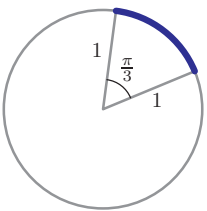


Glossary

	Definition	Example
acceleration	The rate of change of velocity with respect to time.	An object falling under the influence of gravity has a constant acceleration: $a = \frac{dv}{dt}$
amplitude	The distance from the centre of an oscillation to an extreme point; often found by calculating half of the distance between the maximum and minimum values.	$y = 4\sin 3x$ has amplitude 4.
angle of depression	The angle below the horizontal.	A ship is observed at an angle of depression of 48° from a cliff top.
angle of elevation	The angle above the horizontal.	The top of a tower forms an angle of elevation of 16° from a point 30 m away.
arc	Part of the circumference of a circle between two points. For each pair of points on the circle there are two arcs: the larger is called the major arc; the smaller is called the minor arc.	The minor arc in the diagram has length $\frac{\pi}{3}$. 
arcsin, arccos and arctan	The inverse functions of sine, cosine and tangent; they are useful for solving trigonometric equations.	$\arcsin\left(\frac{1}{2}\right) = \frac{\pi}{6}$
argument	An expression used as the input to a function.	The argument of $\cos(3x+1)$ is $3x+1$.
arithmetic sequence or arithmetic progression	A sequence in which the difference between consecutive terms is constant.	3, 7, 11, 15, ... is an arithmetic sequence.
asymptote	An asymptote is a straight line which the graph approaches as either x or y gets very large.	The graph $y = \frac{1}{x-2}$ has asymptotes $x=2$ and $y=0$.
background level	The value that a function will approach after a sufficiently long time that the effect of any intervention has become negligible.	A model predicts that the temperature will drop to a background level of 25°C .
base	The number which is being multiplied with itself a certain number of times.	The base in $(xy)^5$ is xy .
base vectors	A set of vectors which can be used to describe other vectors.	In three dimensions we conventionally use the base vectors i, j and k .
bimodal	A probability distribution or data set which has two modes.	The data set 1, 1, 1, 3, 4, 4, 4 is bimodal.

binomial

Containing two terms.

$a + x$ is a binomial expression.

binomial coefficient $\binom{n}{r}$

A coefficient containing the term $a^{n-r} b^r$ in the expansion of $(a + b)^n$, usually denoted by $\binom{n}{r}$.

10 is a binomial coefficient in the expansion of $(1 + x)^5$.

binomial distribution

A common distribution modelling the number of 'successes' occurring in a situation with a fixed number of independent trials and a constant probability of success.

The number of heads obtained when ten fair coins are tossed follows the binomial distribution $B(10, 0.5)$.

binomial theorem or binomial expansion

A formula for expanding $(a + b)^n$ into $n + 1$ terms.

The first three terms in the binomial expansion of $(2x - 3y)^5$ are $32x^5 - 240x^4y + 720x^3y^2$.

bivariate

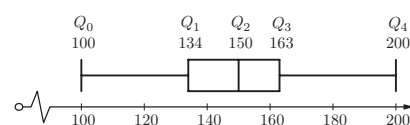
Data consisting of paired measurements of two separate variables, both taken from the same source.

The following is a set of bivariate data collected from four students in a class:

Height (cm)	157	163	171	174
IB score	35	39	34	42

box and whisker plot

A diagram showing the median, lower and upper quartiles, and minimum and maximum values of a set of data.



chain rule

A rule for differentiating composite functions:

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

The derivative of $\sin x^2$ with respect to x can be found using the chain rule with a substitution $u = x^2$ to get $2x \cos x^2$.

change-of-base rule

A rule for converting logarithms to different bases.

$\log x$ can be converted into $\frac{\ln x}{\ln 10}$ using the change-of-base rule.

chord

A line connecting two points on a curve.

A chord connecting two points is always shorter than the minor arc between those two points.

coefficient

A number multiplying an algebraic expression.

The coefficient of x^2 in $5x^2 + 3$ is 5.

column vector

A vector described by its components written vertically.

$2\mathbf{i} + 3\mathbf{j}$ can be written as the column vector $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

complement

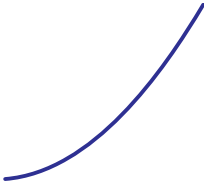
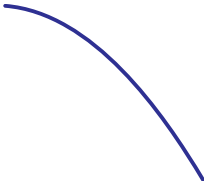
All relevant events other than the event in question.

