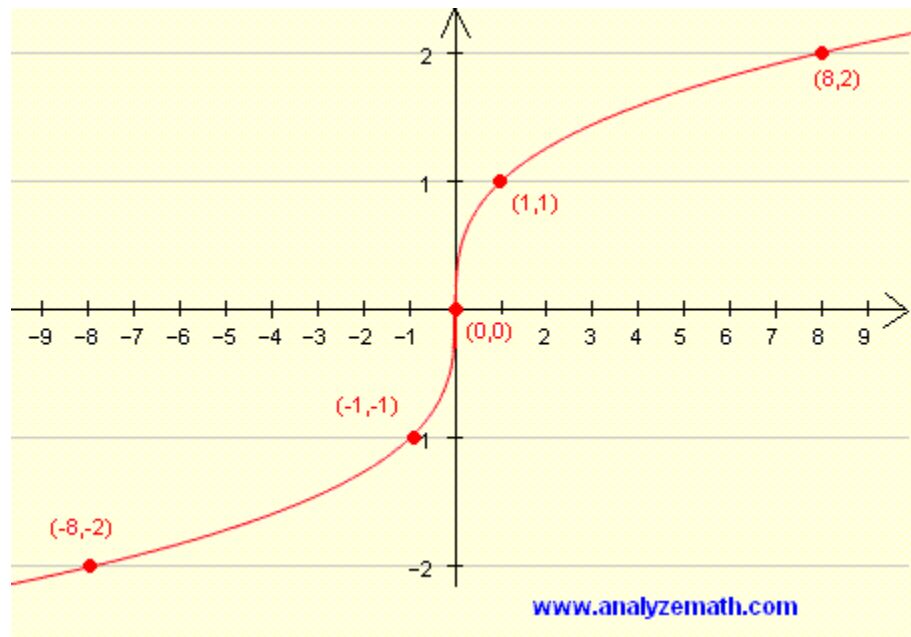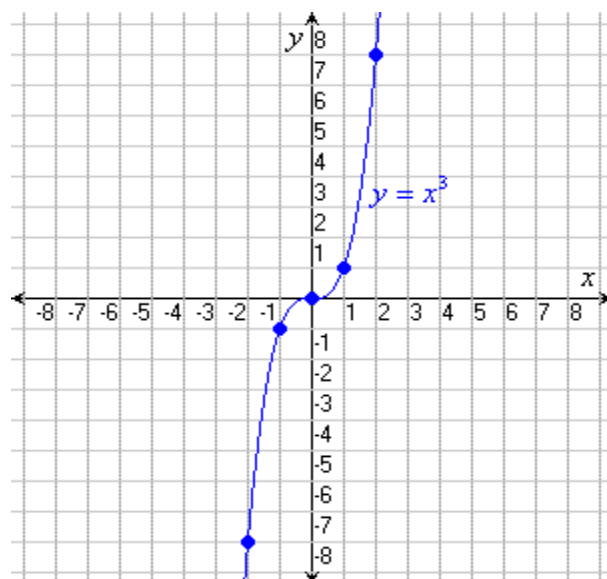**Square Root Function**-

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

This is its graph:

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

Domain and range are the Non-Negative Real Numbers: [0, +∞)

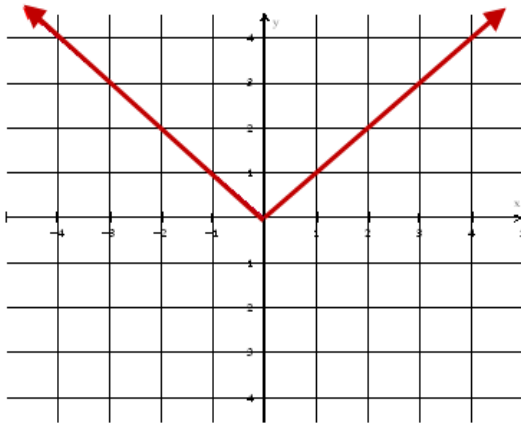**Cube Root Function- f(x) = ³√ (x)**

Cubic Function- y = x³

Absolute Value Function- y = IxI

Example 1: Graph

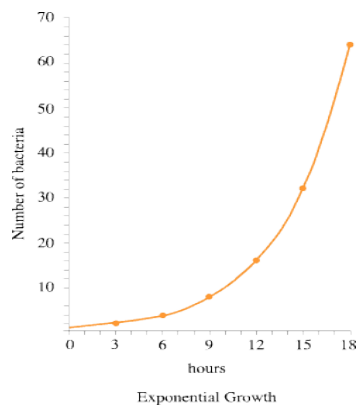$y = |x|$

| x	y
2	2
1	1
0	0
-1	1
-2	2

Parent Function- The most basic function in a family of functions.

Piecewise Function- A function that is defined by different expressions on different parts of the domain

Exponential Growth- The graph of an exponential function with a base greater than 1.

Exponential Growth

Exponential Decay- A decreasing exponential function. The base is smaller than one
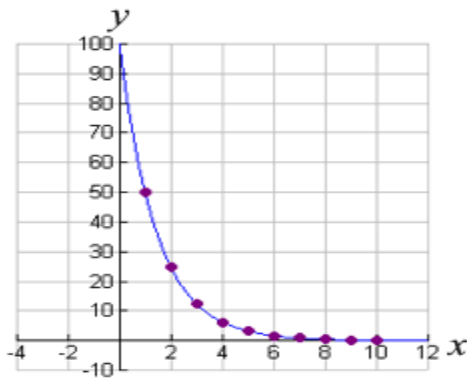
Compound Interest-

Where interest is calculated on both the amount borrowed and any previous interest. Usually calculated one or more times per year.

