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| **Absolute value function** a function in which the input is contained within absolute value symbols    *Example:*  **Accuracy** how close a measure or calculation is to its actual value  **Additive identity** the number that, when added to a number a, gives the sum a; for real numbers, the additive identity is 0: a + 0 = a  **Additive inverse** for any real number a, the number –a, such that their sum is the additive identity:  a + (-a) = (-a) + a = 0  **Algebraic equation** A mathematical statement that is written using one or more variables and constants which contains an equal signExamples: 3y + 5 = 1 ; 2x = 8    **Algebraic expression** a statement that expresses a mathematical relationship using symbols, words and numbers. The symbols most commonly encountered include +, -, x, ÷, √, | |, ( ), {}, and π. Parts of an algebraic expression include variables, coefficients, and constants but does not contain a relation symbol ( <, >, ≤, ≥, =, ≠ )  Examples: 3y + 5 ; 2x  **Algebraic fraction** contains an algebraic expression in its numerator and/or denominator.  *Example*:  **Analytic model** a model that seeks to explain data based on deeper theoretical ideas. For example, by using an algebraic equation. This is sometimes referred to as a symbolic model  **Approximation** a value used to represent a true measurement when as exact answer is not possible  **Arithmetic sequence** a sequence in which success terms have a common difference  **Association** a statistical association is any relationship between measures of two types of quantities so that one is statistically dependent on the other  **Common difference** the number added to find the next term in an arithmetic sequence  **Common ratio** the number by which each term in a geometric sequence is multiplied to obtain the next term  **Commutative property** A property of real numbers that states that the sum or product of two terms is unaffected by the order in which the terms are added or multiplied; i.e., the sum or product remains the same  *Examples:*  Addition: 2x + 3.5y = 3.5y + 2x  Multiplication: xy2= y2x  **Completing the square** a method of converting a quadratic expression of the form *ax2 + bx + c* to form *a(x – h)2 + k*  **Compound inequality** an inequality that has two or more boundaries  **Conditional frequency** a relative frequency in the body of a two-way relative frequency table  **Conditional relative frequency** compares a frequency count to the marginal total that represents the condition of interest  **Constant** a number with a known value that does not change in a mathematical expression  **Continuous** not having any jumps or breaks in shape; able to be drawn in one motion without interruption  **Conversion factor** a number used to convert from one unit to another through multiplication or division  **Correlation coefficient** a number r, where , that measures the strength and direction of a linear relationship between the two types of quantities. If r = 1, then the graph of data points of the bivariate data set lie on a line of positive slope and if r = -1, graph will have a negative slope  **Cubic function** a polynomial function of degree 3  **Cube root function** the parent function  **Curve of best fit** the curve that most closely represents the relationship between variables that do not have a linear association  **Degree of monomial** is the sum of the exponents of the variable symbols that appear in the monomial  **Equivalent Algebraic Expressions** two algebraic expressions are *equivalent* if we can convert one expression into the other by repeatedly applying the Commutative, Associative, and Distributive Properties and the properties of rational exponents to components of the first expression  **Equivalent Numerical Expressions** two numerical expressions are *equivalent* if they evaluate to the same number  **Estimate** a value made inexact on purpose in order to make calculations easier  **Even function** a function that is symmetrical with respect to the y-axis  **Experimental study** a study in which the researcher controls variables in order to determine their effect  **Exponent** the number in an exponential expression that indicates how many times a base is multiplied by itself; in an expression of the form bn, n is called the exponent, b is the base, and bn is a power of b  **Exponential decay** a relationship modeled by a function of the form f(x) =  in which a > 0 and  0 < b < 1, where *a* represents the starting value of a quantity being measured and base *b* shows how that quantity changes as the variable x changes.  When a quantity grows by a fixed percent at regular intervals, the pattern can be represented by the function : f(x)= a(1 – r)x, where a is the initial amount, r is the decay rate (often given as a percent but written as a decimal) and x is the number of time intervals that have passed (in years)  **Exponential equation** an equation in which the variable is in the exponent, the independent variable  **Exponential function** a function of the form  f(x) = + c, in which the input, x, is the exponent of a constant, b. Function grows by equal *factors* over equal intervals  **Exponential growth** a relationship modeled by a function of the form f(x) =  in which a > 0 and  b > 1, where *a* represents the starting value of a quantity being measured and base *b* shows how that quantity changes as the variable x changes.  