

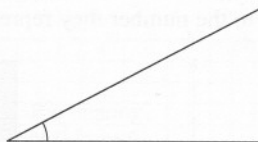
absolute cell reference: in a spreadsheet formula, a reference to one particular cell of the spreadsheet that will not change when the formula is moved to a different cell

\$B\$3 indicates that the value or expression contained in cell B3 is to be used in the formula.

accuracy: when referring to a measurement, it indicates how close the measurement comes to its true value

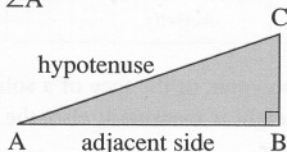
active cell: the cell of a spreadsheet into which an item of data is placed when you start to type

acute angle: an angle whose measure is less than 90°

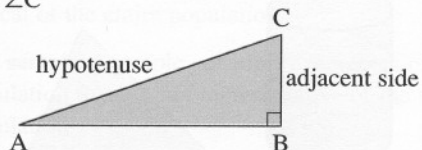


adjacent side: in a right triangle, the side next to the named angle that is not the hypotenuse

For $\angle A$



For $\angle C$



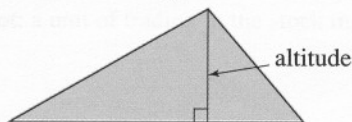
algebraic expression: a mathematical expression that contains at least one variable

$6x + 4$ is an algebraic expression.

alleles: alternative forms of a gene

alternate angles: see *parallel lines*

altitude: the perpendicular distance from the base of a figure to the opposite side or vertex; the height of an aircraft above the ground



amortization period: the length of time over which a loan is paid off, usually used for a large amount of loan such as a house purchase

amount of an investment: the value of the principal plus interest

Calculate the amount of an investment of \$200 after 3 years at 6.5%, compounded annually.

$$\begin{aligned}
 P &= 200 & i &= 0.065 & n &= 3 & A &= P(1+i)^n \\
 & & & & & & A &= 200(1+0.065)^3 \\
 & & & & & & &= 200(1.207\ 949\ 625) \\
 & & & & & & &\doteq 241.59
 \end{aligned}$$

The investment was worth \$241.59.

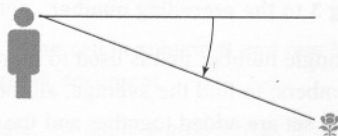
amplitude: half the distance between the maximum and minimum values of a periodic function;

$$\text{amplitude} = \frac{\text{maximum value} - \text{minimum value}}{2};$$

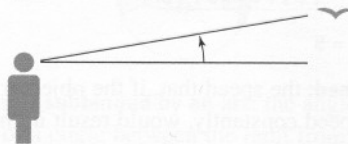
see *Tutorials 5.2, 5.3, and 5.4*

angle of declination of the sun: the angle of the sun above or below the equator as measured on the equator at noon; see *Tutorial 5.6*

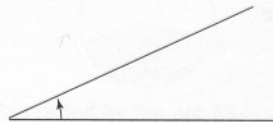
angle of depression: the angle between the horizontal and the oblique line joining the observer's eye to a point lower than eye level



angle of elevation: the angle between the horizontal and the oblique line from the observer's eye to some object above eye level



angle of inclination of a line segment: the acute angle, measured from the horizontal to the line segment

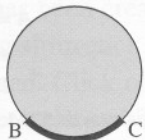


annuity: a series of regular, equal payments paid into, or out of, an account

approximation: a number close to the exact value of a quantity or an expression; the symbols \doteq and \cong mean “is approximately equal to”

3.14 is an approximation for π .

arc: part of the circumference of a circle or other curve.



BC is an arc of this circle.

area: the number of square units needed to cover a surface; common units used to express area include cm^2 , m^2 , and hectares; see *circle*, *rectangle*, *square*, and *triangle*

arithmetic sequence: a sequence of numbers in which each term after the first is formed by adding a constant to the preceding term

The numbers 1, 4, 7, 10, ... form an arithmetic sequence, since each term after the first is formed by adding 3 to the preceding number.

average: a single number that is used to represent a set of numbers; to find the average, all the numbers in the data set are added together and the sum is divided by the number of entries in the data set; see *mean*

The data set 1, 3, 4, 7, 7, 8 has 6 entries.

$$\begin{aligned}\text{Average} &= \frac{1+3+4+7+7+8}{6} \\ &= 5\end{aligned}$$

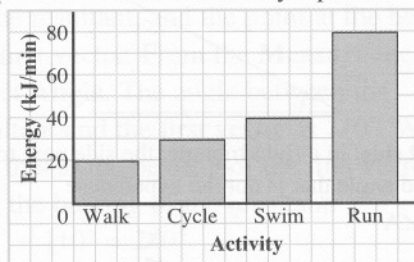
average speed: the speed that, if the object travelled at that speed constantly, would result in the same total distance being travelled in the same total time. To calculate average speed, the total distance travelled during the given time period is divided by the total time.

In one hour, a car travels 100 km. The car stops for $\frac{1}{2}$ h and then travels 80 km in the next hour. Find the average speed of the car.

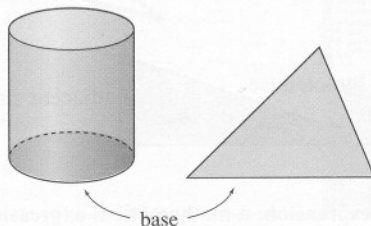
The total distance travelled is 180 km and the time required to travel this distance includes the stopping time of $\frac{1}{2}$ h.

$$\begin{aligned}\text{Average speed} &= \frac{\text{Distance}}{\text{Time}} \\ v &= \frac{d}{t} \\ &= \frac{180 \text{ km}}{2.5 \text{ h}} \\ &= 72 \text{ km/h}\end{aligned}$$

bar graph: a graph that displays data by using horizontal or vertical bars whose lengths are proportional to the number they represent



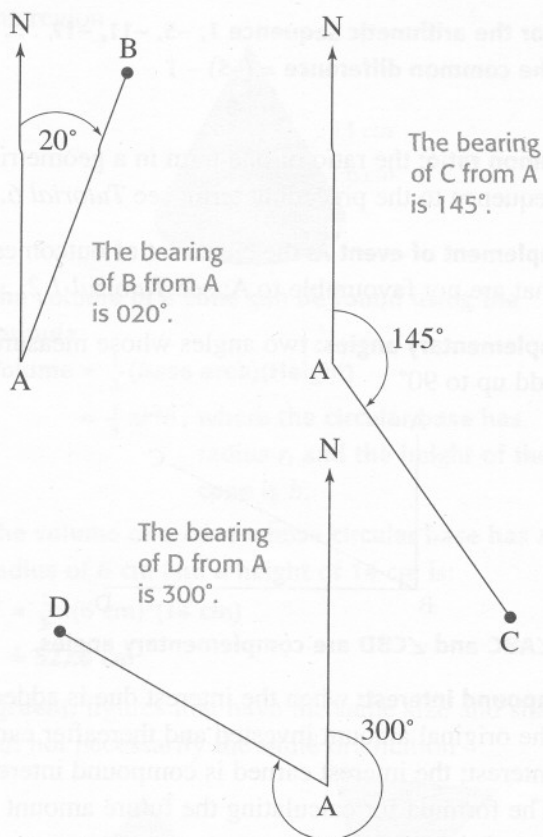
base: the side of a polygon, or the face of a solid, from which the height is measured; also, the factor repeated in a power



In the expression 5^3 , 5 is the base.

bear market: a term used to describe the stock market when stock prices are falling

bearing: the 3-digit angle, measured in a clockwise direction, between the north line and a given direction



bias: an emphasis on characteristics that are not typical of the entire population

biased sample: a sample containing members of the population that are not representative of the whole population

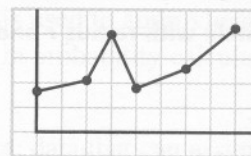
binomial distribution: the probability distribution for a binomial experiment; see *Tutorial 3.1*

binomial experiment: an experiment with a fixed number of independent trials in which the outcomes can be classified as success or failure and the probabilities remain constant for each trial; see *Tutorials 1.1* and *3.1*

blueprints: the initial drawings used in a construction project

board lot: a unit of trading in the stock market

broken-line graph: a graph that displays data by using points that are joined by line segments



budget: a written plan to outline how money will be spent

bull market: a term used to describe the stock market when stock prices are rising

CBL: the Calculator-Based Laboratory; a data collection device used with the TI-83 calculator

CBR: the Calculator-Based Ranger; a sonic motion detector used with the TI-83 calculator

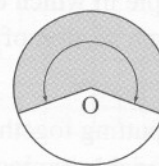
cash investments: short-term investments that are easily accessible; include bank accounts, term deposits, and money market funds; see *Tutorial 4.3*

cell: a rectangle in a spreadsheet into which data may be entered

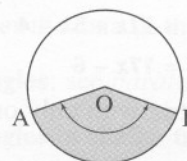
cell reference: the name of a cell in a spreadsheet, given by indicating the column and row to which it belongs

Cell B3 is the cell in column B and row 3 of the spreadsheet document.

central angle: the angle whose vertex is at the centre of a circle between two radii



central angle subtended by an arc: the angle at the centre of a circle between the radii from the ends of an arc of the circle



$\angle AOB$ is subtended by the arc AB.

circle: the set of points in a plane that are a given distance from a fixed point (the centre)

The area of a circle with radius r and diameter d is:

$$A = \pi r^2$$

$$= \frac{\pi d^2}{4}$$

The circumference C of a circle is:

$$C = 2\pi r, \text{ where } r \text{ is the radius}$$

$$= \pi d, \text{ where } d \text{ is the diameter}$$

The area of a circle with radius 5 cm is:

$$A = \pi (5 \text{ cm})^2$$

$$= \pi (25 \text{ cm}^2)$$

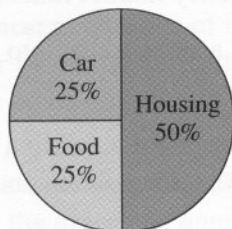
$$\doteq 78.5 \text{ cm}^2$$

The circumference of a circle whose radius is 5 cm is:

$$C = 2\pi (5 \text{ cm})$$

$$\doteq 31.4 \text{ cm}$$

circle graph: a diagram that uses parts of a circle to display data



circumference: the distance around a circle; the boundary of any region whose boundary is a simple closed curve; see *circle*

cluster sample: a sample in which every member of a randomly chosen section of the population is selected

collecting like terms: putting together terms with exactly the same variable expressions, then simplifying by addition or subtraction

Collect like terms: $4(3x - 1) + 5x - 2$

$$= 12x - 4 + 5x - 2$$

$$= 12x + 5x - 4 - 2$$

$$= 17x - 6$$

column matrix: a matrix with only one column; see *Tutorial 2.1*

common difference: the number obtained by subtracting any term from the next term in an arithmetic sequence

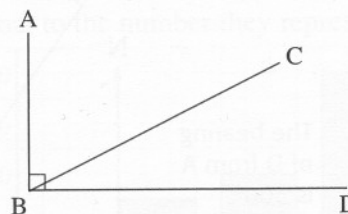
For the arithmetic sequence 1, -5, -11, -17, ..., the common difference = $(-5) - 1$

$$= -6$$

common ratio: the ratio of one term in a geometric sequence to the preceding term; see *Tutorial 6.1*

complement of event A: the entire set of outcomes that are not favourable to A; see *Tutorial 1.2*

complementary angles: two angles whose measures add up to 90°



$\angle ABC$ and $\angle CBD$ are complementary angles.

compound interest: when the interest due is added to the original amount invested and thereafter earns interest; the interest earned is compound interest. The formula for calculating the future amount is $A = P(1 + i)^n$.