The complement of rolling a 6 on a die is rolling a 1, 2, 3, 4 or 5.

completed square form

A quadratic expression written in the form $a(x - h)^2 + k$.

The completed square form is convenient for finding the vertex, which has coordinates (h, k) .

component	The amount of displacement of a vector in the direction of a base vector.	The component of $\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}$ in the k direction is -1 .
composite function	A function applied to another function.	$fg(x) = \sin(x^2)$ is a composite function.
compound interest	Increasing an amount by a given ratio over a specific period of time, usually in a financial context.	If \$1000 was invested in a bank account at a rate of 5% interest compounded annually, the account balance will be \$1050 after one year.
concave-up or concave-down	A description of whether a graph is bending upwards or downwards, i.e. whether the gradient is increasing or decreasing. For example, a concave-up graph might look like  and a concave-down graph might look like 	The graph $y = x^3$ is concave-down when $x < 0$ and concave-up when $x > 0$.
conditional probability	The probability of an event occurring given that another event has occurred.	The conditional probability P (getting an ace on the second card first card was an ace) is $\frac{3}{51}$.
constant of integration	A constant which reflects the fact that many different functions differentiate to give a particular function.	If you say that the integral of $\cos x$ is $\sin x$, then you are forgetting the constant of integration.
continuous	May take any value in a given interval.	Height is a continuous variable.
continuous random variable	A random variable which can take any value in a given interval.	The weight of a hamster is a continuous random variable.
convergent series	Where the sum of a sequence gets closer and closer to a particular number.	The sequence $\frac{1}{2}, -\frac{1}{3}, \frac{1}{4}, -\frac{1}{5}$ is convergent; it converges to zero.
correlation	A measure of association between two variables.	The height and weight of a person tend to be positively correlated.
cosine	A fundamental trigonometric function, often abbreviated to 'cos'; can be defined as the x -coordinate of a point on the unit circle.	$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$

cosine rule

A rule linking side lengths and angles in any triangle:

$$c^2 = a^2 + b^2 - 2ab \cos C;$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

The cosine rule can be used to find the angles in a triangle when all of the side lengths are known.

cumulative frequency

The number of data items up to and including a certain value.

For the grouped data

Height (cm)	Frequency
155–160	13
161–166	22
167–172	11

cumulative probability

The probability of a random variable being less than or equal to a particular value.

the cumulative frequency corresponding to the data value '166.5' is 35.

If X is a binomially distributed random variable, the cumulative probability $P(X \leq 2)$ equals $P(X = 0) + P(X = 1) + P(X = 2)$.

deductive rule

A rule for generating terms of a sequence based on each term's position in the sequence.

$u_n = n^3 - 1$ is a deductive rule.

definite integration

Integration with limits; the result is a definite value.

$$\int_0^1 e^x dx = e - 1$$

degree

A unit for measuring angles: 1 degree or 1° is $\frac{1}{360}$ of a full rotation.

A right angle is 90° .

dependent variable

A variable that is not controlled directly in an experiment or survey.

In an experiment to determine whether petrol consumption is affected by the speed at which a car is driven, the dependent variable is the petrol consumption.

derivative

A function which gives the gradient of (the graph of) another function at every point of its domain.

The derivative of $3x^2 + 2$ is $6x$.

difference

The result of subtracting two numbers.

21 and 7 have a difference of 14.

differentiation

The process of finding the derivative of a function.

If we differentiate $\sin 2x$, we get $2 \cos 2x$.

differentiation from first principles

Finding the derivative of a function by considering the limit of gradients of smaller and smaller chords.

The general formula for differentiation from first principles is

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}.$$

discrete

Restricted to fixed values in a given domain.

