Glossary

Instructional Words

C

calculate: Figure out the number that answers a question; compute

clarify: Make a statement easier to understand; provide an example

classify: Put things into groups according to a rule and label the groups; organize into categories

compare: Look at two or more objects or numbers and identify how they are the same and how they are different (e.g., Compare the numbers 6.5 and 5.6. Compare the size of the students' feet. Compare two shapes.)

conclude: Judge or decide after reflection or after considering data

construct: Make or build a model; draw an accurate geometric shape (e.g., Use a ruler and a protractor to construct an angle.)

create: Make your own example

D

describe: Tell, draw, or write about what something is or what something looks like; tell about a process in a step-by-step way

determine: Decide with certainty as a result of calculation, experiment, or exploration

draw: 1. Show something in picture form (e.g., Draw a diagram.)
2. Pull or select an object (e.g., Draw a card from the deck. Draw a tile from the bag.)

E

estimate: Use your knowledge to make a sensible decision about an amount; make a reasonable guess (e.g., Estimate how long it takes to cycle from your home to school. Estimate how many leaves are on a tree. What is your estimate of 3210 + 789?)

evaluate: 1. Determine if something makes sense; judge
2. Calculate the value as a number

explain: Tell what you did; show your mathematical thinking at every stage; show how you know

explore: Investigate a problem by questioning, brainstorming, and trying new ideas

extend: 1. In patterning, continue the pattern
2. In problem solving, create a new problem that takes the idea of the original problem further

J

justify: Give convincing reasons for a prediction, an estimate, or a solution; tell why you think your answer is correct

M

measure: Use a tool to describe an object or determine an amount (e.g., Use a ruler to measure the height or distance around something. Use a protractor to measure an angle. Use balance scales to measure mass. Use a measuring cup to measure capacity. Use a stopwatch to measure the time in seconds or minutes.)

model: Show, represent, or demonstrate an idea or situation using a diagram, graph, table of values, equation, formula, physical model, or computer model

P

predict: Use what you know to work out what is going to happen (e.g., Predict the next number in the pattern 1, 2, 4, 7, ...)

R

reason: Develop ideas and relate them to the purpose of the task and to each other; analyze relevant information to show understanding

relate: Describe how two or more objects, drawings, ideas, or numbers are similar

represent: Show information or an idea in a different way that makes it easier to understand (e.g., Draw a graph. Make a model.)

S

show (your work): Record all calculations, drawings, numbers, words, or symbols that make up the solution

sketch: Make a rough drawing (e.g., Sketch a picture of the field with dimensions.)

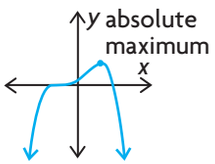
solve: Develop and carry out a process for finding a solution to a problem

sort: Separate a set of objects, drawings, ideas, or numbers according to an attribute (e.g., Sort 2-D shapes by the number of sides.)

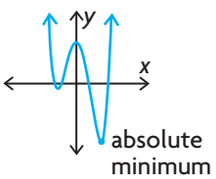
Mathematical Words

A

absolute maximum: The greatest value of a function for all values in its domain



absolute minimum: The least value of a function for all values in its domain

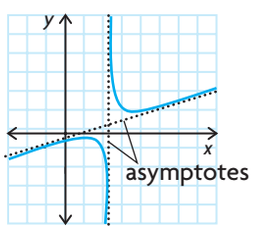


absolute value: Written as $|x|$; describes the distance of x from 0; equals x when $x \geq 0$ and equals $-x$ when $x < 0$; for example, $|3| = 3$ and $|-3| = -(-3) = 3$

amplitude: Half the difference between the maximum and minimum values of a sinusoidal function; also the vertical distance from the axis of a sinusoidal function to the maximum or minimum value

argument: The expression on which a function operates; for example, in $\sin(x + \pi)$, sin is the function and $x + \pi$ is the argument

asymptote: A line that the graph of a relation or function gets closer and closer to, but never meets, on some part of its domain



V

validate: Check an idea by showing that it works

verify: Work out an answer or solution again, usually in another way; show evidence of

visualize: Form a picture in your head of what something is like; imagine

average rate of change: In a relation, the change in the quantity represented by the dependent variable (Δy) divided by the corresponding change in the quantity represented by the independent variable (Δx); for a function $y = f(x)$, the average rate of change in the interval $x_1 \leq x \leq x_2$ is $\frac{\Delta y}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$