Calculate the amount of interest on an investment of \$100 after 4 years at 6.25%, compounded annually.

$$P = 100 \quad i = 0.0625 \quad n = 4 \quad A = 100(1 + 0.0625)^4$$

$$= 100(1.274 429 321)$$

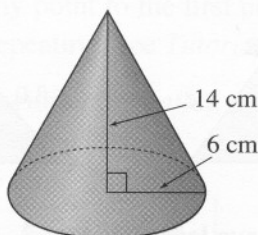
$$\doteq 127.44$$

The \$100 is worth \$127.44 after 4 years so the amount of interest earned is \$27.44.

compounding: the process of converting interest into principal. After a certain length of time, the interest becomes part of the money that earns interest.

conditional probability: the probability that an event will occur given that another event has occurred; see *Tutorial 1.4*

cone: a solid that is formed by a region (the base of the cone) and all the line segments joining points on the boundary of the region to a point not on the region



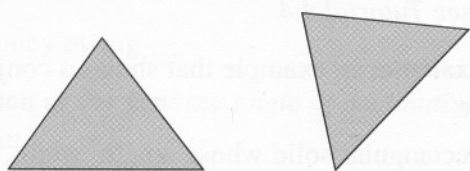
The volume of a cone can be found using the formula:

$$\begin{aligned} \text{Volume} &= \frac{1}{3}(\text{Base area})(\text{Height}) \\ &= \frac{1}{3}\pi r^2 h, \text{ where the circular base has} \\ &\quad \text{radius } r, \text{ and the height of the} \\ &\quad \text{cone is } h. \end{aligned}$$

The volume of a cone whose circular base has a radius of 6 cm and a height of 14 cm is:

$$\begin{aligned} V &= \frac{1}{3}\pi(6 \text{ cm})^2(14 \text{ cm}) \\ &\doteq 527.8 \text{ cm}^3 \end{aligned}$$

congruent: figures that have the same size and shape, but not necessarily the same orientation



conjecture: a conclusion based on examples

consecutive integers: integers that come one after the other without any integers missing

34, 35, 36 are consecutive integers; so are -2, -1, 0, 1.

consistent system of equations: a system of equations with at least one solution

$x + y = 3$ and $x - y = 1$ is a consistent system since (2, 1) solves both equations.

constant: a particular number

7 is a constant.

constant term: a number

In the equation $y = 4x + 2$, the constant term is 2.

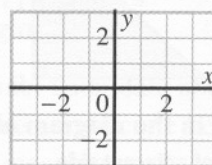
continuity correction: an adjustment of 0.5 added to or subtracted from the endpoints when the normal distribution is used to approximate the binomial distribution in probability calculations; see *Tutorial 3.5*

continuous data: data that can assume any value without a break; data about the time it takes for a plant to grow is continuous because in-between values have meaning

control chart: used in statistical process control to track the value of some aspect of a product over time

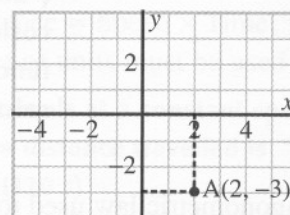
convenience sample: a sample whose members are selected based on convenience

coordinate axes: the horizontal and vertical number lines on a grid that represents a plane



coordinate plane: a two-dimensional surface on which a coordinate system has been set up

coordinates: also called Cartesian coordinates; the numbers in an ordered pair that locate a point in the coordinate plane



The coordinates of point A are (2, -3).

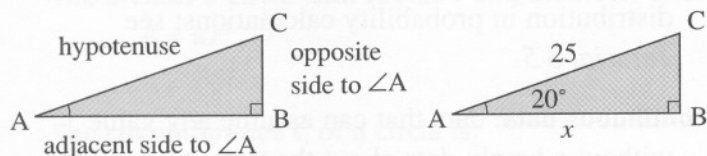
correlation coefficient: a measure of how closely data can be described by a certain type of function; the closer the value of the correlation coefficient to 1 or -1, the closer the data fit the function

corresponding angles: see *parallel lines*

corresponding angles in similar triangles: two angles, one in each triangle, that are equal



cosine: for an acute angle $\angle A$ in a right triangle, the ratio of the length of the side adjacent to the angle to the length of the hypotenuse



To determine AB in the diagram above, right:

$$\cos \angle A = \frac{\text{Length of adjacent side}}{\text{Length of the hypotenuse}}$$

$$\cos 20^\circ = \frac{x}{25}$$

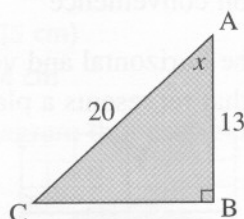
$$0.9397 \doteq \frac{x}{25}$$

$$23.5 \doteq x$$

Substitute the known quantities.

Use a calculator to determine $\cos 20^\circ$.

Multiply both sides by 25.



To determine $\angle A$ in the diagram above:

$$\cos \angle A = \frac{\text{Length of adjacent side}}{\text{Length of the hypotenuse}}$$

$$\cos x^\circ = \frac{13}{20}$$

$$\cos x^\circ = 0.65$$

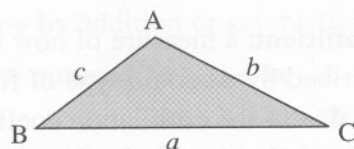
Substitute the known quantities.

Convert the fraction into a decimal.

Use the \cos^{-1} ("the angle whose cosine is") function on the calculator.

$$x \doteq 49.5^\circ$$

Cosine Law: a trigonometric law used to solve triangles that are not necessarily right triangles



In any $\triangle ABC$,

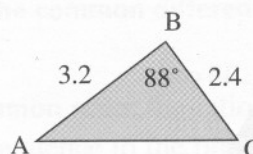
$$a^2 = b^2 + c^2 - 2bc \cos A, \text{ so } \cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$b^2 = a^2 + c^2 - 2ac \cos B, \text{ so } \cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

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

Use the Cosine Law to solve problems when you know all 3 sides of a triangle and wish to find an angle, or 2 sides and the included angle and wish to find the other side.

1.



1. In $\triangle ABC$, above left, find AC.

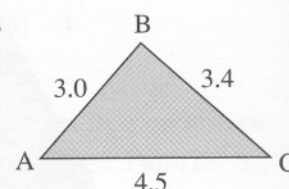
$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$b^2 = 2.4^2 + 3.2^2 - 2(2.4)(3.2) \cos 88^\circ$$

$$b^2 = 15.463 \ 943 \ 73$$

$$b \doteq 3.9$$

2.



2. In $\triangle ABC$, above right, find $\angle A$.

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos A = \frac{4.5^2 + 3.0^2 - 3.4^2}{2 \times 4.5 \times 3.0}$$

$$\cos A = 0.655 \ 185 \ 2$$

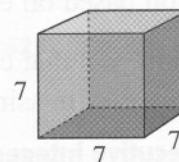
Use \cos^{-1} to find A.

$$A \doteq 49.1^\circ$$

cost of financing: the difference between the cash price and the sum of the payments made for an item; see *Tutorial 4.4*

counterexample: an example that shows a conjecture is false

cube: a rectangular solid whose length, width, and height are all equal



For a cube with sides of length s , the surface area is $S = 6s^2$; the volume of the cube is $V = s^3$.

If $s = 7$ cm

$$\begin{aligned} \text{Surface area} &= 6(7)^2 \text{ cm}^2 \\ &= 294 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Volume} &= (7)^3 \text{ cm}^3 \\ &= 343 \text{ cm}^3 \end{aligned}$$

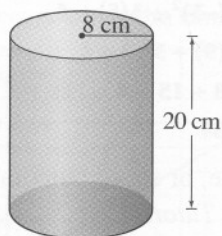
cube root: a number that, when raised to the power 3, results in the given number

$$\sqrt[3]{8} = 2, \text{ since } 2^3 = 8$$

cubic units: units that measure volume; common cubic units include cm^3 and m^3

cycle: a cycle of a periodic function is a part of its graph from any point to the first point where the graph starts repeating; see *Tutorial 5.1*

cylinder: a solid with two parallel, congruent, circular bases



$$\begin{aligned}\text{Surface area} &= 2\pi rh + 2\pi r^2 \\ &= 2\pi(8)(20) + 2\pi(8)^2 \\ &\doteq 1005.3 + 402.1 \\ &\doteq 1407.4 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= \pi r^2 h \\ &= \pi(8)^2(20) \\ &\doteq 4021.2 \text{ cm}^3\end{aligned}$$

data: numeric or non-numeric facts or information

debt: money owing

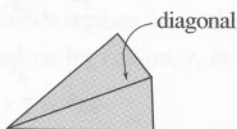
declination of the sun: see *angle of declination of the sun*

dependent events: the occurrence of one event is affected by the occurrence of another event; see *Tutorial 1.4*