Shoe size is a discrete variable.

discriminant (Δ)	An expression which determines the number of solutions to a quadratic equation: $\Delta < 0 \rightarrow$ no solutions; $\Delta = 1 \rightarrow$ 1 solution; $\Delta > 0 \rightarrow$ two solutions	The discriminant of $x^2 + x + 12 = 0$ is negative, the equation has no solutions.								
displacement	1. Displacement vector: A vector quantity representing the position of a point relative to another, i.e. the distance and direction from one point to another. 2. In kinematics: How far something is away from the origin.	A ship has a displacement of $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$ km relative to the lighthouse. In a 400 metre race where the start and finish line are in the same place, an athlete's displacement upon finishing the race is 0 m.								
displacement vector	A vector that represents how to get from one point to another; the displacement vector from point A to point B is written as \overrightarrow{AB} .	If A, B and C are three points, then $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$.								
distance	In kinematics, the distance is how much ground is covered.	In a 400-metre race, an athlete runs a distance of 400 m.								
divergent sequence	A sequence which does not get closer and closer to a particular number.	The sequence 1, 4, 9, 16, 25, ... is divergent.								
domain	The set of all allowed input values of a function.	The domain of $f(x) = \sqrt{x+2}$ is $x \geq -2$.								
doubleangle formula	An identity which expresses a trigonometric function involving 2θ in terms of trigonometric functions involving θ .	$\sin 2x = 2 \sin x \cos x$ is a double-angle formula.								
equation	Two expressions which are equal for some values of the variable.	$x^2 = 9$ is an equation.								
expectation	The expected mean of a probability distribution.	The following probability distribution has expectation $E(X) = 1.25$.								
		<table><tr><td>X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>p</td><td>0.25</td><td>0.25</td><td>0.5</td></tr></table>	X	0	1	2	p	0.25	0.25	0.5
X	0	1	2							
p	0.25	0.25	0.5							
exponent form	A number or expression written in the form of a base raised to an exponent.	The exponent form of 32 is 2^5 .								
exponent or power	The number of times the base is multiplied together.	The exponent of x in x^7 is 7.								
exponential decay	Something that can be modelled by a negative exponential function.	The mass of a radioactive isotope exhibits exponential decay.								
exponential growth	Something that can be modelled by a positive exponential function.	A population of bacteria grows exponentially.								
expression	A combination of numbers, variables and mathematical operations, containing no equals or inequality signs.	$\sin(\sqrt{x+3})$ is an expression.								

extrapolating or extrapolation

Estimating the value of the dependent variable corresponding to a value of the independent variable that lies outside the range of data.

For the data above, using the regression line to estimate the weight when the height is 181 is extrapolation.

factorised form

An expression written as a product of (usually) linear factors.

A quadratic function $y = a(x - p)(x - q)$ has zeros at $x = p$ and $x = q$.

function

A rule telling us how to calculate an output value given an input value.

$f : x \mapsto \sqrt{x+2}$ is a function.

geometric sequence or geometric progression

A sequence in which the ratio between consecutive terms is constant.

3, 6, 12, 24, ... is a geometric progression.

gradient

The steepness of a line, measured as how far up it goes for each shift of one unit to the right.

The gradient of the line $y = 3x + 2$ is 3.

grouped data

A data set in which subsets of the original data values have been grouped together.

The following table shows a set of grouped data:

Weight of plants (g)	Frequency
[50,100[17
[100,200[23
[200,300[42
[300,500[21
[500,1000[5

growth factor

The factor that a function increases by (above the background level) when the independent variable increases by one unit.

The function $R = 12 \times 1.05^{2t}$ has a growth factor of 1.1025.

horizontal asymptote

A horizontal line of the form $y = a$ which a curve approaches.

$y = \frac{10x}{2x-3}$ has a horizontal asymptote $y = 5$.

hyperbola

A graph consisting of two curves which approach asymptotes and are mirror images of each other.

The graph $y = \frac{1}{x}$ is a hyperbola.

identity

Two expressions which are equal for every possible value of the variable.

$x^2 = x \times x$ is an identity.

identity function

The function which leaves its input unchanged, i.e. one whose output is exactly the same as its input.

The composite functions $f \circ f^{-1}$ and $f^{-1} \circ f$ are both equal to the identity function.

indefinite integration

Integration without limits; the result is a function plus a constant of integration.

$\int e^x dx = e^x + c$

independent events

Two events whose probabilities are not affected by the outcome of each other.

