Absolute Maximum: The highest point over the entire domain of a function or relation.
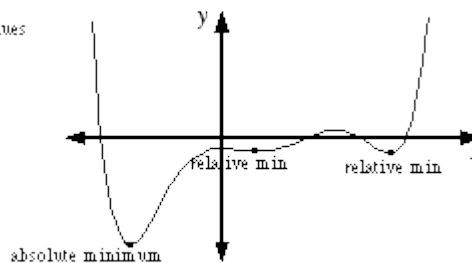
Maximum Values
of a Function
absolute maximum
relative maximum
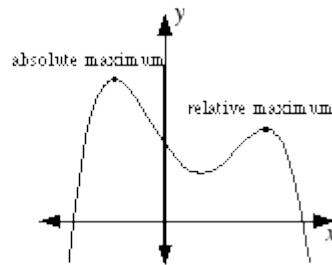
Absolute Minimum: The lowest point over the entire domain of a function or relation.

Minimum Values
of a Function
relative min   relative min
absolute minimum

Absolute Value Function: A piecewise function, written as f(x) = |x|, where f(x) ≥ 0 for all values of x.

Absolute Value of a Real Number: The distance a number is from zero on a number line. Absolute value is denoted as |x|.

 Algebraic Model: A mathematical statement that represents a real life situation. Algebraic models are usually written as equations or inequalities.

Augmented Matrix: An augmented matrix contains the coefficient matrix and the matrix of constants for a system of linear equations. The augmented matrix of the linear system ax + by = e, cx + dy = f is given by $\begin{bmatrix} a & b & \vdots & e \\ c & d & \vdots & f \end{bmatrix}$.

Axis of Symmetry: Also known as a line of symmetry for a graph, is a line that divides a graph to form a mirror image.
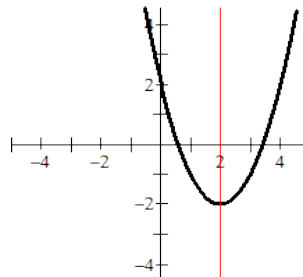
Base: The number in a power that is used as a factor. The base of the expression 2^5 is 2.

Best Fitting Quadratic Model: The second degree polynomial equation that best represents the set of data is the best fitting quadratic model. The model can be determined by performing a quadratic regression on a graphing calculator.

Coefficient Matrix: The matrix formed by the coefficients in a linear system of equations.

$$\text{System:} \quad \begin{array}{l} 2x - 3y = 8 \\ 4x + 5y = 1 \end{array} \qquad \text{Coefficient Matrix:} \quad \begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$$

Coefficient: The number multiplied times a product of variables or powers of variables in a term. For example, 123 is the coefficient in the term $123x^3y$.

Column Matrix: A matrix having only one column.

Complements: Two angles whose measures add to $90°$.

Complex Conjugates: The conjugate of the complex number a + bi is a − bi.

Complex Fraction: A fraction that contains a fraction in its numerator or denominator.

Complex Number: The set of numbers of the form a + bi, where a and b are real numbers and i is the imaginary unit. The complex numbers are represented by C.

Composite Function: Evaluation of a function with another function. Given functions f and g, the composite function $f \circ g$ can be described by $[f \circ g](x) = f(g(x))$. Composite functions are also known as composition functions.

Compound Inequality: Two simple inequalities joined with "and" or "or".

Conjunction: A compound inequality formed using "and". The conjunction can also be written using two inequality symbols.   The compound inequality -2 ≤ x ≤ 3 is logically equivalent to x ≥ -2 **and** x ≤ 3.

Constant Function: A function of the form y = k or $f(x)$ = k, such as $y = -2$.   The graph of a constant function is a horizontal line.

Constant of Variation: The nonzero constant (usually denoted k) in a direct variation equation (y=kx), an inverse variation equation $(y = \dfrac{k}{x})$, or a joint variation equation $(z = kxy)$.

Constant: A monomial that has no variable part. It is a number.

Constraints: In linear programming, the linear inequalities that form a system.

Coordinates: The ordered pair that corresponds to the location of a point in the coordinate plane.