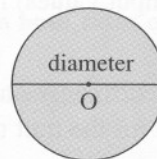
dependent variable: the output of a relation, often denoted as y ; also called the responding variable

depreciation: the decrease in value of an asset; see *Tutorial 4.4*

diagonal: a line that joins two vertices of a figure, but is not a side



diameter: a line segment that joins two points on a circle (or sphere) and passes through its centre; the diameter of a circle is twice the length of the radius; see *circle*



dimensions of a matrix: the number of rows and columns of a matrix; an $m \times n$ matrix has m rows and n columns; see *Tutorial 2.1*

direct variation: when the ratio of two variable quantities remains constant

If y varies directly as x , the equation that relates y to x is $y = mx$, where m is a constant. The graph of a direct variation is a straight line that passes through the origin.

discrete data: distinct data; data about the number of oranges in a crate are discrete because intermediate values have no meaning

displacement: a vector that describes the distance and direction an object moves; see *Tutorial 7.1*

distance: the space between two points; also, the distance travelled by an object that is moving at a constant speed for a time is determined from the relation $\text{Distance} = \text{Speed} \times \text{Time}$, where a consistent set of units must be used

If an object travels at a constant speed of 20 m/s for 2 min, the distance travelled is

$$\begin{aligned}d &= (20 \text{ m/s})(120 \text{ s}) \\ &= 2400 \text{ m}\end{aligned}$$

distance formula: a formula used to determine the distance between two points whose coordinates are known

If $A(x_A, y_A)$ and $B(x_B, y_B)$, then

$$AB = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$$

Find the distance between the points $A(7, 2)$ and

$$\begin{aligned}B(-4, 4) \quad AB &= \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2} \\ &= \sqrt{(-4 - 7)^2 + (4 - 2)^2} \\ &= \sqrt{125} \\ &\doteq 11.2\end{aligned}$$

dividends: a portion of a company's earnings paid to shareholders

domain of a relation or function: the set of all possible x -values (or valid input values) represented by the graph or equation

dominant trait: in genetics, only one dominant allele needs to be present for the trait to be expressed

effective annual interest rate: the rate that with annual compounding has the same effect as the stated rate; see *Tutorial 4.5*

elements: the entries in a matrix; see *Tutorial 2.1*

equal vectors: have the same magnitude and direction; see *Tutorial 7.1*

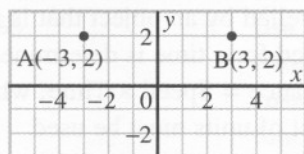
equation: a mathematical statement indicating that two expressions are equal

$2x + 5y = -4$ is an equation.

equation of a line: an equation that gives the relationship between the coordinates of every point on the line; see *linear equation and its graph*

equidistant: the same distance apart

Points A and B are equidistant from the y -axis since they are both 3 units from the y -axis.



equilibrant: a force, equal and opposite to the resultant of forces acting on an object so that the object does not move; see *Tutorial 7.2*

equity: the difference between the market value of real estate and the amount still owing; see *Tutorial 4.6*

equity investments: stocks and mutual funds; see *Tutorial 4.3*

evaluate an expression: substitute a value for each variable in the expression, then calculate the resulting arithmetic expression applying the order of operations rules

Evaluate $2x^2 + 3y - 4$, if $x = -3$ and $y = 5$.

Replace each letter with its value, placing each number in parentheses to prevent errors with signs.

$$\begin{aligned} 2x^2 + 3y - 4 &= 2(-3)^2 + 3(5) - 4 \\ &= 2(9) + 3(5) - 4 \\ &= 18 + 15 - 4 \\ &= 29 \end{aligned}$$

event: any outcome, or set of outcomes, of an experiment; see *Tutorial 1.1*

expected value: the number that would be expected to be the average when an experiment is repeated many times; the mean of a probability distribution; see *Tutorial 3.1*

expenses: items that must be paid from income; for example, food, shelter, transportation

experiment: a procedure, carried out under controlled conditions, that is used to test a hypothesis

experimental probability: probability determined using sampling or a simulation; see *Tutorial 1.1*

exponent: a number, shown in a smaller size and raised, that tells us how many times the number before it is used as a factor

2 is the exponent in 6^2 .

The laws of exponents are given below left, with examples to the right.

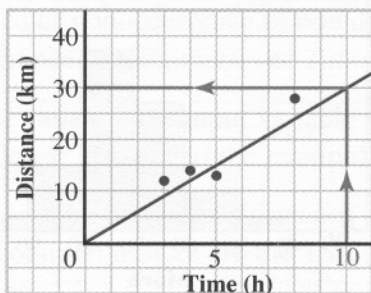
$a^m \cdot a^n = a^{m+n}$	$x^3 \cdot x^5 = x^{3+5} = x^8$
$(a^m)^n = a^{mn}$	$(x^3)^4 = x^{3 \cdot 4} = x^{12}$
$(ab)^m = a^m b^m$	$(4x)^3 = 4^3 \cdot x^3 = 64x^3$
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{x}{2}\right)^4 = \frac{x^4}{2^4} = \frac{x^4}{16}$
$\frac{a^m}{a^n} = a^{m-n}$	$\frac{x^8}{x^2} = x^{8-2} = x^6$
$a^{-m} = \frac{1}{a^m}$	$2^{-4} = \frac{1}{2^4} = \frac{1}{16}$
$a^0 = 1$	$7x^0 = 7 \cdot 1 = 7$

expression: a meaningful combination of mathematical symbols, such as a polynomial.

$3x - 2$ is an expression, as is $-13x^2 - 5x + 6$.

extrapolate: estimate a value beyond the known values

To use the graph below to estimate the distance travelled after 10 h requires extrapolation; the last known value occurs when the time is 8 h.



extremes: the highest and lowest values in a set of numbers

fair market value: an expert's determination of the value of a saleable item

Fibonacci sequence: a sequence of numbers in which each term after the second is formed by adding the two preceding terms; see *Tutorial 6.1*

1, 1, 2, 3, 5, 8, 13, 21, ...

fixed income investments: provide a source of regular income with limited risk; includes bonds, debentures, and guaranteed investment certificates; see *Tutorial 4.3*

force: a push or a pull on an object in a certain direction

A force of 1 Newton (N) will cause a 1-kg object to accelerate at a rate of 1 m/s^2 .

formula: an equation that is used to describe the relationship between two or more quantities

The formula that describes how the volume, V , of a sphere is related to its radius, r , is $V = \frac{4}{3}\pi r^3$.

formula rearrangement: changing a formula to an equivalent form using the rules of equality

1. Rearrange the equation $y = mx + b$ to isolate x .

$$y = mx + b$$

Subtract b from both sides of the equation.

$$y - b = mx$$

Divide by m to isolate x .

$$\frac{y - b}{m} = \frac{mx}{m}$$

$$\frac{y - b}{m} = x$$

2. Make d the subject of the formula $F = \frac{12g}{d^2}$.

$$F = \frac{12g}{d^2}$$

Clear the fraction by multiplying both sides of the equation by d^2 .

$$Fd^2 = 12g$$

Divide both sides of the equation by F to isolate d^2 .

$$\frac{Fd^2}{F} = \frac{12g}{F}$$

$$d^2 = \frac{12g}{F}$$

Take the square root of both sides of the equation to isolate d .

$$d = \pm \sqrt{\frac{12g}{F}}$$

fractals: geometric figures that can be generated by repeating the same process many times; see *Tutorial 6.3*

frequency: the number of times an event occurs in an experiment; the number of times that something occurs in a given time; a common unit is the Hertz (Hz), which is the number of cycles that occur in 1 s

If you eat breakfast, lunch, and dinner every day, your meal frequency is 3 times a day.

If a pendulum swings back and forth 10 times in 5 s, its frequency would be

$$\begin{aligned} 10 \text{ cycles} / 5 \text{ s} &= 2 \text{ cycles/s} \\ &= 2 \text{ Hz} \end{aligned}$$

function: a rule that gives a single output number for each input number

$y = 3x + 2$ and $y = 5x^2$ are functions.

function notation: the use of the function name, such as f , to indicate the output value for a particular input

$$f(x) = 3x + 2$$

Fundamental Counting Principle: if one item can be selected in m different ways and a second item can be selected in n different ways, then the two items can be selected in $m \times n$ different ways; see *Tutorial 1.3*

genotype: the pair of alleles that determine a genetic characteristic

geometric sequence: a sequence of numbers in which each term after the first is formed by multiplying the preceding term by a constant; see *Tutorial 6.1*

geometric vectors: a directed line segment used to represent a vector quantity; the length represents the magnitude and the arrowhead indicates the direction; see *Tutorial 7.1*

gradien: a unit of angle measure; $400 \text{ grad} = 360^\circ$; see *Tutorial 5.2*

gross income: the amount of money earned before deductions

gross profit: the difference between the cost price and selling price of an item; also called the *markup*

Lori's Fashions buys a coat for \$29.00 and sells it for \$49.99.

The gross profit on the coat is \$(49.99 - 29.00), or \$20.99.