C

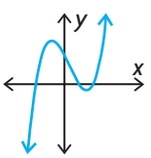
centred interval: An interval of the independent variable of the form $a - h \leq x \leq a + h$, where h is a small positive value; used to determine an average rate of change

composite function: A function that is the composite of two other functions; the function $f(g(x))$, denoted by $(f \circ g)(x)$, is called the composition of f with g and is defined using the output of the function g as the input for the function f

compound angle: An angle that is created by adding or subtracting two or more angles

conjecture: A guess or prediction based on limited evidence

continuous function: A function that does not contain any holes or breaks over its entire domain



counterexample: An example that shows a general statement to be false

cubic function: A polynomial function whose degree is three; for example, $y = 5x^3 + 6x^2 - 4x + 7$

curve of best fit: The curve that best describes the distribution of points in a scatter plot; typically found using regression analysis

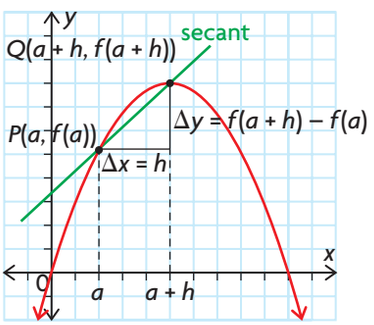
D

damped motion: Motion where a restriction is placed on an oscillating system that results in a decrease in amplitude over time

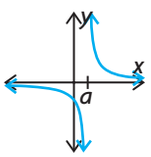
decreasing function: A function $f(x)$ whose y values get continually smaller as x gets continually larger

degree: The size of an angle that is subtended at the centre of a circle by an arc with a length equal to $\frac{1}{360}$ of the circumference of the circle

difference quotient: If $P(a, f(a))$ and $Q(a + h, f(a + h))$ are two points on the graph of $y = f(x)$, then the instantaneous rate of change of y with respect to x at P can be estimated using the average rate of change $\frac{\Delta y}{\Delta x} = \frac{f(a + h) - f(a)}{h}$, where h is a very small number; the expression $\frac{f(a + h) - f(a)}{h}$ is the difference quotient



discontinuity: A value for x, on an x-y graph, for which a value for y is not defined. In the graph below the y-value is not defined when $x = a$



displacement: A translation from one position to another, without consideration of any intervening positions; the minimal distance between two points

domain: The set of all values of the independent variable of a relation

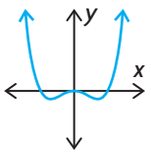
E

end behaviour: A description of the values of $f(x)$ as $x \to \infty$ or $x \to -\infty$

equation of the axis: The equation of the horizontal line that is halfway between the maximum value and minimum value of a sinusoidal function; determined using

$$y = \frac{\text{maximum value} + \text{minimum value}}{2}$$

even function: A function that is symmetric about the y-axis; algebraically, all even functions have the property $f(-x) = f(x)$



exponential function: A function of the form $y = a(b^x)$

extrapolation: The process of using a graphical or algebraic model to predict the value of a function beyond the known values

F

factor theorem: A theorem stating that $x - a$ is a factor of $f(x)$ if and only if $f(a) = 0$

family of polynomial functions: A set of polynomial functions whose equations have the same degree and whose graphs have common characteristics; for example, one quadratic family may have the same zeros and another quadratic family may have the same x-intercepts

finite difference: The difference between two consecutive values in a table that has a constant difference between the values of the independent variable; first differences are the differences between the values of the dependent variable, second differences are the differences between the first differences, and so on

following interval: An interval of the independent variable of the form $a \leq x \leq a + h$, where h is a small positive value; used to determine an average rate of change

function: A relation in which each value of the independent variable corresponds to only one value of the dependent variable

function notation: Notation, such as $f(x)$, that is used to represent the value of the dependent variable, y (the output) for a given value of the independent variable, x (the input)

H

half-life: The time that is required for a quantity to decay to half of its initial value

horizontal asymptote: An asymptote that takes the form of a horizontal line

I

identity: A mathematical statement that is true for all values of the given variables; any restrictions on the variables must be stated; for example, if an identity involves fractions, the denominator cannot be zero

increasing function: A function $f(x)$ whose y values get continually larger as x gets continually larger

independent variable: In an algebraic relation, a variable whose values may be freely chosen and upon which the values of the other variables depend; often represented by x

instantaneous rate of change: The exact rate of change of a function $y = f(x)$ at a specific value of the independent variable, $x = a$; estimated using average rates of change for small intervals of the independent variable that are very close to the value $x = a$

interpolation: The process of using a graphical or algebraic model to predict the value of a function between known values

intersection: A set that contains the elements that are common to both sets; the symbol for intersection is $\cap$

interval of decrease: The interval(s) within the domain of a function where the y values of the function get smaller, moving from left to right

interval of increase: The interval(s) within the domain of a function where the y values of the function get larger, moving from left to right

inverse of a function: The reverse of the original function; undoes what the original function has done