When a quantity grows by a fixed percent at regular intervals, the pattern can be represented by the function : f(x)= a(1 + r)x, where a is the initial amount, r is the decay rate (often given as a percent but written as a decimal) and x is the number of time intervals that have passed (in years)  **Index** a small number indicating what root is being taken in a radical expression  **Input** the first value, often an x-coordinate, in an ordered pair for a function; the value that is entered into a function in order to produce the related output  **Interquartile range (IQR)** a measure of the spread of the middle 50% of a data set; equal to the difference of the first and third quartiles of the set; IQR = Q3 – Q1. The IQR describes variability by identifying the length of the interval that contains the middle 50% of the data values  **Inverse (of a function)** the relation that swaps the input and output of a given function  **Irrational number** a number that cannot be written as a quotient of integers  **Joint frequency** a frequency in the body of a two-way frequency table  **Leading coefficient (of a quadratic equation)** the coefficient a of a quadratic equation in standard form,  y = ax2 + bx +c; the leading coefficient of a polynomial is the coefficient of the term of highest degree  *Examples*:  5 is the leading coefficient of 5x2 - 9x + 7  - 4 is the leading coefficient of 1 - 4n2 +7n  **Least integer function** a step function that outputs the least integer that is greater than or equal to the input; also called a ceiling function  **Linear equation** an equation in which every variable is raised to the first power; in the form of y = mx + b  **Linear function** a function of the form f(x) = mx + b, in which the input, x, is raised to the first power and whose graph is a straight line; a polynomial function of degree 1; Function grows at equal *differences* over equal intervals  **Linear inequality** an inequality in which every variable is raised to the first power  **Line of best fit (trend line)** the line that most closely represents the relationship between variables that have a linear association; A line used to approximate and generalize the linear relationship between the  independent and dependent variables for a set of data  **Line of reflection** the line over which a figure or graph is flipped to produce a mirror image  **Outlier**  an element that is very different from the other elements in the same data set; is a value that is greater than Q3 by a distance of 1.5 x IQR or a value that is less than Q1 by a distance of 1.5 x IQR. Outliers are usually identified by an “\*” or a “” in a box plot  **Output**  the second value, often a y-coordinate, in an ordered pair for a function; the value that is produced when a function is evaluated for a given input  **Parabola** the U-shaped graph of a quadratic function;  A common form of an equation of a parabola with vertical line symmetry is y = ax2 + bx + c where a, b, and c are real numbers and a ≠ 0  **Parent function** the most basic function in a “family”, or group, of related functions  **Piecewise function** a function in which the output is calculated according to two or more rules, depending on the input; given non-overlapping intervals on the real number line, it is a function from the union of the intervals to the et of real numbers such that the function is defined by (possible different) linear functions on each interval  **Polynomial (expression)** a collection of constants and variables joined through addition, subtraction, and multiplication  **Power the exponent** is an exponential expression; the number that indicates how many times a base is used as a factor  **Prime factorization** a string of prime factors whose product is a given number or polynomial  **Prime number** a positive integer that cannot be divided without remainder by any positive integer other than itself and 1  **Principal square root** the positive square root of a number  **Properties of the real numbers** rules that apply to the operations with real numbers.  **Quadratic expression** a polynomial expression a degree 2  **Quadratic equation** an equation that can be written in the form ax2 + bx + c = 0 , where a, b,  and c are real constants and a ≠ 0  **Quadratic function** a function in which the highest power of the variable is 2 (degree of 2)  **Residual plot** given a bivariate data set and linear equation used to model the data set, a residual plot is the graph of all ordered pairs determined as follows: for each data point (*xi,yi*) in the data set, the first entry of the ordered pair is the x-value of the data point and the second entry is the residual of the data point  **Root (of an equation)** a factor of a number that, when multiplied by itself a given number of times, equals the number; root of an equation A solution to an equation of the form f(x) = 0.  *Example:* A root of the equation y = 6x – 18 is 3 because when 3 is substituted in for x,  the value of y = 0.  *Example*: The roots of x2  – x – 2 = 0 are x = 2 and  x = −1. The equation is true if we substitute either x = 2 or x = −1 into the equation.  **Sample standard deviation** the sample variance for a numerical sample data set of n vales is the sum of the squared distances the values are from the mean divided by (n – 1). The sample standard deviation is the principle (positive) square root of the sample variance  **Scatter plot** a graph that shows the relationship between two variables; a graph on which data are plotted as points (x,y) on a coordinate plane; A graphical display of statistical data plotted as points on a coordinate plane to show the correlation between two quantities  **Sequence** a predictable arrangement of numbers, expressions, pictures, or other objects that follows a pattern or rule  **Set** a well-definedcollection of items  **Set-builder notation** the set of all positive real number in set builder notation is This is read as “the set of values of *x* such that *x* is a real number and *x* is greater than 0.”  **Skewed data distribution** a distribution of data which, when graphed, shows a “tail” that extends much more to one side of the graph than to the other; when the distribution of data is not symmetric with respect to its mean. Left-skewed or skewed to the left is indicated by the data spreading out longer (like a tail) on the left side. Right-skewed to the right is indicated by the data spreading out longer (like a tail) on the right side  **Third quartile (Q3)** the median of the upper half of a data set  **Transformation** an operation that changes a figure or graph according to a rule  **Translation** a transformation that moves (slides) all of the points on a figure that same distance in the same direction  **Trend line (line of best fit)** the line that most closely represents the relationship between variables that have a linear association; A line used to approximate and generalize the linear relationship between the  independent and dependent variables for a set of data  **Trinomial**  a polynomial containing exactly three unlike terms  **Two-way frequency table** a data display used to display and interpret frequencies for categorical variables  **Two-way relative frequency table** a data display used to display and interpret relative frequencies for categorical variables  **Undefined**  an expression in mathematics which does not have meaning and therefore is not assigned a value.  *Example:*When x = 4, the expression  is undefined  **Uniform distribution** a distribution of data in which all values have the same frequency  **Upper extreme** the greatest value in a data set  **Variability** measure of variability for a data distribution is a number that conveys the idea of spread of the values in the data set around the mean. Measures of variability helps to understand the distribution of data set better. Such measures are called the measures of variability or the measures of variation  **Variable** a letter or symbol that represents an unknown or changing number in a mathematical expression  **Variable symbol** a symbol that is a placeholder for a number. It is possible that a question may restrict the type of number that a placeholder might permit, maybe integers only or positive real number, for instance | **Associative property** A property of real numbers that states that the sum or product of a set of numbers or variables has the same value, regardless of how the numbers or variables are grouped.  *Examples:*  Addition: 2x + (3.5y + 1.3z) = (2x + 3.5y) + 1.3z  Multiplication: –6a × (18b × 7c) = (–6a × 18b) × 7c  **Asymptote** a line that the graph of a function continuously approaches but never touches  **Average rate of change** given a function *f* whose domain includes the closed interval of real numbers [a,b] and whose range is a subset of the real numbers, the average rate of change on the interval  [a,b] is  **Axis of symmetry (of a parabola)** given a quadratic function in standard form*, f(x) = ax2 + bx + c*, a vertical line of symmetry (with the graph of the equation,  ) passing through the vertex of a parabola  **Base** the number or variable that is raised to a power in an exponential expression  **Bimodal distribution** a distribution of data that, when graphed, shows two clear peaks  **Binomial** a polynomial containing exactly two unlike terms  Examples: 5a + 6; x2 + 3y; 9m – 13p    **Bivariate data** statistical data in which two variables are being studied  **Box plot (box-and-whisker plot)** a graph above a number line that shows the five number summary; minimum (lower extreme), first quartile, median (second quartile), third quartile, and maximum (upper extreme). This plot shows the range of scores  within each quarter of the data. It is very useful for examining the variation in a set of data and  comparing the variation of more than one set of data  **Categorical data** data that cannot be measured and are generally in the form of names or labels  **Ceiling function (least integer function)** a step function that outputs the least integer that is greater than or equal to the input  **Coefficient**  a number that is multiplied by a variable in an expression or equation  **Degree (of polynomial)** a characteristic of a polynomial determined by the highest exponent or sum of exponents of any term  **Dependent variable** a variable, often y or f(x), that provides the output value of an equation or function  **Descriptive model** a model that seeks to describe phenomena or