Guaranteed Investment Certificates: a type of investment offered at banks and trust companies which usually offers a higher rate of return than a bank account, but is for a fixed period of time and is not cashable until the expiration of the fixed period

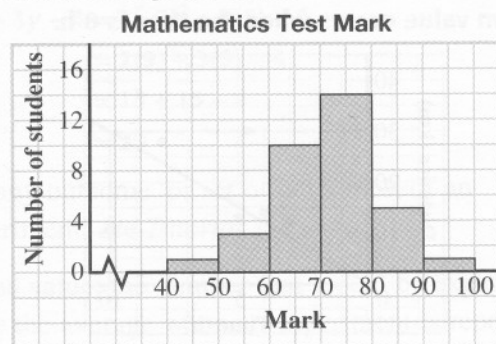
half-life: the time taken for an item to reduce its quantity by half

head-to-tail: two vectors are drawn head-to-tail if the second vector begins where the first vector ends; see *Tutorial 7.2*

heading: the direction toward which a vehicle is steered; see *Tutorial 7.4*

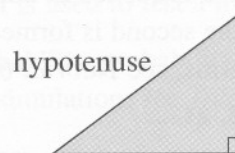
hectare: a metric unit used for land area; the area of a square of side 100 m, so 1 hectare = $10\,000 \text{ m}^2$

histogram: a graph that uses bars, where each bar represents a range of values



horizontal intercept: the horizontal coordinate of the point(s) where the graph of the line or function intersects the horizontal axis; see *intercepts*

hypotenuse: the side opposite the right angle in a right triangle



imperial system: a system of measures that was used in Canada prior to 1976; a variant is still used in the U.S.A.; measuring devices using this system often have each unit subdivided by halving, then halving the subdivisions

Relationship between common imperial units	Relationship between common imperial units and SI units
Length	
1 mile = 1760 yards	1 mile = 1.609 km
1 yard = 3 feet	1 yard = 0.9144 m
1 foot = 12 inches	1 inch = 2.54 cm
Capacity (Volume)	
1 gallon = 4 quarts	1 gallon = 4.546 L
1 quart = 2 pints	
Mass (Weight)	
1 ton = 2000 pounds	1 pound = 0.454 kg
1 pound = 16 ounces	1 ounce = 28.35 g

income tax: money paid as tax to the federal and provincial governments based on the amount of income earned

inconsistent system of equations: a system of linear equations with no solutions

$x + y = 7$ and $x + y = 14$ is an inconsistent system. The solution represents distinct parallel lines.

independent events: two or more events for which the occurrence or nonoccurrence of one does not affect the occurrence of the others; see *Tutorial 1.4*

independent variable: the input variable in a relation, often called x ; also called the manipulated variable

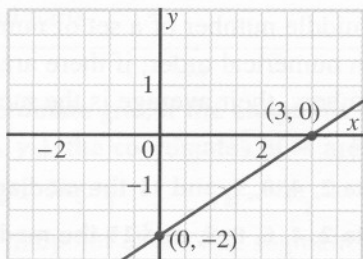
index: used to measure the performance of the stock market; common indices are the TSE 300 and the Dow Jones

inferential statistics: statistics calculated for a set of data collected from a sampling of the population; used to draw conclusions about the population; see *Tutorial 1.1*

initial probability matrix: a row matrix containing the probabilities at the beginning of an experiment; see *Tutorial 2.4*

integers: see *number systems*

intercepts: the horizontal and vertical coordinates of the points at which a graph crosses the horizontal and vertical axes



The x -intercept is 3 and the y -intercept is -2.

interest (simple): money paid for the use of money, usually at a predetermined percent. If P is the amount invested or borrowed, r , the rate of interest per annum, and t , the time in years, then I , the interest, is given by the formula $I = Prt$.

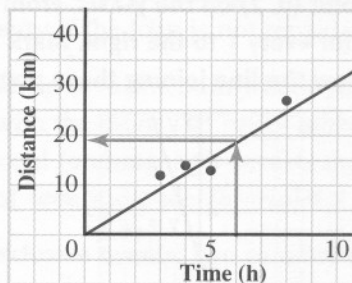
Juanita purchased a \$500 bond at an interest rate of 6.5% per annum. After 6 months, she receives

the following interest:

$$\begin{aligned} I &= \$500 \times 6.5\% \times \frac{6}{12} \\ &= \$500 \times 0.065 \times 0.5 \\ &= \$16.25 \end{aligned}$$

interpolate: estimate a value that lies between known values

To use the graph below to estimate the distance travelled after 6 h requires interpolation.



irrational numbers: see *number systems*

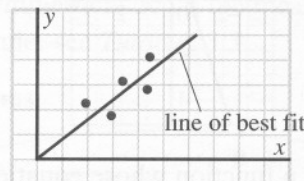
iterative procedure: a procedure in which a sequence of steps is repeated many times; see *Tutorial 6.3*

lease: to rent an item from the owner; the lease payments cover the depreciation of the item over the course of the lease plus interest on the outstanding balance of the full purchase price; see *Tutorial 4.4*

least squares method: for a set of data, a method that is used by many calculators and computers to determine a line or curve of best fit

limiting factor: a factor that restricts the number of possible outcomes of an experiment

line of best fit: a line that passes as close as possible to a set of plotted points



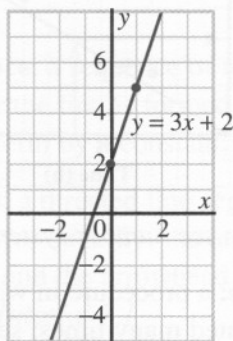
line segment: the part of a line between two points on the line, including the two points



linear equation and its graph: an equation that represents a straight line; can be written in the form $y = mx + b$, where m is the slope and b is the y -intercept, or $Ax + By + C = 0$, where A , B , and C are numbers

Slope-Intercept method of graphing: Graph the line $y = 3x + 2$.

This line has a slope of 3 and a y -intercept of 2. Mark the point $(0, 2)$ on the y -axis. From that point, move up 3 for every 1 to the right. Mark this point, and then draw the line joining these points.



Intercept method of graphing: Calculate the points at which the line intersects the axes.

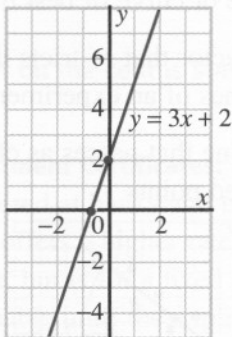
y -intercept: when $x = 0$, $y = 3(0) + 2 = 2$

x -intercept: when $y = 0$, $0 = 3x + 2$

$$-2 = 3x$$

$$-\frac{2}{3} = x$$

Plot, then join the intercepts $(-\frac{2}{3}, 0)$ and $(0, 2)$.



linear function: a function whose equation can be written in the form $y = mx + b$, and whose graph is a non-vertical line

linear system: two or more linear equations in the same variables

$5x - 2y = 7$ and $y = \frac{2}{3}x + 1$ form a linear system.

maintenance level: the maximum level of an ingested substance that will be absorbed into the bloodstream; see *Tutorial 6.2*

margin of error: the proportion that we add to and subtract from the result to construct the confidence interval; see *Tutorial 3.6*

marginal tax rate: the rate of income tax charged on the last dollar earned; as your income increases, the rate of tax you pay increases; see *Tutorial 4.2*

Mary paid a total of \$26 000 tax on her \$81 000 salary. She received a final bonus of \$1000, and paid \$450 tax on these last thousand dollars. This means that her marginal tax rate is \$450 per \$1000, or 45%.

markup: see *gross profit*

mass: a measure of the amount of material in an object; common units are grams or kilograms

matrix: a rectangular array of numbers; see *Tutorial 2.1*

mean: the average of a set of numbers; see *average*

measurement error: the difference between a measure and its true value

measurement standards: the standard set by the General Conference on Weights and Measures in 1889 so that all persons would be dealing in the same measurements

median: the middle number of a set of numbers arranged in numerical order; if there are two middle numbers, their average is the median of the data set

For the data 2, 4, 8, 9, and 11 the median is 8.

For the data 2, 4, 6, 8, 9, and 11 the median is 7, since $\frac{6+8}{2} = 7$.

meiosis: the process of cell division in which sperm and egg cells are produced

metric system: also called the *SI system*; based on a decimal system, with each unit subdivided into tenths and prefixes showing the relation of a unit to the base unit; commonly used base units are:

Metre (m) for length	Gram (g) for mass
Litre (L) for capacity	Second (s) for time

Prefix	Multiplying Factor	Symbol
mega	1 000 000	M
kilo	1000	k
hecto	100	h
deca	10	da
	1	
deci	0.1	d
centi	0.01	c
milli	0.001	m
micro	0.000 001	μ
nano	0.000 000 001	n

Note: 1 L = 1000 cm³, so 1 mL = 1 cm³

1 tonne (sometimes called a metric ton) is used for mass: 1 t = 1000 kg

Convert 34.6 cm to m:

from the table above, 1 cm = 0.01 m

$$34.6 \times 1 \text{ cm} = 34.6 \times 0.01 \text{ m}$$

$$34.6 \text{ cm} = 0.346 \text{ m}$$

Convert 246 cm² to mm²:

from the table above, 1 cm = 10 mm

$$(1 \text{ cm})^2 = (10 \text{ mm})^2$$

$$1 \text{ cm}^2 = 100 \text{ mm}^2$$

$$246 \times 1 \text{ cm}^2 = 246 \times 100 \text{ mm}^2$$

$$246 \text{ cm}^2 = 24\,600 \text{ mm}^2$$

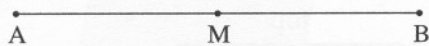
Convert 35 mL to L:

from the table above, 1 mL = 0.001 L

$$35 \times 1 \text{ mL} = 35 \times 0.001 \text{ L}$$

$$35 \text{ mL} = 0.035 \text{ L}$$

midpoint: the point that divides a line segment into two equal parts



On a coordinate grid, if the endpoints are $A(x_A, y_A)$ and $B(x_B, y_B)$, the coordinates of M are:

$$x_M = \frac{x_A + x_B}{2} \quad y_M = \frac{y_A + y_B}{2}$$

Find the midpoint of the line segment with endpoints $P(-2, 8)$ and $Q(3, 0)$.

$$\begin{aligned} \text{Midpoint} &= \left(\frac{-2+3}{2}, \frac{8+0}{2} \right) \\ &= \left(\frac{1}{2}, 4 \right) \end{aligned}$$

mill rate: the rate (in thousandths of a dollar) at which property tax is to be paid on the assessed value of the property

mode: the most frequently occurring value in a set of data

In the data set {5, 12, 8, 7, 3, 5, 3, 10, 5}, the mode is 5.

momentum: a vector quantity found by multiplying an object's mass by its velocity; see *Chapter 7 Project*

mortgage: a long-term loan on real estate that gives the person or firm providing the money a claim on the property if the loan is not repaid

mutual fund: an investment in which your money is pooled with the money of many other investors; a professional fund manager invests the monies in a variety of securities; see *Tutorial 4.3*

mutually exclusive events: two or more events that do not share any common outcomes; see *Tutorial 1.5*

natural numbers: see *number systems*

negative number: a number less than 0

95% confidence interval: the range of values that lie within 1.96 standard deviations of the mean; the probability a particular data value lies in that range is 0.95; see *Tutorial 3.6*

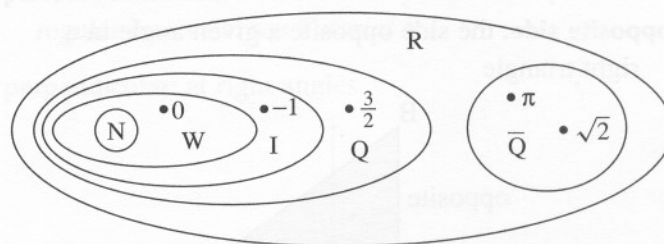
nominal rate of interest: the stated rate of interest for the given period; see *Tutorial 4.5*

non-linear systems: two or more equations in which at least one is not a linear equation

The system $y = 2x^2 + 3$ and $4x + 3y = 12$ is a non-linear system.

normal distribution: a probability distribution with mean μ and standard deviation σ ; the bell-shaped graph is symmetrical about the mean; obeys the 68-95-99 rule; see *Tutorial 3.3*

number systems:



The *Natural numbers*, N , also called the counting numbers, are 1, 2, 3, 4, 5,

If the number 0 is included, we get the **Whole numbers, W**: 0, 1, 2, 3, 4, 5,

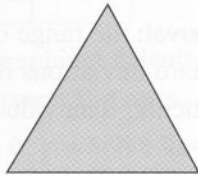
The **Integers, I**, contain all of the whole numbers and all of their negatives: ..., -3, -2, -1, 0, 1, 2, 3,

The set of numbers that can be written in the form $\frac{m}{n}$, where m and n are integers and $n \neq 0$ are the **Rational numbers, Q**. Integers are rational numbers, since they can be expressed as fractions with denominator 1. All terminating or repeating decimals are rational numbers.