L

leading coefficient: The coefficient of the term with the highest degree in a polynomial

linear inequality: An inequality that contains an algebraic expression whose degree is one; for example, $5x + 3 > 6x - 2$

linear relation: A relation between two variables that appears as a straight line when graphed on a coordinate system; can be represented by an equation whose degree is one; also called a *linear function*

logarithm: The exponent required on base a to give the value x; written as $\log_a x$, where $a > 0$ and $a \neq 1$

logarithmic function: The inverse of the exponential function $y = a^x$ is the function with exponential equation $x = a^y$. We write y as a function of x using the logarithmic form of this equation, $y = \log_a x$. As with the exponential function, $a > 0$ and $a \neq 1$

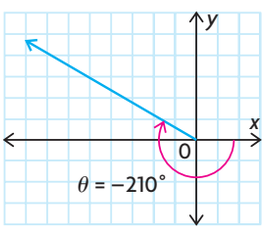
lowest common denominator: The smallest multiple that is shared by two or more denominators

M

magnitude: The absolute value of a quantity

N

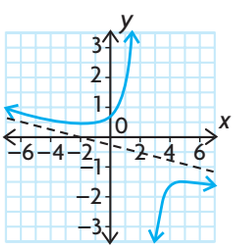
negative angle: An angle that is measured *clockwise* from the positive x-axis



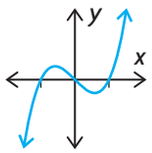
nonlinear relation: A relation whose graph is not a straight line

O

oblique asymptote: An asymptote that is neither vertical nor horizontal, but slanted



odd function: A function that has rotational symmetry about the origin; algebraically, all odd functions have the property $f(-x) = -f(x)$

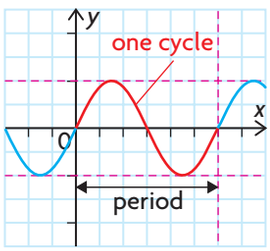


order: The exponent to which each factor in an algebraic expression is raised; for example, in $f(x) = (x - 3)^2(x - 1)$, the order of $(x - 3)$ is 2 and the order of $(x - 1)$ is 1

P

parent function: The simplest, or base, function in a family; for example, $y = x^2$ is the parent function for all quadratic functions

period: The change in the independent variable (typically x) that corresponds to one cycle of a sinusoidal function; the cycle of a periodic function is the part of the graph that repeats



piecewise function: A function that is defined using two or more rules on two or more intervals; as a result, the graph consists of two or more pieces of similar or different functions

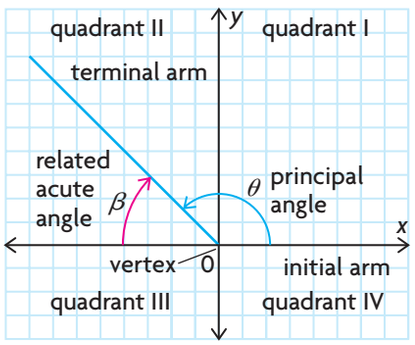
polynomial equation: An equation in which one polynomial expression is set equal to another polynomial expression; for example, $x^3 - 5x^2 = 4x - 3$ or $5x^4 - 3x^3 + x^2 - 6x = 9$

polynomial function: A function of the form $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2x^2 + a_1x + a_0$, where a_0, a_1, a_2, . . . , a_{n-1}, and a_n are real numbers and n is a whole number; the equation of a polynomial function is defined by a polynomial expression, as in $f(x) = 5x^3 + 6x^2 - 3x + 7$

polynomial inequality: An inequality that contains a polynomial expression; for example, $5x^3 + 3x^2 - 6x \leq 2$

preceding interval: An interval of the independent variable of the form $a - h \leq x \leq a$, where h is a small positive value; used to determine an average rate of change

principal angle: The counterclockwise angle between the initial arm and terminal arm of an angle in standard position; its value is between 0° and 360° (0 and 2π)



Q

quadratic function: A function that can be represented by a quadratic equation whose degree is two; for example, $y = x^2 + 3x - 2$

quartic function: a polynomial function whose degree is four; for example, $y = 8x^4 - 5x^3 + 6x^2 - 4x + 7$

quintic function: a polynomial function whose degree is five; for example, $y = -2x^5 + 8x^4 - 5x^3 + 6x^2 - 4x + 7$

R

radian: The size of an angle that is subtended at the centre of a circle by an arc with a length equal to the radius of the circle; both the arc length and the radius are measured in units of length (such as centimetres) and, as a result, the angle is a real number without any units

range: The set of all values of the dependent variable of a relation

rational expression: A quotient of polynomials; for example, $\frac{2x - 1}{3x}$, $x \neq 0$