Coordinate Plane: The plane divided into four quadrants by the horizontal axis (x-axis) and the vertical axis (y-axis). It is also called the x-y plane and the Cartesian plane.
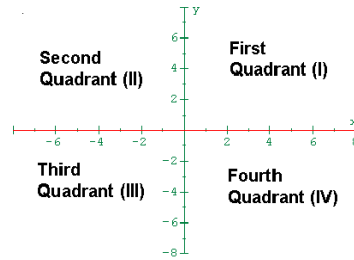
Cross Multiplication: A method for solving simple rational equations for which each side of the equation is a single rational expression. Equal products are formed by multiplying the numerator of each expression by the denominator of the other expression. For example:

$\frac{3x}{4} = \frac{9}{24}$ yields (3x)(24) = (9)(4) which simplifies to be 72x = 36 which implies $x = \frac{36}{72}$ or $\frac{1}{2}$.

Data: A collection of information usually in the form of numbers.

Degree of a monomial: The sum of the exponents of the variables forming the monomial.

Degree of a Polynomial: The greatest monomial degree of the polynomial.

Dependent: A system of equations that has infinitely many solutions is called dependent.

Determinant: A real number associated with any square matrix A, denoted by det A or by |A|. The determinant of a 2 x 2 matrix is the difference of the products of the entries on the diagonals. For example: $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

Dimensions of a Matrix: The number m of rows of a matrix by the number n of columns of the matrix given as m x n. $\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$ is an example of a 2 x 3 matrix.

Discriminant: The expression b²- 4ac for the quadratic equation $a x^2 + bx + c = 0$.

Disjunction: A compound inequality formed with the word "or".

Domain: The set of all abscissas, x-values, of the ordered pairs of a relation.

End Behavior: The behavior of the graph of a function as x approaches positive infinity or negative infinity.

Entries of a Matrix: The numbers with in a matrix.

Equal Matrices: Matrices that have the same dimensions and equal entries in corresponding positions.

Equation: A statement in which two expressions are equal.

Equivalent Equations: Equations that have the same solution.

Equivalent Expressions: Algebraic expressions that have the same value for all values of their variable(s).

Exponent: The number in a power that represents the number of times the base is used as a factor. In the expression 2^5, the number 5 is the exponent.

Exponential Decay Function: A function of the form $f(x) = ab^x$ where $a > 0$ and $0 < b < 1$.

Exponential Function: A function that involves the expression b^x where the base b is a positive number other than 1.

Exponential Growth Function: A function of the form $f(x) = ab^x$ where $a > 0$ and $b > 1$.

Extraneous Solution: A solution of a transformed equation that is not a valid solution of the original equation.

Factor of an Integer: An integer which divides evenly into a given integer. For example, 8 is a factor of 24.

Factor of Polynomial: A polynomial which divides evenly into another polynomial $P(x)$. For example, $x + 2$ is a factor of the polynomial $x^2 - 4$.

Factoring: A process used to write a polynomial as a product of other polynomials having equal or lesser degree. For Example: $x^2 + 8x + 15 = (x + 3)(x + 5)$

Factorial: Represents the product of all integers from 1 to the number and is denoted n!.

For example: $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

Feasible Region: In linear programming, the graph of the system of constraints. It is also known as a convex polygonal set.

Function: A relation with exactly one output for each input. It is a relation that can pass the vertical line test.

Half-planes: The two regions of a coordinate plane that are separated by the boundary line of an inequality. One region contains the points that are solutions of the inequality, and the other region contains the points that are not.

Identity: A statement such as 7x + 4x = 11x that equates two equivalent expressions.

Identity Matrix: The n x n matrix that has 1's on the main diagonal and 0's elsewhere. The 2 x 2 identity matrix is given by $\begin{smallmatrix} 1 & 0 \\ 0 & 1 \end{smallmatrix}$ and the 3 x 3 identity matrix is given by $\begin{smallmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{smallmatrix}$.

Imaginary Number: A complex number of the form $a = bi$ where $b \neq 0$ and i is the imaginary unit which represents $\sqrt{-1}$. The imaginary numbers are represented by I.

Imaginary part of a complex number: b in the complex number a + bi is the imaginary part of the complex number.

Imaginary Unit: The imaginary unit, i, represents $\sqrt{-1}$.

Inconsistent: A system of equations that has no solution.

Increasing Function: A function f where f(a) < f(b) whenever a < b for all a and b on the interval.

Independent Variable: The input variable in an equation. For most of our work it is the variable x.

Index: The number n in the expression $\sqrt[n]{a}$.

Integer: All positive and negative whole numbers (including zero). The set of numbers {…-3, -2, -1, 0, 1, 2, 3,…}. The integers are represented by either Z or J.

Inverse function: The function obtained by switching the *x*- and *y*-variables in a function. The inverse of function *f* is written f^{-1}.