Irrational numbers, \bar{Q} , cannot be expressed as fractions involving integers. They are non-terminating, non-repeating decimals. Numbers such as $\sqrt{2}$ and π are irrational.

The **Real number system, R**, consists of all rational numbers together with all irrational numbers. It can be represented by all positions on a number line.

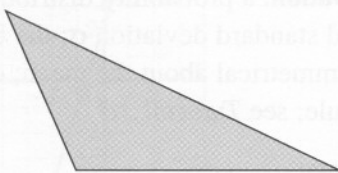
oblique triangle: a triangle that does not contain a 90° angle



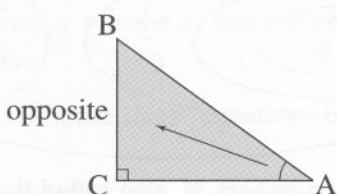
obtuse angle: an angle greater than 90° but less than 180°



obtuse triangle: a triangle with one obtuse angle



opposite side: the side opposite a given angle in a right triangle



opposite vectors: have the same magnitude but act in opposite directions; see *Tutorial 7.1*

order of operations: the rules that are followed when simplifying or evaluating an expression:

Complete all operations within brackets following the order of operations.

Evaluate all exponents.

Complete all multiplication and division in the order they appear from left to right.

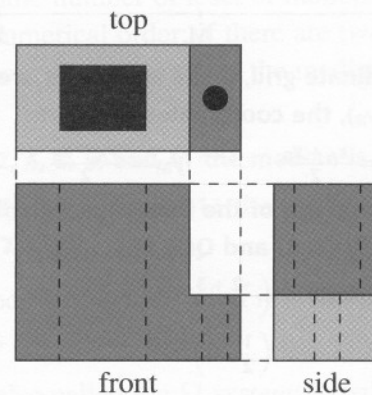
Complete all addition and subtraction in the order they appear from left to right.

Evaluate the following:

$$\begin{aligned}
 &5 - 2(4 + 2^3 \div 4) && \text{Begin with the exponent within the brackets.} \\
 &= 5 - 2(4 + 8 \div 4) && \text{Complete the division within the brackets.} \\
 &= 5 - 2(4 + 2) && \text{Complete the addition within the brackets.} \\
 &= 5 - 2(6) && \text{Complete the multiplication.} \\
 &= 5 - 12 && \text{Finish by completing the subtraction.} \\
 &= -7
 \end{aligned}$$

ordered pair: a pair of numbers, written as (x, y) that represent a point on the coordinate plane; see *coordinates*

orthographic diagram: a diagram commonly used in industry that shows at least three points of view: the top, front and side; also shows the internal features

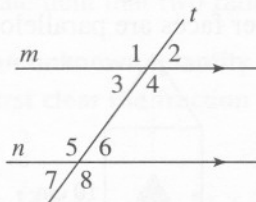


outcome: a possible result of an experiment; a possible answer to a survey question

For the experiment of tossing a six-sided die, the possible outcomes are rolling a 1, 2, 3, 4, 5, or 6.

outlier: an observed value that differs markedly from the pattern established by most of the data

parallel lines: lines in the same plane that do not intersect



Lines m and n are parallel with a transversal, t . If two lines are parallel and cut by a transversal, then the following will be true:

The alternate interior angles will have equal measures (congruent). $\angle 3 = \angle 6$ and $\angle 4 = \angle 5$

The corresponding angles will have equal measures (congruent).

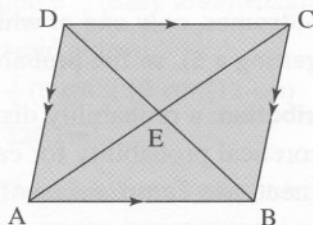
$$\angle 1 = \angle 5 \text{ and } \angle 2 = \angle 6 \quad \angle 3 = \angle 7 \text{ and } \angle 4 = \angle 8$$

The same-side interior angles add up to 180° (supplementary).

$$\angle 3 + \angle 5 = 180^\circ \text{ and } \angle 4 + \angle 6 = 180^\circ$$

If any one of these conditions is true then the lines must be parallel. Lines that are parallel will have the same slope.

parallelogram: a quadrilateral with opposite sides parallel



A parallelogram has these properties:

The opposite sides have equal lengths.

$$AB = CD \text{ and } AD = BC$$

The opposite angles have equal measures (congruent). $\angle A = \angle C$ and $\angle B = \angle D$

The diagonals bisect each other (cut each other into equal lengths).

$$AE = EC \text{ and } DE = EB$$

parallelogram method of vector addition: a method for finding the sum of two vectors arranged tail-to-tail; see *Tutorial 7.2*

parameters: the constants in the equation of a particular function; see *Tutorial 5.4*

percent: means “out of 100”; symbolized by %

A percent can be written as a fraction with denominator 100, or as a decimal.

$$45\% = \frac{45}{100} = 0.45 \text{ and } 150\% = \frac{150}{100} = 1.50$$

1. What percent is 33 out of 48?

We must determine x , where $\frac{33}{48} = \frac{x}{100}$.

To isolate x , multiply both sides by 100.

$$100 \times \frac{33}{48} = 100 \times \frac{x}{100} \\ 68.75 = x$$

Thus, 33 out of 48 is 68.75%.

2. Find 7% of 45.95.

$$7\% \text{ of } 45.95 = 0.07 \times 45.95, \text{ changing the percent to its decimal form} \\ = 3.2165$$

Thus, 7% of 45.95 is 3.2165.

3. 7.5 is 20% of what number?

Let the unknown number be x and write the question as:

$$7.5 = 20\% \text{ of } x$$

Use the decimal form of the percent.

$$7.5 = 0.20 \times x$$

Solve for x by dividing both sides of the equation by 0.20.

$$\frac{7.5}{0.20} = \frac{0.20x}{0.20} \\ 37.5 = x$$

Thus, 7.5 is 20% of 37.5.

perimeter: the distance around a closed figure; see *square, rectangle, triangle, and circle*

period: the length of the shortest part of the graph that repeats, measured along the horizontal axis; see *Tutorials 5.1, 5.2, 5.3, and 5.4*

periodic data: data that contain cycles that repeat at regular intervals; see *Tutorial 5.1*

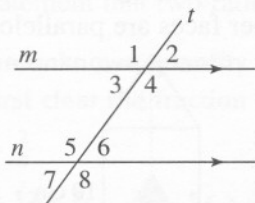
perpendicular: at right angles



Two lines are perpendicular if their slopes are negative reciprocals of one another.

outlier: an observed value that differs markedly from the pattern established by most of the data

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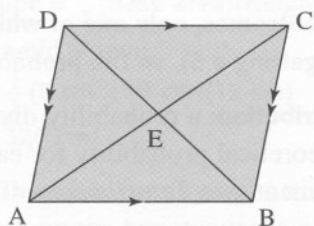
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$$\angle 3 + \angle 5 = 180^\circ \text{ and } \angle 4 + \angle 6 = 180^\circ$$

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Use the decimal form of the percent.

$$7.5 = 0.20 \times x$$

Solve for x by dividing both sides of the equation by 0.20.

$$\frac{7.5}{0.20} = \frac{0.20x}{0.20} \\ 37.5 = x$$

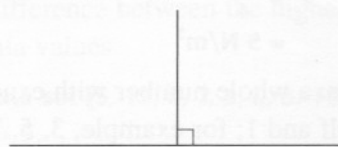
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perimeter: the distance around a closed figure; see *square, rectangle, triangle, and circle*

period: the length of the shortest part of the graph that repeats, measured along the horizontal axis; see *Tutorials 5.1, 5.2, 5.3, and 5.4*

periodic data: data that contain cycles that repeat at regular intervals; see *Tutorial 5.1*

perpendicular: at right angles

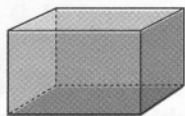


Two lines are perpendicular if their slopes are negative reciprocals of one another.

phenotype: the appearance of a genetic trait

pi (π): the ratio of the circumference of a circle and its diameter; $\pi \doteq 3.1416$

pictorial diagram: a two dimensional representation of a three dimensional figure drawn from one perspective



polygon: a closed figure that consists of line segments that only intersect at their endpoints



The above figures are polygons.

The table below gives the names of some common polygons.

Number of Sides	Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
8	Octagon
10	Decagon
n	n -gon

population: the entire set of objects, people, or processes being studied

positive number: a number greater than 0

power: see *exponent*

pressure: a measure of the amount of force acting on a unit area of a surface; calculated by dividing the force acting on a surface by the area of the surface

If a force of 20 N is acting on a surface whose area is 4 m², what is the pressure on the surface?