A person's telephone number and the number of their house are independent events.

independent variable	A variable that we can control in an experiment or survey.	In an experiment to measure how the amount of sleep affects exam results, the independent variable is the number of hours of sleep.														
initial value	The value of a function at time zero.	The speed of a car takes an initial value of 3 ms^{-1} .														
inner function	The function $g(x)$ in a composite function $f(x) = h(g(x))$, i.e. the function that is applied first.	The composite function $f(x) = \sin(x^2)$ has inner function $x \mapsto x^2$.														
integration	The reverse process to differentiation.	The integral of x^{-1} with respect to x is $\ln x + c$.														
integration by substitution	A method for turning one integral into another (easier) integral.	The integral of xe^{x^2} with respect to x can be found using the substitution $u = x^2$.														
interpolating or interpolation	Estimating the value of the dependent variable corresponding to a value of the independent variable within the range of data already collected.	If we use the regression line $y = 0.696x - 57.4$ found from the data <table border="1"><tr><td>Height (x)</td><td>151</td><td>153</td><td>158</td><td>161</td><td>161</td><td>172</td></tr><tr><td>Weight (y)</td><td>48</td><td>52</td><td>50</td><td>55</td><td>52</td><td>64</td></tr></table> to estimate the weight when height is 157, we are interpolating.	Height (x)	151	153	158	161	161	172	Weight (y)	48	52	50	55	52	64
Height (x)	151	153	158	161	161	172										
Weight (y)	48	52	50	55	52	64										
interquartile range	A measure of how spread out the data is: the length of the interval covering the central 50% of values in the data set, calculated as the difference between the lower and the upper quartiles.	The interquartile range (IQR) of 1, 1, 4, 6, 8, 10, 12 is 9.														
intersection	The combined event corresponding to two events both occurring.	The intersection of odd numbers less than 6 and prime numbers less than 6 is $\{3, 5\}$.														
inverse function	A function which undoes the action of another function.	Finding the cube root is the inverse of cubing.														
inverse normal distribution	A function which turns a cumulative probability into a Z-score; often denoted by $\Phi^{-1}(x)$.	In a normal distribution, the values in the top 20% are at least $\Phi^{-1}(0.8) = 0.842$ standard deviations above the mean.														
kinematics	The study of the movement of objects.	One important rule of kinematics is that the area under a graph of velocity against time gives the displacement.														
limits of integration	The points between which a function is integrated in a definite integral.	The limits of the integral $\int_0^1 e^x dx$ are 0 and 1.														

line of best fit or regression line

A straight line modelling the relationship between two variables.

For the set of data

Height (x)	151	153	158	161	161	172
Weight (y)	48	52	50	55	52	64

the regression line has equation

$$y = 0.696x - 57.4$$

local maximum

A point around which the graph looks like



The graph $y = x^3 - 12x + 7$ has a local maximum at $(-2, 23)$.

local minimum

A point around which the graph looks like



The graph $y = x^3 - 12x + 7$ has a local minimum at $(2, 9)$.

logarithm to base a
($x = \log_a b$)

The answer to the question 'what power of the base a is this number?'

The logarithm to base 2 of 32 is 5.

lower interval boundary

Smallest possible value that data in a given group can take. This value is used in drawing histograms and cumulative frequency graphs.

In the group $[100, 120[$ the lower interval boundary is 100. When heights have been rounded to the nearest cm, the group '155-160' has lower interval boundary of 154.5.

lower quartile

The value one quarter of the way up a list of data arranged in ascending order.

The lower quartile (LQ or Q_1) of 1, 1, 4, 6, 8, 10, 12 is 1.

magnitude

The size of a vector; the magnitude of a vector \mathbf{v} is usually denoted by $|\mathbf{v}|$.

The magnitude of a velocity vector is the speed.

mean

An average found by dividing the sum of a set of data values by the number of data values in the set.

The mean of 6, 3 and 3 is 4.

median

An average found by identifying the central value of the data set when the data items are arranged in order.

The median of 6, 3 and 3 is 3.

mid-interval value

The mean of the upper and lower interval boundaries.

The mid-interval value of the group '155-160' is 157.5. Mid-interval values are used to estimate the mean of grouped data.

mode

An average found by identifying the most frequently occurring data item.

The mode of 6, 3 and 3 is 3.

modelling

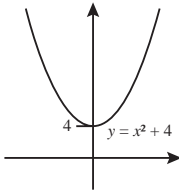
Describing a real-world situation in terms of mathematical functions.

Tides can be modelled by a sine function.

negative exponential

A curve of the form $ka^x + c$ which is decreasing as x increases.