So you work out the interest for the first period, add it to the total, and then calculate the interest for the next period, and so on, like this:

Elimination Method- The process of adding or subtracting one equation to another in order to eliminate one or more variables and solve a system of equations.

Substitution Method- Replacing a variable in one equation with an expression, equal to that variable, obtained from another equation to solve for a system of equations.

Point of Intersection- Where lines cross over (have some common point).

Domain/Input- is all the values that go into a function

Range/Output- all the values that come out

Sequence- a list of things (usually numbers) that are in order.

Recursive Sequence- Applying a rule or formula to its results (again and again).

Arithmetic Sequence- which has a constant difference between terms. The first term is a_1, the common difference is d, and the number of terms is n.

$$\text{Explicit Formula} \qquad a_n = a_1 + (n-1)d$$

Geometric Sequence-

To **find any term** of a **geometric sequence:**

$$a_n = a_1 \bullet r^{n-1}$$

where a_1 is the first term of the sequence,
r is the common ratio, n is the number of the term to find.

X-intercept- the point at which the graph of a function crosses the x-axis. The value of y is zero.

Y-intercept- the point at which the graph of a function crosses the y- axis. The value of x is zero.

Maximum- when the vertex is the highest point on the graph

Minimum- when the vertex is the lowest point on the graph

Vertex/Turning Point- The vertex of a parabola is the highest or lowest point

Axis of Symmetry-

A line through a shape so that each side is a mirror image.

When the shape is folded in half along the axis of symmetry, then the two halves match up.

Average Rate of Change-

$$A(x) = \frac{f(b) - f(a)}{b - a}$$

Slope-

$$m = \frac{\text{Change in Y}}{\text{Change in X}}$$

Horizontal Translation- A shift in which a plane figure moves left or right.

Vertical Shrinking- the graph becomes narrower

Vertical Stretching- the graph becomes wider

Vertical Translation- the plane figure moves up or down

Statistics- the branch of mathematics that deals with the collection, organization, analysis, and interpretation of numerical data.

Dot Plot- a statistical chart consisting of data points plotted on a fairly simple scale.

Histogram- a diagram consisting of rectangles whose area is proportional to the frequency of a variable and whose width is equal to the class interval.

Box Plot- a graphic way to display the median, quartiles, maximum and minimum values of a data set on a number line.

Interquartile Range- the range of values of a frequency distribution between the first and third quartiles.

Standard Deviation- a measure of how spread out numbers are.

Outlier- A value that "lies outside" (is much smaller or larger than) most of the other values in a set of data. $y < Q1 - 1.5 \times IQR$ or $y > Q3 + 1.5 \times IQR$

Frequency- the rate at which something occurs or is repeated over a particular period of time or in a given sample.

Frequency Table- a table that shows the total for each category or group of data.

Relative Frequency- how often something happens divided by all outcomes.

Joint Frequency- It is called joint frequency because you are joining one variable from the row and one variable from the column.

Joint Relative Frequency- the ratio of the number of observations of a joint frequency to the total number of observations in a frequency table.

Marginal Frequency- the total in a row or column in a two way table.

Marginal Relative Frequency- the ratio of the sum of the joint relative frequency in a row or column and the total number of data values.

Conditional Frequency- an entry in a relative frequency table. It is the ratio of a joint frequency to the total number of observations.

Conditional Relative Frequency- the ratio of a joint frequency to a marginal frequency in its row or column.

Residuals- the distance from the predicted location of a point on a line to an actual data point.

Correlation- mathematical relationship between two variables.

Causation- the capacity of one variable to influence another.

Correlation Coefficient- The quantity r, called the linear correlation coefficient, measures the strength and the direction of a linear relationship between two variables. The value of r is such that $-1 < r < 1$.

Spread- the name given in statistics to describe how the data lies. It is measured in a variety of ways such as the range, the interquartile range and the standard deviation.

Shape- a way to classify data sets into 3 categories that describe the shape of the data distribution: symmetric, left skewed, right skewed.

Mean- The mean is the average of the numbers: a calculated "central" value of a set of numbers.

Median- The middle number in a sorted list of numbers.

Mode- The number which appears most often in a set of numbers.

Range- The difference between the lowest and highest values.

Gap- refer to areas of a graphic display where there are no observations.

Cluster- refers to a type of sampling method.

Two-Way Frequency Table- involves listing all of the values for two categorical variables. All of the values for one of the variables is listed in a vertical column. The values for the other variable are listed along a horizontal row.

Bivariate Data- a study that examines the relationship between two variables

Univariate Data- a study that looks at only one variable

Categorical Data- represent characteristics such as a person's gender, marital status, hometown, or the types of movies they like. Categorical data can take on numerical values (such as "1" indicating male and "2" indicating female), but those numbers don't have mathematical meaning.

First Quartile- (in a frequency distribution) the smallest quartile; the twenty-fifth percentile; the value of the variable below which one quarter of the elements are located.

Third Quartile- (in a frequency distribution) the largest quartile; the 75th percentile; the value of the variable below which three quarters of the elements are located.

Quantitative Data- data expressing a certain quantity, amount or range.

Scatter Plot- is a useful summary of a set of bivariate data (two variables), usually drawn before working out a linear correlation coefficient or fitting a regression line. It gives a good visual picture of the relationship between the two variables, and aids the interpretation of the correlation coefficient or regression model.

Line of Best Fit (*Trend line or Linear regression*)- A line on a graph showing the general direction that a group of points seem to be heading.

Interpolation- a value inside the set of data points.

Extrapolation- a value outside the set of data points

Bias-unfair

Unbiased- fair