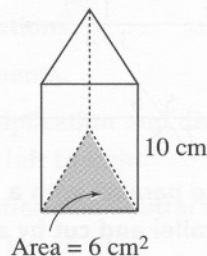
$$\begin{aligned} \text{Pressure} &= \frac{\text{Force}}{\text{Area}} \\ P &= \frac{20}{4} \\ &= 5 \text{ N/m}^2 \end{aligned}$$

prime numbers: a whole number with exactly two factors, itself and 1; for example, 3, 5, 7, 11, 29, 31, and, 43

principal: the original amount of a loan or investment

Suppose you invest \$5000 at 7%, compounded annually, for 5 years. The principal is \$5000.

prism: a solid with two congruent and parallel faces (bases), all other faces are parallelograms



The volume of a prism is the area of the base multiplied by the height.

$$\text{Volume} = (\text{Area of base})(\text{Height})$$

$$V = A \times h$$

For the prism shown:

$$\begin{aligned} V &= (6 \text{ cm}^2)(10 \text{ cm}) \\ &= 60 \text{ cm}^3 \end{aligned}$$

probability: an indication of the likelihood of an event occurring; if the outcomes of an experiment are equally likely, it is the ratio of the number of favourable outcomes to the total number of outcomes

Find the probability of getting a 5 in a single roll of one die.

There are 6 outcomes, only one of which is favourable (getting a 5), so the probability is $\frac{1}{6}$.

probability distribution: a probability distribution gives the theoretical probability for each outcome of an experiment; see *Tutorial 3.1*

property taxes: property owners pay tax to their municipal government; the amount of property tax is calculated using the formula

$\frac{\text{Assessed value} \times \text{Mill rate}}{1000}$ where the assessed value is a percent of the fair market value and the mill rate is determined locally

Determine the property taxes for a property that has a fair market value of \$265 000 if the assessed value is 75% of the fair market value and the mill rate is 18 mills.

$$\begin{aligned} \text{Assessed value} &= 0.75 \times 265\ 000 \\ &= \$198\ 750 \end{aligned}$$

$$\begin{aligned} \text{Property tax} &= \frac{198\,750 \times 18}{1000} \\ &= \$3577.50 \end{aligned}$$

The property tax is \$3577.50

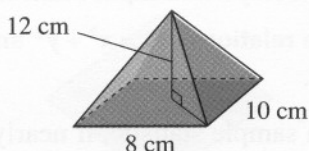
proportion: a statement that two ratios are equal

To solve for an unknown quantity within a proportion, first clear the fraction by multiplication.

$$\begin{aligned} \frac{x}{12} &= \frac{2}{5} & \frac{3}{x} &= \frac{4}{5} \\ 12 \times \frac{x}{12} &= 12 \times \frac{2}{5} & 5x \times \frac{3}{x} &= 5x \times \frac{4}{5} \\ x &= 4.8 & 15 &= 4x \\ & & \frac{15}{4} &= \frac{4x}{4} \\ & & 3.75 &= x \end{aligned}$$

Punnett Square: a table showing the sample space for the possible genotypes of the offspring of parents with given genotypes

pyramid: a solid with one face that is a polygon (base) and other faces that are triangles with a common vertex



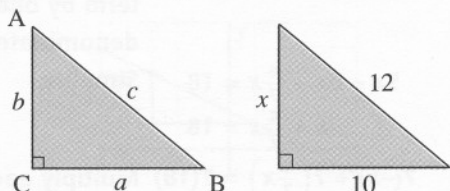
The formula to calculate the volume, V , of a pyramid is:

$$\text{Volume} = \frac{1}{3} (\text{Base area})(\text{Height})$$

For the pyramid shown:

$$\begin{aligned} V &= \frac{1}{3} (8 \text{ cm} \times 10 \text{ cm})(12 \text{ cm}) \\ &= 320 \text{ cm}^3 \end{aligned}$$

Pythagorean Theorem: for any right triangle, the area of the square on the hypotenuse is equal to the sum of the areas of the squares on the other two sides



In right triangle ABC: $a^2 + b^2 = c^2$.

Using the values for the right triangle shown, substitute into the above formula.

$$10^2 + x^2 = 12^2$$

$$100 + x^2 = 144$$

$$100 + x^2 - 100 = 144 - 100$$

$$x^2 = 44$$

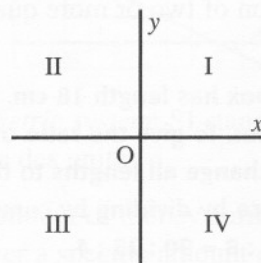
$$x \doteq 6.6$$

Simplify each side.

Isolate the variable.

To solve, take the square root of both sides.

quadrant: one of the four regions into which the coordinate axes divide the plane, usually numbered as shown in the diagram



quadrilateral: a four-sided polygon; see *polygon*

radian: a unit for angle measure; the measure of the central angle of a sector with arc length of the sector equal to the radius; see *Tutorial 5.2*

$$\pi \text{ radians} = 180^\circ$$

radical: the root of a number

$$\sqrt{5}, \sqrt[3]{5}, \sqrt{2.6}$$

radius: the distance from the centre of a circle to any point on the circumference; also, a line segment joining the centre of a circle to any point on the circumference

The radius of a circle is half the length of its diameter.



random sample: a sampling in which all members of the population have an equal chance of being selected

range: the difference between the highest and the lowest data values

For the data set {5, 12, 8, 7, 3, 5, 3, 10, 5}, the range is $12 - 3 = 9$.

range of a function or a relation: the set of output numbers of a function or a relation

rate: a certain quantity of one thing considered in relation to one unit of another

Speed is the rate at which distance travelled changes in relation to one unit of time.

The slope of a line is the rate at which the line rises for one unit of horizontal run.

ratio: a comparison of two or more quantities with the same unit

A rectangular box has length 18 cm, width 5 cm, and height 8 mm. To give the ratio of the lengths of its sides, first change all lengths to the same units, mm, then reduce by dividing by common factor:

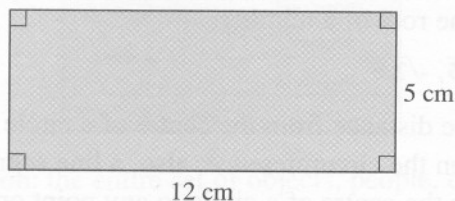
$$180 : 50 : 8 = 90 : 25 : 4$$

rational numbers: see *number systems*

real numbers: see *number systems*

recessive trait: in genetics, both alleles must be recessive for the trait to be expressed

rectangle: a quadrilateral that has four right angles



$$\text{Perimeter} = 2 \times \text{Length} + 2 \times \text{Width}$$

$$P = 2l + 2w$$

$$\text{Area} = \text{Length} \times \text{Width}$$

$$A = lw$$

For the rectangle shown:

$$\begin{aligned} P &= 2(12 \text{ cm}) + 2(5 \text{ cm}) & A &= (12 \text{ cm})(5 \text{ cm}) \\ &= 24 \text{ cm} + 10 \text{ cm} & &= 60 \text{ cm}^2 \\ &= 34 \text{ cm} & & \end{aligned}$$

rectangular prism: a prism that has rectangular faces; see *prism*

recursively generated sequence: a sequence in which each term, after the first, is generated using the terms that come before it

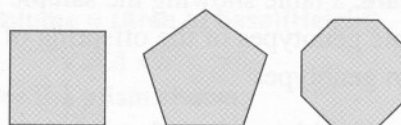
The sequence 3, 6, 12, 24 is recursive, since each successive term after the first is twice the previous one.

Registered Retirement Savings Plan (RRSP): a savings plan for individuals who earn income, where funds contributed and interest earned are not taxed until the funds are withdrawn

regression: a process by which a curve or line of best fit is fitted to a set of data using a least squares process

regular polygon: a polygon with all sides and all angles equal

The polygons below are regular polygons.



relation: a rule that produces one or more output numbers for every valid input number

Here are two relations: $25 = x^2 + y^2$ and $f(x) = 3x - 7$.

reliability: for a sample statistic, if nearly the same result is obtained in subsequent studies; for a test, if, when the test is repeated, the results are nearly the same

remove fractions from an equation: to make an equation easier to simplify by getting rid of the fractions

Solve:

$$\begin{aligned} \frac{5}{2}x - 3x + \frac{2}{7}x &= 9 \\ 2\left(\frac{5}{2}x\right) - (2)3x + 2\left(\frac{2}{7}x\right) &= 2(9) \end{aligned}$$

Multiply each term by one denominator.

$$5x - 6x + \frac{4}{7}x = 18$$

Simplify.

$$-x + \frac{4}{7}x = 18$$

$$7(-x) + 7\left(\frac{4}{7}x\right) = 7(18)$$

Multiply each term by another value on the denominator.

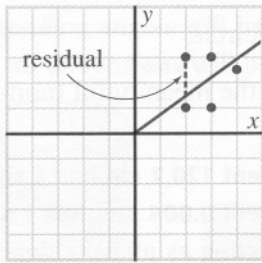
$$-7x + 4x = 126$$

Simplify.

$$-3x = 126$$

$$x = -42$$

residual: the vertical distance between a plotted point and a line of best fit



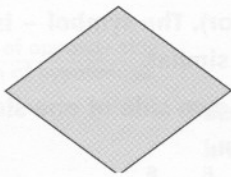
residual value: the value of a leased item at the end of the lease period; see *Tutorial 4.4*

resultant: the vector that results from adding two or more vectors; see *Tutorial 7.2*

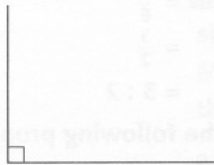
revenue: money brought in from the sale of goods or services

The sale of 158 tickets for a show costing \$20 each produces revenue of \$3160.

rhombus: a parallelogram with four equal sides

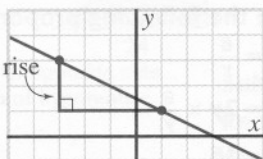


right angle: a 90° angle



right triangle: a triangle with one right angle

rise: the vertical distance between two points; see *slope*



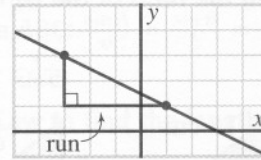
rough sketch: a drawing that is not accurate, but is representative of the data being considered

row matrix: a matrix with only one row; see *Tutorial 2.1*

Rule of 72: the number of years it takes money to double in value is approximately $\frac{72}{\text{Annual interest rate}}$

Susan invests a sum of money at 10%/a. She will double her money in about $\frac{72}{10}$ or 7.2 years.

run: the horizontal distance between two points; see *slope*



SI system: see *metric system*; SI stands for *Système Internationale des unités*

salary: a fixed amount of money earned by an individual over a specific amount of time

sample: part of a population chosen to represent the total population in a study

sample space: the list of all possible outcomes in an experiment; see *Tutorial 1.2*

sample statistic: a numerical value that is used to describe a sample, such as the *mean*