Inverse Matrices: Two square matrices whose product is the identity matrix. For a square matrix A, the inverse is written A^{-1}. Non-square matrices do not have inverses.

$$AA^{-1} = A^{-1}A = I$$

Note: Not all square matrices have inverses. A square matrix which has an inverse is called invertible or nonsingular, and a square matrix without an inverse is called noninvertible or singular.

Inverse Operations: The quantity which cancels out a given quantity. There are different kinds of inverses for different operations.

Quantity	Operation	Inverse	Verification
3	addition	-3	$3 + (-3) = 0$ $(-3) + 3 = 0$
3	multiplication	$\dfrac{1}{3}$	$3 \cdot \dfrac{1}{3} = 1$ $\dfrac{1}{3} \cdot 3 = 1$
$f(x) = 2x - 5$	composition	$f^{-1}(x) = \dfrac{1}{2}x + \dfrac{5}{2}$	$\left(f \circ f^{-1}\right)(x) = 2\left(\dfrac{1}{2}x + \dfrac{5}{2}\right) - 5 = x$ $\left(f^{-1} \circ f\right)(x) = \dfrac{1}{2}(2x - 5) + \dfrac{5}{2} = x$

Inverse relations: Two relations in which one relation contains the element (b,a) whenever the other relation contains the element (a,b)

Inversely proportional: A relationship between two variables in which the product is a constant. When one variable increases, the other variable decreases in proportion so that their product is unchanged. It is also known as inverse variation.

If y is inversely proportional to x, the equation is of the form $y = \dfrac{k}{x}$ (where *k* is a constant).

Irrational Numbers: Real numbers that are not rational. Irrational numbers include numbers such as $\sqrt{6}, \dfrac{2 - \sqrt{29}}{4}, \sqrt[7]{5}, \pi, e, etc.$ Irrational numbers are characterized by non-repeating non-terminating decimals and are represented by H.

Joint Variation: A variable z varies jointly, or is jointly proportional, to a set of variables, when z is directly proportional to each variable taken one at a time.   Joint variation is represented algebraically as $y = k\,x^n z^n$ where $x \neq 0$, $z \neq 0$, and $n > 0$.

Leading Coefficient: The number in front of the variable with the greatest degree in a polynomial is the leading coefficient.

Like Radicals: Two radical expressions that have the same index and the same radicand.

Like Terms: Two monomials that have the same variable part.

Line of Best Fit: A line used to model a set of data. It is also known as a linear regression.

Linear Equation: An equation that can be written in the form "linear polynomial = linear polynomial" or "linear polynomial = constant".

The following are examples of linear equations: $2x - 3 = 5$, $4a + 9 = 8 - 9a$, and $2x + 5y = 1$.

Linear Function: A function of the form $y = mx + b$ where m and b are constants. The graph of the function is a line. It is also known as a first degree polynomial function.

Linear Inequality: An inequality that can be written in the form "linear polynomial > linear polynomial" or "linear polynomial > constant". The > sign may be replaced by <, ≤, or ≥.
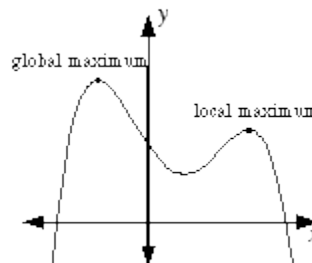
The following are examples of linear inequalities:

$$2x - 3 < 5, \quad 4a + 9 \geq 8 - 9a, \quad \text{and} \quad 2x + 5y \leq 1.$$

Local Extremum: A point that represents the maximum or minimum for a certain interval. They are also known as relative extremum.
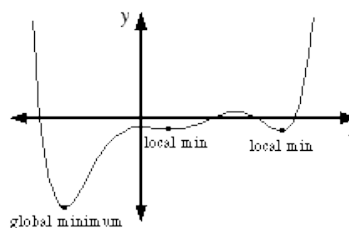
Local Maximum: A point that represents the maximum value of a function for a certain interval. It is also referred to as a relative maximum.

Local Minimum: A point that represents the minimum for a certain interval. It is also called a relative minimum.

Mathematical Model: A representation of a real life situation usually in the form of an equation or an inequality.

Matrix: Any rectangular array of terms called elements such as $\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix}$.

Monomial: An expression with one term such as 7x or a constant such as 2.

**Monomial Degree:** The sum of the exponents of the variables of a monomial.

Multiplicative Inverse of a Number: The multiplicative inverse is also called the reciprocal. A reciprocal is a fraction flipped upside down.

For example, the multiplicative inverse (reciprocal) of 12 is $\frac{1}{12}$ and the multiplicative inverse (reciprocal) of $\frac{3}{5}$ is $\frac{5}{3}$.