$y = \left(\frac{1}{2}\right)^x$ is a negative exponential curve.

normal	A line intersecting a graph such that it is perpendicular to the tangent at the point of intersection.	The normal to $y = x^2$ at $x = 1$ is $y = \frac{1}{2}(3 - x)$.
normal distribution	A common distribution modelling many naturally occurring continuous random variables.	The arm span of adults follows a normal distribution.
origin	A fixed reference point in space.	The origin is at the intersection of the x and y axes.
outer function	The function $h(x)$ in a composite function $f(x) = h(g(x))$.	The composite function $f(x) = \sin(x^2)$ has outer function $x \mapsto \sin x$.
outlier	An observation which is unusually large or small.	Usain Bolt's 100 m time record is an outlier.
parabola	The shape of the graph of a quadratic function. It has a single vertex (turning point) and a vertical line of symmetry.	The curve $y = x^2 + 4$ is a parabola.
		
parallel	Lines or vectors which point in the same or opposite direction.	The vectors $i - 3j$ and $6j - 2i$ are parallel.
period	The interval between consecutive repeating units of a periodic function.	The period of $\cos 2x$ is π .
periodic function	A function whose graph repeats itself regularly.	$\sin(3x) + 2$ is a periodic function.
point of inflexion	A place where a graph changes from concave-up to concave-down or vice versa.	The graph $y = x^3 + 3x^2 - 2x + 1$ has a point of inflexion at $(-1, 5)$.
position vector	A vector which represents displacement relative to the origin.	The point $A(1, 2)$ has position vector $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$.
positive exponential	A curve of the form $ka^x + c$ which is increasing as x increases.	$y = 3^x$ is a positive exponential curve.
probability	A number between 0 and 1 (inclusive) which represents the likelihood of an event occurring.	When tossing a fair coin, the probability of getting a head is $\frac{1}{2}$.
probability distribution	A list of all possible outcomes of a random variable along with their probabilities.	The probability distribution for the number of heads obtained when two coins are tossed (H) is:

H	0	1	2
P	0.25	0.5	0.25

(Pearson's) product-moment correlation coefficient

A particular measure of correlation. It is usually denoted by r and can take values between -1 and 1 .

The correlation coefficient for the data set

Height	151	153	158	161	161	172
Weight	48	52	50	55	52	64

is $r = 0.92$.

The derivative of xe^x is $xe^x + e^x$ by the product rule.

product rule

A rule for differentiating a product $y = u(x)v(x)$ of two functions:

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

Pythagorean identity

An identity relating $\sin x$ and $\cos x$:
 $\sin^2 x + \cos^2 x = 1$

The Pythagorean identity is useful in solving trigonometric equations.

quadrant

One of the four regions obtained when the plane is subdivided by a pair of coordinate axes. The first quadrant is the region with positive x and y coordinates; the quadrants are then numbered in an anticlockwise fashion.

The point $(3, -5)$ lies in the fourth quadrant.

quadratic function or quadratic expression

An expression involving only terms in x^2 , x and numbers (constants).

The path of flight of a javelin can be modelled by a quadratic function.

quotient rule

A rule for differentiating a quotient (fraction) $y = \frac{u(x)}{v(x)}$ of two functions:

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

The derivative of $\tan x$ can be found by expressing $\tan x$ as $\frac{\sin x}{\cos x}$ and using the quotient rule.

radian

A unit for measuring angles: 1 radian is $\frac{1}{2\pi}$ of a full rotation.

A right angle is $\frac{\pi}{2}$ radians.

random variable

A quantity which can take a different value each time it is observed.

The outcome of rolling a die is a random variable.

range

1. The set of all possible outputs of a function defined on a specified domain.
2. A measure of spread of a data set, found by subtracting the smallest value from the largest value.

1. The range of $f(x) = x^2 + 3$ is $f(x) \geq 3$.

2. The range of 7, 3, 5, 12, 10 is 9.

rate of change

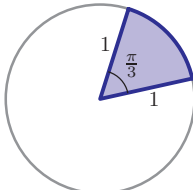
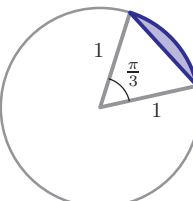
How quickly a quantity changes as another quantity changes.