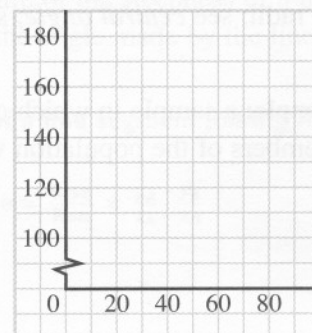
sampling: the process used to choose part of a population to represent the total population in a study

scalar: a constant; see *Tutorials 2.1* and *7.3*

scalar quantities: quantities that can be described by specifying their magnitude only; see *Tutorial 7.1*

scale: for a map, model, or diagram, the ratio of the distance between two points to the distance between the actual locations; also the numbers on the coordinate axes

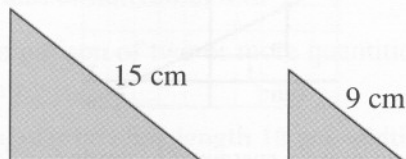
scale break: a small zig-zag mark on a graph's scale to indicate a break in the scale



scale drawing: a drawing which either enlarges or reduces the original by a particular factor; see *scale factor*

scale factor: the ratio of corresponding sides on similar figures

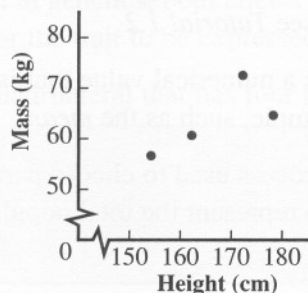
The triangles in the diagram are similar. To find the scale factor, find the ratio of the corresponding sides.



$$\begin{aligned} \text{Scale factor} &= \frac{9 \text{ cm}}{15 \text{ cm}} \\ &= \frac{3}{5} \text{ Divide by the common factor 3.} \\ &= 0.6 \end{aligned}$$

scatterplot: a graph of data that are a series of points

Height (cm)	154	162	172	178
Mass (kg)	56.3	60.1	72.2	64.3



scientific notation: a number expressed as the product of a number greater than -10 and less than -1 , or greater than 1 and less than 10 , and a power of 10

$$47\ 000 = 4.7 \times 10^4, \text{ and } -26 = -2.6 \times 10^1$$

sector: the figure formed by an arc of a circle, the radii at the ends of the arc, and all the enclosed points; see *Tutorial 5.2*

sector angle: the angle at the centre of the circle between two radii; see *central angle*; see *Tutorial 5.2*

self-selected sample: a sample in which only interested members of the population will participate

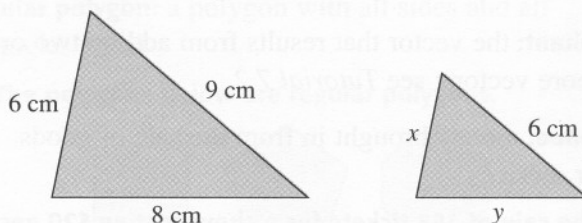
self-similarity: a part of an object is geometrically similar to the whole object; see *Tutorial 6.3*

semicircle: half a circle

significant digits: the meaningful (non-zero) digits of a number

The measurement 120.7 cm has 4 significant digits. The measurement 0.004 mm has 1 significant digit; the zeros are acting as placeholders.

similar figures: figures that have the same shape but are not necessarily the same size



When two figures are similar, their corresponding angles will have equal measures, and their corresponding sides are in proportion (all have the same scale factor). The symbol \sim is used to indicate two figures are similar.

To find an unknown side of one similar figure, use a proportion.

$$\begin{aligned} \frac{9}{6} &= \frac{8}{y} = \frac{6}{x} \\ \text{Scale factor} &= \frac{9}{6} \\ &= \frac{3}{2} \\ &= 3 : 2 \end{aligned}$$

To find x , solve the following proportion.

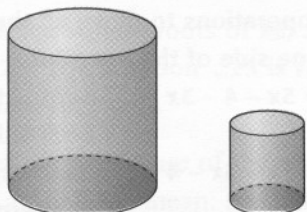
$$\begin{aligned} \frac{3}{2} &= \frac{6}{x} \\ 2x \times \frac{3}{2} &= 2x \times \frac{6}{x} \\ 3x &= 12 \\ x &= 4 \end{aligned}$$

To find y , solve the following proportion.

$$\begin{aligned} \frac{3}{2} &= \frac{8}{y} \\ 2y \times \frac{3}{2} &= 2y \times \frac{8}{y} \\ 3y &= 16 \\ y &\doteq 5.33 \end{aligned}$$

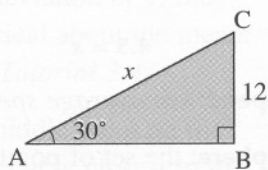
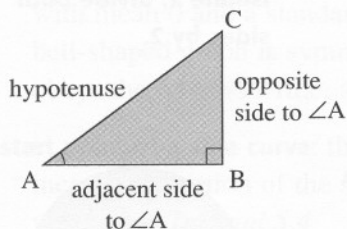
similar objects: objects that have the same shape but are not necessarily the same size

All the corresponding angles will have equal measures and all dimensions will be proportional.



simple interest: see *interest* (simple)

sine: for an acute angle $\angle A$ in a right triangle, the ratio of the length of the opposite side to the length of the hypotenuse



$$\sin A = \frac{\text{Length of opposite side}}{\text{Length of hypotenuse}}$$

$$\sin 30^\circ = \frac{12}{x}$$

$$0.5 = \frac{12}{x}$$

$$x \times 0.5 = x \times \frac{12}{x}$$

$$0.5x = 12$$

$$\frac{0.5x}{0.5} = \frac{12}{0.5}$$

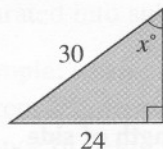
$$x = 24$$

Substitute in the known quantities.

Use a calculator to determine the sine ratio.

Multiply to clear the fraction.

Divide to isolate x .



$$\sin A = \frac{\text{Length of opposite side}}{\text{Length of hypotenuse}}$$

$$\sin x^\circ = \frac{24}{30}$$

$$\sin x^\circ = 0.8$$

$$x \doteq 53.1^\circ$$

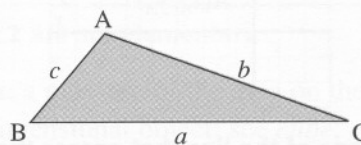
Substitute in the known quantities.

Convert the fraction into an equivalent decimal.

Use \sin^{-1} ("the angle whose sine is") function.

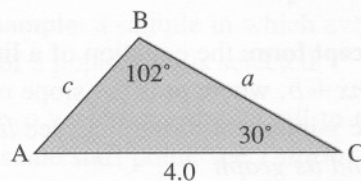
Sine Law: a trigonometric law used to solve triangles

Use the Sine Law in an oblique triangle where 2 angles and one side are known.



$$\text{In any triangle ABC: } \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \text{ and } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Use the Sine Law to find the length of AB.



$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{4.0}{\sin 102^\circ} = \frac{c}{\sin 30^\circ}$$

$$\frac{4.0 \times \sin 30^\circ}{\sin 102^\circ} = c$$

$$2.0 \doteq c$$

sinusoid: see *sinusoidal function*

sinusoidal data: periodic data that, when graphed, looks like a sine curve; see *Tutorial 5.1*

sinusoidal function: functions of curves that can be described by an equation of the form $y = a \sin(bx + c) + d$; see *Tutorial 5.3*

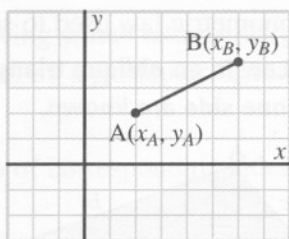
sinusoidal regression: determining the equation of the sinusoid of best fit for given data; see *Tutorial 5.5*

68-95-99 rule: about 68% of the population are within 1 standard deviation of the mean; about 95% of the population are within 2 standard deviations of the mean; about 99.7% of the population are within 3 standard deviations of the mean; see *Tutorials 3.3* and *3.4*

slope: a measure of the steepness of a line; the tangent of the angle made by the line with the x -axis

The slope of a line segment joining $A(x_A, y_A)$ and $B(x_B, y_B)$ is:

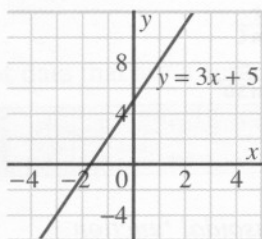
$$\text{Slope} = \frac{\text{Rise}}{\text{Run}} = \frac{y_A - y_B}{x_A - x_B}$$



Find the slope of the line that passes through the points M(5, -1) and N(1, 4)

$$\begin{aligned} \text{Slope} &= \frac{-1 - 4}{5 - 1} \\ &= \frac{-5}{4} \end{aligned}$$

slope, y-intercept form: the equation of a line in the form $y = mx + b$, where m is the slope of the line and b is the y-intercept of the line; see *linear equation and its graph*



The equation $y = 3x + 5$ is that of a line with a slope of 3 and a y-intercept of 5.

solve a linear system: to find all the ordered pairs that satisfy both equations in the linear system

Solve the system:

$$\begin{aligned} 2x + y &= 5 & \textcircled{1} \\ 4x - y &= 7 & \textcircled{2} \end{aligned}$$

$$\begin{array}{r} 2x + y = 5 \\ + \quad 4x - y = 7 \\ \hline 2x + 4x = 5 + 7 \\ 6x = 12 \\ x = 2 \end{array}$$

Substitute $x = 2$ in either of the original equations.

$$\begin{aligned} 4(2) - y &= 7 \\ 8 - y &= 7 \\ 8 - 7 &= y \\ 1 &= y \end{aligned}$$

Therefore, (2, 1) solves the system.

solve an equation: to determine the value(s) of the unknown that, when substituted for the unknown in the equation, result(s) in a true statement

Solve the equation $3x + 5 = 5x - 4$.

Use inverse operations to move all the terms in the variable to one side of the equation.

$$3x + 5 - 3x = 5x - 4 - 3x$$

Subtract 3x from both sides.

$$3x - 3x + 5 = 5x - 3x - 4$$

Rearrange to collect like terms.

$$5 = 2x - 4$$

Simplify.

$$5 + 4 = 2x - 4 + 4$$

Isolate the term in x; add 4 to both sides.

$$9 = 2x$$

Simplify.