 Note: The product of a number and its multiplicative inverse is 1. Observe that $\frac{3}{5} \cdot \frac{5}{3} = 1$.

Natural Numbers: The numbers used for counting, or the set of numbers {1, 2, 3, 4,…}. The Natural numbers are represented by N.

Negative Correlation: The relationship between paired data when y tends to decrease as x increases, as shown by a scatter plot where the plotted points generally fall from left to right.
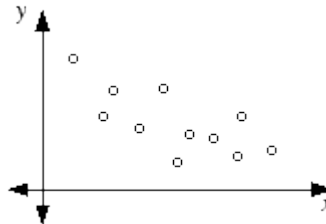
No Relative Correlation: In a scatter plot, no relationship exists between the paired data. The points on the graph appear very random.
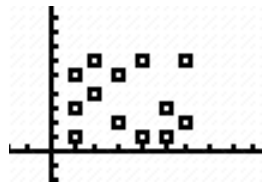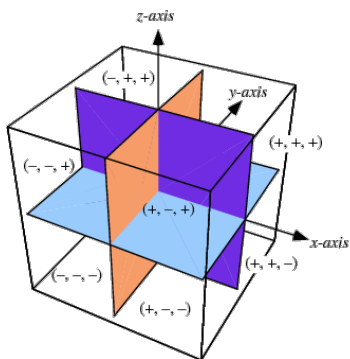

N^th Root: For an integer n greater than 1, if $b^n=a$, then b is the nth root of a. It is written as $\sqrt[n]{a}$.

Numerical Expression: An expression that consists of numbers, operations, and grouping symbols.

Objective Function: The linear function that is to be optimized in linear programming.

Octant: One of the eight regions of space formed by a three dimensional coordinate-system.

Opposite: The opposite, or additive inverse, of any number a is –a.

Optimization: A process in which you find the maximum or minimum value of some variable quantity. One type of optimization process is linear programming.

Ordered Pair: A pair of numbers of the form (x,y) that represents a point in the coordinate plane.

Ordered Triple: A set of three numbers of the form (x,y,z) that represents a point in space.

Parallel Lines: Parallel lines are two distinct coplanar lines that do not intersect. Note: Parallel lines have the same slope. The symbol for parallel is ∥ .

Perpendicular Lines: Two lines such that the product of their slopes is -1. The symbol for perpendicular is ⊥ .

Piecewise Function: A function in which different equations are used for different intervals of the domain.

Example: Consider $f(x) = \begin{cases} 1-x & \text{if } x \le -2 \\ x^2 & \text{if } -2 < x \le 3 \\ 5 & \text{if } x > 3 \end{cases}$
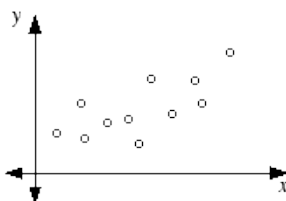
For this function,
$$f(-5) = 1-(-5) = 6$$
$$f(1) = 1^2 = 1$$
$$f(12) = 5$$

Polynomial Function: A function y = P(x) where P(x) is a polynomial in one variable.

Positive Correlation: The relationship between paired data when y tends to increase as x increases, as shown by a scatter plot where the plotted points generally rise from left to right.

Power Function: A function of the form $y = x^b$, where b is a real number.

Quadrant: One of the four regions into which the axes divide a coordinate plane.
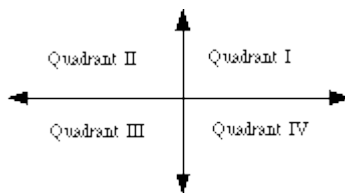
Quadratic Equation: An equation which includes nothing greater than second degree polynomials. Some examples are $y = 3x^2 - 5x^2 + 1$, $x^2 + 5xy + y^2 = 1$, and $1.6a^2 + 5.9a - 3.14 = 0$.

Note: When there is only one variable, a quadratic equation can be expressed in the form $ax^2 + bx + c = 0$ where *a*, *b*, and *c* are all constants.

Radical Expression: A mathematical expression containing $\sqrt{}$ or $\sqrt[n]{}$.

Radical Sign: The symbol $\sqrt{}$ or $\sqrt[n]{}$ used to indicate square roots and n[th] roots.

Radicand: The number under the $\sqrt{}$ (radical) symbol. It is the number that is having its square root taken (or 3rd root or 4th root or n[th] root). In the expression $\sqrt{5}$, the radicand is 5.