The rate of change of velocity with respect to time is acceleration.

rational function

A ratio of two polynomial functions.

$f(x) = \frac{2x-1}{x^2+3x-5}$ is a rational function.

reciprocal	The number 1 divided by another number or expression.	The reciprocal of 39 is $\frac{1}{39}$; the reciprocal of $\frac{2}{5}$ is $\frac{5}{2}$; the reciprocal of x^2 is $\frac{1}{x^2}$.
reciprocal function	A function of the form $f(x) = \frac{k}{x}$ where k is a constant.	$g(x) = \frac{-4}{x}$ is a reciprocal function.
recursive rule (also known as inductive)	A rule for generating terms of a sequence which depends upon previous results.	$u_{n+1} = 5u_n$ is a recursive rule.
reverse chain rule	A method for integrating a product by recognising it as the result of a chain rule differentiation.	The integral of $x \cos x^2$ with respect to x can be seen to be $\frac{1}{2} \sin x^2 + c$ by using the reverse chain rule.
root (or solution)	A value of a variable that makes an equation true.	3 is a root of $x^2 + 15 = 8x$.
sample space	A list of all possible equally likely outcomes.	The sample space when two coins are tossed can be represented by HH, HT, TH, TT.
scalar	A quantity which has size but no direction.	Energy is a scalar quantity.
scalar product or dot product	An operation which combines two vectors \mathbf{a} and \mathbf{b} to produce the scalar $ \mathbf{a} \mathbf{b} \cos\theta$.	$\begin{pmatrix} 3 \\ -2 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 4 \end{pmatrix} = 1$
second derivative	The derivative of the derivative of a function.	The second derivative of x^3 is $6x$.
sector	A region in a circle enclosed by two radii and an arc. Each pair of radii defines two such regions: the larger is called the major sector; the smaller is called the minor sector.	The sector in the diagram has area $\frac{\pi}{6}$. 
segment	A region in a circle enclosed by a chord and an arc. Each chord defines two such regions: the larger is called the major segment; the smaller is called the minor segment.	The segment below has area $\frac{\pi}{6} - \frac{\sqrt{3}}{4}$. 
self-inverse function	A function whose inverse is the same as itself: $f^{-1} = f$.	$g(x) = \frac{-4}{x}$ is a self-inverse function.
sequence	A list of numbers in a specified order.	1, 4, 9, 16, ... is a sequence.

series	A sequence formed by summing terms from another sequence.	The harmonic series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$ is formed by summing the terms of the sequence $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots$
sigma notation (Σ)	A shorthand way of describing the sum of values with a common pattern or reference.	The n th square number can be expressed as $\sum_{k=1}^n 2k - 1$.
simultaneous equations	A set of at least two equations involving more than one variable.	The intersection coordinates of two graphs can be found by solving a pair of simultaneous equations.
sine	A fundamental trigonometric function, often abbreviated to 'sin'; can be defined as the y -coordinate of a point on the unit circle.	$\sin \frac{\pi}{6} = \frac{1}{2}$
sine rule	A rule linking side lengths and angles in any triangle: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	When using the sine rule to find an angle, there may be two possible answers.
skew lines	Two lines which are neither parallel nor intersecting.	The lines $x - 2 = \frac{y + 4}{3} = \frac{z - 1}{4}$ and $\mathbf{r} = \lambda \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$ are skew.
speed	A scalar quantity describing how fast an object is moving.	The magnitude of the velocity vector is the speed: $ v $.
standard derivatives	Derivatives, given in the information booklet, which can be quoted without proof.	$\frac{d}{dx}(\tan x) = \frac{1}{\cos^2 x}$ is a standard derivative.
standard deviation	A measure of how spread out the data is, given by an average distance of data values from the mean.	The standard deviation of 1, 1, 4, 6, 8, 10, 12 is $\sqrt{\frac{110}{7}}$.
standard integrals	Integrals, given in the information booklet, which can be quoted without proof.	$\int \frac{1}{x} dx = \ln x + c$ is a standard integral.
standard normal distribution or Z-distribution	A normal distribution with mean zero and standard deviation one, denoted by $N(0, 1)$.	If $X \sim N(\mu, \sigma^2)$, then $\frac{X - \mu}{\sigma}$ follows a standard normal distribution.
stationary point	A point on a graph at which the gradient is zero.	The graph $y = x^3 - 12x + 7$ has stationary points at $(2, -9)$ and $(-2, 23)$.
subtends	When each end of a curve (or line) is joined by a straight line to a specified point, the angle enclosed by the two lines is said to be subtended by the curve at that point.	The diameter of a circle subtends an angle of 90° at any point on the circumference.

sum to infinity

The result of adding together all the terms of a never-ending sequence.