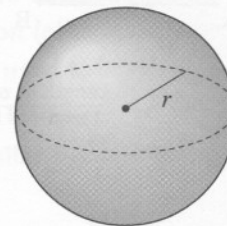
$$\frac{9}{2} = \frac{2x}{2}$$

Isolate x; divide both sides by 2.

$$4.5 = x$$

speed: see *average speed*

sphere: the set of points in space that are a given distance (radius) from a fixed point (centre)



$$\begin{aligned} \text{Surface Area, } S &= 4\pi r^2 \\ &= \pi d^2 \end{aligned}$$

$$\begin{aligned} \text{Volume, } V &= \frac{3}{4}\pi r^3 \\ &= \frac{\pi d^3}{6} \end{aligned}$$

spreadsheet: a computer-generated arrangement of data in rows and columns, where a change in one value can result in appropriate calculated changes in the other values

square: a rectangle with four equal sides

$$\text{Perimeter} = 4 \times \text{Length of side}$$

$$P = 4s$$

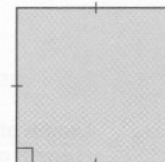
$$\text{Area} = (\text{Length of side})^2$$

$$A = s^2$$

For the square shown:

$$\begin{aligned} P &= 4(11 \text{ cm}) \\ &= 44 \text{ cm} \end{aligned}$$

$$\begin{aligned} A &= (11 \text{ cm})^2 \\ &= 121 \text{ cm}^2 \end{aligned}$$



11 cm

square matrix: a matrix with the same number of rows as columns; see *Tutorial 2.1*

square root: a number which, when multiplied by itself, results in the given number

5 and -5 are the square roots of 25, since $5^2 = 25$ and $(-5)^2 = 25$. The notation $\sqrt{25}$ is reserved for the positive square root only.

standard deviation: a measure of the extent to which data cluster around the mean; see *Tutorial 3.2*

standard form: for the equation of a line, the standard form is $Ax + By + C = 0$, where A , B , and C are integers; see *equation of a line*

standard normal distribution: a normal distribution with mean 0 and a standard deviation of 1; the bell-shaped graph is symmetrical about the mean; obeys the 68-95-99 rule; see *Tutorial 3.4*

start point of a sine curve: the middle point on the increasing portion of the sine curve closest to the y -axis; see *Tutorial 5.4*

statistic: a quantity used to describe a set of data; see *Tutorial 3.2*

statistics: the branch of mathematics that deals with the collection, organization, and interpretation of data

steady state: the probability matrix does not change when multiplied by the transition matrix; in other words, $P_{n+1} = P_n$; see *Tutorial 2.4*

strata: the non-overlapping subgroup obtained when a population is separated into subpopulations

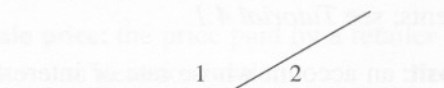
stratified random sample: a sample in which all members of different segments of the population have an equal chance of being selected

substituting into an expression: in an algebraic expression, replacing the letters with the indicated numbers or expressions each time they occur and simplifying according to the order of operations

Substitute $r = 4.5$ and $t = 3v$ into the expression $8r^2 - 2t$.

$$\begin{aligned} 8r^2 - 2t &= 8(4.5)^2 - 2(3v) \\ &= 8(20.25) - 6v \\ &= 162 - 6v \end{aligned}$$

supplementary angles: two angles whose sum is 180°



$\angle 1$ and $\angle 2$ are supplementary.

surface area: a measure of the area on the surface of a three-dimensional object; see *cube*, *cylinder*, and *sphere*

survey: an investigation of a topic to find out people's views

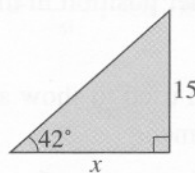
systematic sample: a sample in which every n th member of a population is selected

tail-to-tail: two vectors are drawn tail-to-tail if they have the same start point; see *Tutorial 7.2*

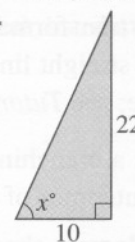
tangent: for an acute $\angle A$ in a right triangle, the ratio of the length of the opposite side to the length of the adjacent side

$$\text{tangent of } \angle A = \frac{\text{Length of side opposite to } \angle A}{\text{Length of side adjacent to } \angle A}$$

1.



2.



1. In the triangle shown above left,

$$\tan A = \frac{\text{Length of opposite side}}{\text{Length of adjacent side}}$$

$$\tan 42^\circ = \frac{x}{15}$$

$$0.9004 \doteq \frac{x}{15}$$

$$\begin{aligned} 0.9004 \times 15 &= 15 \times \frac{x}{15} \\ 13.506 &= x \end{aligned}$$

Substitute the known values.

Use a calculator to obtain the value of $\tan 42^\circ$.

Clear the fraction.

2. In the triangle shown above right,

$$\tan A = \frac{\text{Length of opposite side}}{\text{Length of adjacent side}}$$

$$\tan x^\circ = \frac{22}{10}$$

$$\tan x^\circ = 2.2$$

$$x \doteq 65.6^\circ$$

Substitute in the known values.

Convert the fraction into an equivalent decimal.

Use \tan^{-1} ("the angle whose tangent is") function.

template: a pattern used to create spreadsheets or documents; see *Tutorial 4.1*

term deposit: an account whose rate of interest is guaranteed for a specified term where withdrawal before the end of the term may result in the loss of interest

theoretical probability: probability determined using the sample space; see *Tutorial 1.1*

three-dimensional: having length, width, and depth or height

Toronto Stock Exchange 300 Composite Index

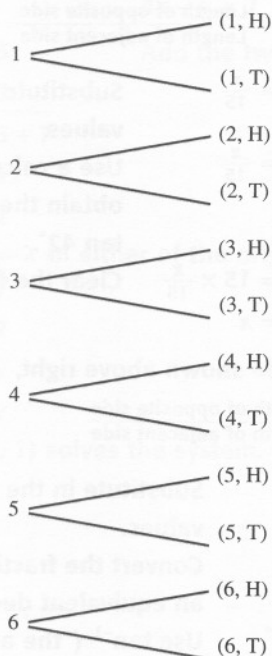
(TSE 300): tracks the composite price of 300 of the largest companies traded on the Toronto Stock Exchange; see *Tutorial 4.3*

transition matrix: a square matrix that shows how the probability of one event is dependent on the probability of another event occurring; see *Tutorial 2.4*

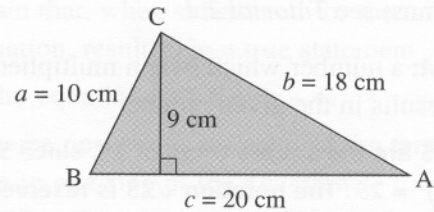
translation: a transformation that moves a point or a figure in a straight line to another position in the same plane; see *Tutorial 5.3*

tree diagram: a branching diagram used to show all possible outcomes of an experiment

This tree diagram shows all the outcomes of an experiment in which a die is rolled and a coin is tossed.



triangle: a three-sided polygon



Perimeter = Sum of the three sides

$$\begin{aligned} &= a + b + c \\ &= 10 \text{ cm} + 18 \text{ cm} + 20 \text{ cm} \\ &= 48 \text{ cm} \end{aligned}$$

Area = $\frac{1}{2}$ (Base)(Height)

$$\begin{aligned} &= \frac{1}{2}bh \\ &= \frac{1}{2}(20 \text{ cm})(9 \text{ cm}) \\ &= 90 \text{ cm}^2 \end{aligned}$$

The interior angles in any triangle add up to 180° . If the measures of two angles within a triangle are known, the third can be calculated by adding the measures of the two known angles and subtracting the result from 180° .

$$\begin{aligned} \text{If } \angle A = 35^\circ \text{ and } \angle B = 48^\circ, \\ \text{then } \angle C = 180^\circ - (35^\circ + 48^\circ) \\ = 97^\circ \end{aligned}$$

triangle method of vector addition: a method for finding the sum of two vectors arranged head-to-tail; see *Tutorial 7.2*

trigonometric ratios: see *cosine*, *sine*, and *tangent*

two-dimensional: having length and width, but no thickness, height, or depth

uniform distribution: a probability distribution in which all the probabilities are equal; see *Tutorial 3.1*

unit price: the price of one item, or the price for a particular mass or volume of an item

validity: an indicator of how well a test really measures what it is suppose to measure; a sample statistic is valid if it closely approximates the quantity for the population

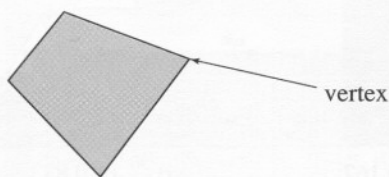
variable: a letter or symbol used to represent a quantity that can vary

vector quantities: quantities that are described by specifying both magnitude and direction; see *Tutorial 7.1*

velocity: a vector quantity describing the speed and direction of a moving object; see *Tutorial 7.1*

Venn diagram: a diagram where the sample space is represented by a rectangle, and event sets are represented by closed curves within the rectangle; see *Tutorials 1.2, 1.4, and 1.5*

vertex: the corner of a figure or solid



vertical intercept: the vertical coordinate of the point at which the graph of the line or function intersects the vertical axis; see *intercepts*

volume: the amount of space occupied by an object; see *cone, cube, cylinder, prism, pyramid, sphere*

wage: monies that are earned hourly, daily, or by piecework; this may include gratuities or overtime pay

whole numbers: see *number systems*

wholesale price: the price paid by a retailer to purchase an item for resale

x-axis: the horizontal number line on a coordinate grid

x-intercept: the x -coordinate where the graph of a line or function intersects the x -axis; see *intercepts* and *horizontal intercept*

y-axis: the vertical number line on a coordinate grid

y-intercept: the y -coordinate where the graph of a line or function intersects the y -axis; see *intercepts* and *vertical intercept*

zero vector: a vector with zero magnitude; parallel to any vector; the result of adding a vector and its opposite; see *Tutorial 7.2*

zeros of a function: the values of x for which a function $y = f(x)$ has the value 0

z-score: the number of standard deviations a datum is from the mean in a normal distribution;

$$z = \frac{x - \mu}{\sigma}; \text{ see } \textit{Tutorial 3.4}$$

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SOURCE BOOK