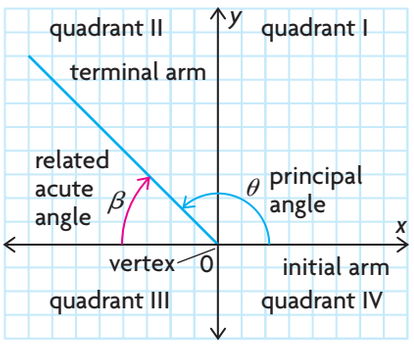
rational function: A function that can be expressed as $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomial functions, $q(x) \neq 0$; for example, $f(x) = \frac{3x^2 - 1}{x + 1}$, $x \neq -1$, and $f(x) = \frac{1 - x}{x^2}$, $x \neq 0$, are rational functions, but $f(x) = \frac{1 + x}{\sqrt{2 - x}}$, $x \neq 2$, is not because its denominator is not a polynomial

rational inequality: A statement that one rational expression is less than or greater than (or as well as equal to in some cases) another rational expression; for example, $\frac{2x}{x+3} > \frac{x-1}{5x}$

rational number: a number that can be expressed exactly as the ratio of two integers; $\left\{\frac{a}{b} \middle| a, b \in I, b \neq 0\right\}$

real numbers: Numbers that are either rational or irrational; include positive and negative integers, zero, fractions, and irrational numbers such as $\sqrt{2}$ and π

related acute angle: The acute angle between the terminal arm of an angle in standard position and the x-axis, when the terminal arm lies in quadrant II, III, or IV.



relation: A set of ordered pairs; values of the independent variable are paired with values of the dependent variable

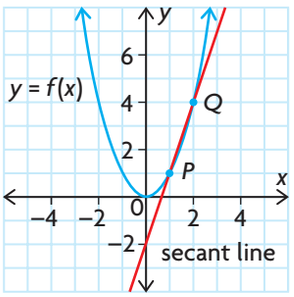
remainder theorem: A theorem stating that when a polynomial $f(x)$ is divided by $x - a$, the remainder is equal to $f(a)$; if the remainder is zero, then $x - a$ is a factor of the polynomial; the remainder theorem can be used to factor polynomials

restrictions: The values of the variable(s) in a function or expression that cause the function or expression to be undefined; the zeros of the denominator, or the numbers that are not in the domain of the function

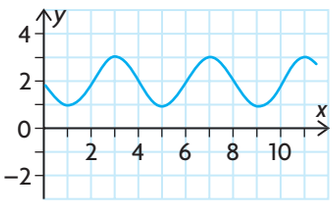
S

scatter plot: A graph that attempts to show a relationship between two variables using points plotted on a coordinate grid

secant line: A line that passes through two points on the graph of a relation

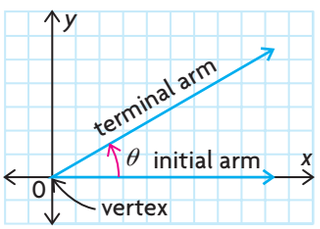


sinusoidal function: A periodic function whose graph looks like smooth symmetrical waves, if any part of the wave can be horizontally translated onto another part of the wave; a graph of a sinusoidal function can be created by transforming the graph of $y = \sin x$ or $y = \cos x$



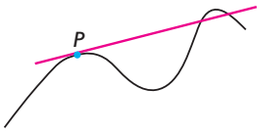
special triangle: A right triangle whose angles measure 45°, 45°, and 90° $\left(\frac{\pi}{4}, \frac{\pi}{4}, \text{and } \frac{\pi}{2}\right)$ or 30°, 60°, and 90° $\left(\frac{\pi}{6}, \frac{\pi}{3}, \text{and } \frac{\pi}{2}\right)$; used to determine the exact values of trigonometric ratios that include these as principal or related angles

standard position: An angle in the Cartesian plane whose vertex lies at the origin and whose initial arm (the arm that is fixed) lies on the positive x-axis; angle θ is measured from the initial arm to the terminal arm (the arm that rotates)



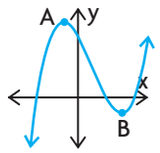
T

tangent line: A line that touches a graph at only one point, *P*, within a small interval of the relation; the tangent line could, but does not have to, cross the graph at another point outside this interval; it goes in the same direction as the relation at point *P* (called the point of tangency)



transformation: A geometric operation, such as a translation, a rotation, a dilation, or a reflection

turning point: A point on a curve where the function changes from increasing to decreasing, or vice versa; for example, A and B are turning points on the following curve



V

vertical asymptote: An asymptote that takes the form of a vertical line

vertical line test: A test that can be used to determine whether a relation is a function; if any vertical line intersects the graph of a relation more than once, then the relation is not a function