summarize them in a compact form. For example, by using a graph  **Difference of two perfect squares** A binomial of the form a2 – b2 which can be factored into (a – b)(a + b)  **Dimensional analysis** a method of determining or checking a mathematical expression for a given context by examining units  **Discriminant** the radicand expression, b2 – 4ac, from the quadratic formula, which can be used to determine how many real roots a quadratic has  **Distributive property** property of real numbers that states that the product of a number and the sum or difference of two numbers is the same as the sum or difference of their products  *Example:*  Multiplication over addition:  2(15 + 4) = 2 x 15 + 2 x 4  Multiplication over subtraction:  4(12 - 8) = 4 x 12 - 4 x 8  **Domain** the set of all the first elements (inputs) of a relation (x-values)  **Dot plot** a data display that represents data values as dots or “x’s”over a number line  **Element** an individual value from a set  **Elimination method** a method for solving systems of equations where equations are multiplied by constants and added and/or subtracted so as to eliminate all but one variable  **Empty Set (or Null Set)** the set with no elements. The empty set can be written .  **End behavior** **(of a quadratic function)** Given a quadratic function in the form of f(x) = *ax2 + bx + c* or f(x) = *a(x – h)2 + k,* the quadratic function is said to *open up* if a > 0 and *open down* if a < 0  **Equation** a mathematical sentence stating that two expressions are equal  **Extraneous solution** a value of a variable that is obtained by solving an equation but that is not a solution to the equation or to the situation that the equation models  **Factored form for a quadratic function** a quadratic function written in the form *f(x) = a(x – n)(x – m)*  **First quartile(Q1)** the median of the lower half of a data set  **Floor function (greatest integer function)** a step function that outputs the greatest integer that is less than or equal to the input  **Function** a relation in which every input is assigned to exactly one output; a correspondence between two set, X and Y, in which each element of X is matched (assigned) to one and only one element of Y  **Geometric sequence** a sequence in which consecutive terms have a common ratio  **Graph of an equation in two variables** the set of all points in the coordinate plane what are solutions to an equation in two variables  **Greatest integer function (floor function)** a step function that outputs the greatest integer that is less than or equal to the input  **Half-plane** the portion of the coordinate plane that lies on one side of a line  **Histogram** a data display that uses bars to show how frequently data occur within certain ranges or intervals.  The horizontal axis is a number line that displays the data in equal intervals. The frequency of each bar is shown on the vertical axis  **Horizontal line test** a test in which if any horizontal line crosses a graph of a relation at two or more points, then the inverse of that relation is not itself a function  **Horizontal shrink** a transformation that pushes the points of a figure or graph toward the y-axis  **Horizontal stretch** a transformation that pulls the points of a figure or graph away from the y-axis  **Horizontal translation** a slide of a graph or figure in the right or the left direction on the coordinate plane  **Independent variable** a variable, often x, that serves as the input value of an equation or function  **Literal equation** an equation that contains more than one variable.  *Example:* 2a + 3b = c  **Lower extreme (minimum value)** the least value in a data set  **Marginal frequency** an entry in the “total” row or “total” column of a two-way frequency table or a two-way relative frequency table  **Maximum** the point on a graph that has the greatest  y-value or f(x)-value  **Mean** the sum of all the terms in a data set divided by the total number of terms  **Mean absolute deviation of a set of**  the average distance between each data value and the mean  **Measure of center** a value that represents the middle or average of a data set  **Median** the middle value in a data set that is ordered from least to greatest  **Minimum** the point on a graph that has the least  y-value or f(x)-value  **Monomial** a polynomial containing only one term  **Multiplicative identity** the number which, when multiplied by a number a, gives the product a; for real numbers, the multiplicative identity is 1: a x 1 = a  **Multiplicative inverse** for any real number *a* other then 0, the number  such that their product is the multiplicative identity:  **Normal distribution** a distribution of data which, when graphed, is symmetrical and resembles a bell curve  **Numerical expression** is an algebraic expression that contains only numerical symbols (no variable symbols) and that evaluates to a single number  **Numerical symbol** a symbol that represents a specific number  **Observational study** a study in which variables are observed or outcomes are measured, but no attempt is made to control variables or affect outcomes  **Odd function** a function that is symmetrical with respect to the origin  **Quadratic formula** a formula  Used to find the solutions to any quadratic equation of the form *ax2 + bx + c* = 0  **Quantitative data** data that can be measured and are in numerical form; descriptions using numerical measures such as quantity, height, or age  **Quartiles** values that divide a list of numbers into quarters  **Radical** an expression of the form , where r is a number or expression  **Radicand** the number or expression inside a radical () sign  **Range (of a function)** the set of all the second elements (outputs) in a relation (y-values)  **Rate of change** the value by which one quantity changes when another related quantity increases  **Rational exponent** in an exponential expression, an exponent that is a rational number  **Rational number** a number that can be written as a quotient of integers,  **Reciprocal**  the multiplicative inverse of a number  **Recursive process** a process that requires knowing or computing previous terms in order to find the value of a desired term  **Reflection** a transformation that flips a figure or graph over a point or line  **Relation** a set of ordered pairs; a correspondence between two sets  **Relative frequency** the ratio of a frequency for a category to the total frequencies in a row, a column, or an entire table  **Residual** the difference of an observed y-value on a scatter plot and a predicted y-value, based on a line of fit; the residual of the data point (*xi,yi*) is the  (actual *y*i-value) – (predicted *y*-value) for the given *xi*  **Slope** the ratio of the vertical change to the horizontal change for the graph of a linear equation; The measure of the steepness of a line; the ratio of vertical change to horizontal change; if point P is (*x*1,*y*1) and point Q is (*x*2,*y*2) the slope of *PQ* is *m* =  =  **Slope-intercept form** a form of a linear equation,  y = mx + b, where m is the slope and b is the  y-intercept  **Solution** a solution to an equation with one variable is a number in the domain of the variable that, when substituted for all instances of the variable in both expressions, makes the equation a true number sentence  **Solution set** the set of solutions of an equation; Any and all value(s) of the variable(s) that satisfy an equation, inequality, system of equations, or system of inequalities  **Spread (of a data set)** describes how data in a given data set are distributed or grouped  **Square root function** the parent function f(x) =  **Standard deviation** a measure of spread for a set of data that indicates how much a data set varies from the mean  **Standard form of a polynomial in one variable** a polynomial expression with one variable symbol x is in standard form if it is expressed as,  anxn + an-1xn-1 + … + a1x + a0, where n is a non-negative integer, and a0, a1, a2…, an are constant coefficients with an . A polynomial expression in x that is in standard form is often called a polynomial in x  **Standard form (of a quadratic equation)** the form  y = ax2 + bx + c of a quadratic equation in which a, b, and c are constants; function form: f(x) = ax2 + bx + c  **Step function** a piecewise function in which each interval has a constant value and which forms a graph made up of “steps”  **Substitution method** a method for solving systems of equations where one variable is replaced by an equivalent expression in the other variable  **System of linear equations/inequalities** a grouping of two or more linear equations written using the same variables; A set of two or more equations/inequalities. The solution set contains those values that satisfy all of the equations/inequalities in the system  **Tangent** intersecting a curve at only one point  **Term (of an expression)** a combination of constants and/or variables joined together through multiplication or division  **Term (of a sequence)** a number, expression, picture, or other object that is part of a sequence  **Vertex** the turning point for the graph of a quadratic or absolute value function  **Vertex form** completed-square form for a quadratic function; in other words, written in the form  f(x) = a(x – h)2 + k, in which (h,k) is the vertex  **Vertex of the graph of a quadratic function** the point where the graph of a quadratic function and its axis of symmetry intersect. The vertex is either a maximum or a minimum of the quadratic function, depending on whether the leading coefficient of the function in standard form is negative or positive  **Vertical line test** a test in which if any vertical line crosses a graph at two or more points, then the graph does not represent a function  **Vertical shrink** a transformation that pushes the points of a figure or graph toward the x-axis  **Vertical stretch** a transformation that pulls the points of a figure or graph away from the x-axis  **Vertical translation** a slide of a graph or figure up or down on the coordinate plane  **x-intercept** a point (a,0) at which a graph crosses the x-axis  **y-intercept** a point (0,b) at which a graph crosses the y-axis  **Zero (of a function)** an input value for a function that produces 0 as the output; equal to the x-coordinate of an x-intercept of the function  **Zero product property** a property stating that if the product of two numbers or expressions is equal to 0, then one of those numbers or expressions must be equal to zero; given real numbers, a and b, if  then either a = 0 or b = 0, or both a and b = 0 |