The sum to infinity of

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots \text{ is } 2.$$

tangent

1. A trigonometric function, often abbreviated to 'tan'.
2. A line which touches a curve without crossing it (except at points of inflexion).

$$1. \tan \frac{\pi}{3} = \sqrt{3}$$

2. A tangent to a circle meets any radius in a right angle.

term

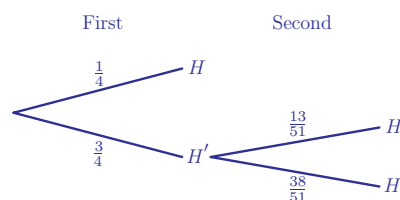
1. A number in a sequence.
2. A component of a sum.

1. The third term of the sequence 2, 5, 10, 17, ... is 10.
2. The expression $3x^2y + 2x$ consists of two terms.

tree diagram

A representation of events that shows the probability of each event occurring depending on previous outcomes.

When two cards are drawn without replacement from a standard deck of cards, the probabilities of drawing at least one heart can be represented in the following tree diagram:

**trigonometric function**

One of the functions relating to ratios of lengths in a right-angled triangle or in the unit circle: sine, cosine, tangent, secant, cosecant or cotangent.

$\sin 4x$ is a trigonometric function.

turning point or vertex

A place where a graph changes from increasing to decreasing or vice versa.

The line of symmetry of a parabola passes through its vertex.

union

The combined event corresponding to either or both of two events occurring.

The union of odd numbers less than 6 and prime numbers less than 6 is $\{1, 2, 3, 5\}$.

unit circle


A circle with radius one unit centred at the origin.

$\cos \theta$ is the x -coordinate of the point on the unit circle where the radius makes an angle θ with the positive x -axis.

unit vector

A vector with magnitude one.

$\frac{1}{\sqrt{3}} \begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$ is a unit vector in the direction of $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$.

upper interval boundary	The highest possible value that the data in a given group can take. This value is used in drawing histograms and cumulative frequency graphs.	When heights have been rounded to the nearest cm, the group '155–160' has upper interval boundary 160.5.
upper quartile	The value three quarters of the way up a list of data arranged in ascending order.	The upper quartile (UQ or Q_3) of 1, 1, 4, 6, 8, 10, 12 is 10.
variable	An unknown quantity, usually represented by an italic letter.	In the expression $3x^2$, the only variable is x .
variance	An indirect measure of how spread out the data is; it is the square of the standard deviation.	The variance of 1, 1, 4, 6, 8, 10, 12 is $\frac{110}{7}$.
vector	A quantity which has both size (magnitude) and direction.	Force is a vector quantity.
vector equation	An equation whose variables are vectors.	The vector equation of a line containing the points A and B is $\mathbf{r} = \mathbf{a} + \lambda(\mathbf{b} - \mathbf{a})$.
velocity	A vector quantity describing how fast an object is moving and in what direction.	Velocity is the rate of change of displacement with respect to time: $v = \frac{ds}{dt}$
Venn diagram	A representation of events as regions in a rectangular area (which represents the whole sample space).	If events A and B are mutually exclusive, their Venn diagram will look like 
vertical asymptote	A vertical line of the form $x = a$ where a function is undefined.	$y = \ln(x - 1)$ has a vertical asymptote $x = 1$.
volume of revolution	A solid shape formed by rotating a curve around an axis.	The volume of revolution of a straight line is a cone.
with respect to	A phrase for describing the controlled variable that is being changed in the process of differentiation or integration.	The derivative of ax^2 with respect to x is $2ax$.
zero of a function	A value of a variable that makes an expression equal to zero.	-2 is a zero of $x^2 + 5x + 6$.
Z-score	The number of standard deviations that a particular value lies above the mean.	In a normal distribution with mean 150 and standard deviation 10, the value 135 has a Z-score of -1.5 .