Radius: A line segment between the center and a point on the circle or sphere. The word *radius* also refers to the length of this segment.
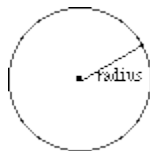
Range of a relation: The set of all ordinates (y-values) of the ordered pairs of a relation.

Rate of Change: The slope of a linear function.

Rational Expression: An expression that can be written as a polynomial divided by a polynomial such as: $\dfrac{x^2 - 4x + 4}{x - 2}$.

Rational Function: The quotient of two polynomials in the form $f(x) = \dfrac{g(x)}{h(x)}$, where h(x) ≠ 0.

Rational Numbers: The numbers commonly called fraction are the real numbers that can be written as a ratio of integers. The rational numbers are represented by Q.

Real Number: The set of numbers consisting of the positive numbers, the negative numbers, zero, and the numbers between them. The real numbers are made up of the rational and irrational numbers. The real numbers are represented by a scripted R such as $\mathcal{R}$.

Real Part of a Complex Number: The number a in the complex number a + bi.

Relation: A mapping or pairing of input values to output values.

Relation: A mapping or pairing of input values with output values.

Relative Extremum: A point that represents the maximum or minimum for a certain interval.

Relative Maximum: A point that represents the maximum value of a function for a certain interval. It is also referred to as a local maximum.

Maximum Values of a Function

global maximum

local maximum
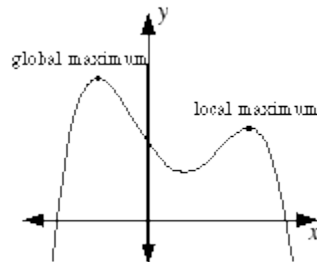
Relative Minimum: A point that represents the minimum for a certain interval. It is also called a local minimum.

Minimum Values of a Function

local min   local min

global minimum
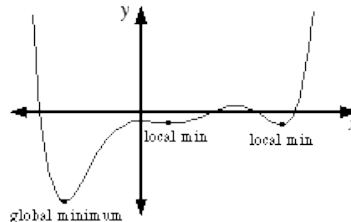
Root: A solution to the equation P(x) = 0.

Row Matrix: A matrix that has only one row.

Scientific Notation: The expression of a number in the form $a \times 10^n$ where $1 \leq a < 10$ and n is an integer.

Simplest Radical Form: A radical expression which has all three of the following qualities: 1) the radicand is not a fraction, 2) the radicand does not contain a factor that is a perfect square, and 3) the denominator does not contain a radical.

Simplest Rational Form: A fraction in which the numerator and denominator have no common factors other than ± 1.

Slope: The ratio of vertical change (the rise) to horizontal change (the run) for a non-vertical line given by the formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Solution: A number that, when substituted for the variable, makes the equation true. It is also called a root.

Square Matrix: A matrix having the same number of rows and columns.

Square Root: The number that when multiplied by itself yields a given number. For example, 3 is the square root of 9 because (3)(3) = 9. The symbol for square root is $\sqrt{\ }$.

Standard Form of a Complex number: The form a + bi where a and b are real numbers and i is the imaginary unit.

Standard Form of a Linear Equation: An equation written in the form Ax + By = C where A and B are not both zero.

Standard Form of a Polynomial Function: A function with terms written in descending order of exponents from left to right.

Standard Form of a Quadratic Equation: The form $ax^2 + bx + c = 0$ where a ≠ 0.

Step Function: A function with a graph resembling a stair case.

$y = \lfloor x \rfloor$
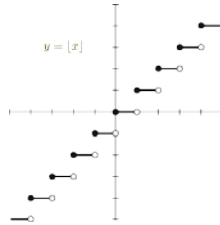
System of Equations: Two or more equations containing common variable(s).

$$\text{Example:} \quad \begin{cases} x^2 + y^2 = 2 \\ x + y = 1 \end{cases}$$

System of Inequalities: Two or more inequalities containing common variable(s). Note: Systems of inequalities sometimes include equations as well as inequalities.

$$\text{Example:} \quad \begin{cases} x \geq 0 \\ y \geq 0 \\ x + y < 2 \end{cases}$$

 Whole Number: The positive integers together with zero. The set of numbers {0, 1, 2, 3, 4,…}. The Whole numbers are represented by W.

x-intercept: The x-coordinate of the point where a graph intersects the x-axis.

y-intercept: The y-coordinate of the point where a graph intersects the y-axis.

Zero Matrix: A matrix with all entries being zero such as $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$.

Zero of a Function: A number that names the function equal to zero. It is also an x-intercept.