opening extract from

Oxford Study Mathematics Dictionary

written by

Frank Tapson

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mutually exclusive events are sets of **events** or **outcomes** for which the happening of one of them means that none of the others can happen.
Example: When rolling a die the outcomes are mutually exclusive, since when one number comes to the top it must mean that none of the others can.

independent events Two or more **events** or **outcomes** are independent if the happening of one of them has no effect on the other.
Example: When two dice are rolled there are two independent outcomes, since the number showing on one does not influence the number on the other.

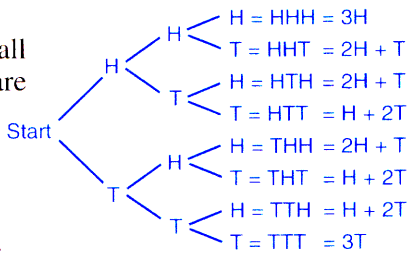
dependent events Two **events** or **outcomes** are dependent if a statement or probability for one of them affects a statement or probability for the other.
Example: One box holds 4 red and 6 black marbles; another holds 1 red and 9 black marbles. The probability of choosing a red marble from one box must depend on which box is chosen.

combined events describe the putting together of two or more separate **events** or **outcomes** to be considered as one single event or outcome. *This is usually done in order to find the probability of a final single outcome. The separate outcomes might be independent of, or dependent upon, each other.*
Examples: Rolling 2 dice (or 1 die twice) and adding the separate scores is combining 2 independent outcomes. Taking 2 counters from a bag of mixed colours WITHOUT replacing the first is combining 2 dependent outcomes.

compound events ≡ **combined events**

conditional probability is the **probability** of an **outcome** happening when it is **dependent** upon, or following, some other outcome.
Example: A bag contains 8 red and 2 black counters. The probability of drawing 2 red counters, if the first drawn is not replaced, is given by the probability of the first counter being red times the probability of the second being red, which is $\frac{8}{10} \times \frac{7}{9} = \frac{28}{45}$

tree diagrams are drawn to find and display all possible results when several outcomes are being combined.
Example: When 3 coins are tossed all possible results can be found and displayed by using a tree diagram like that on the right (H=Head, T=Tail).



odds are another type of **probability** and the odds against a successful **outcome** happening are given by:
number (of *other* outcomes in the activity) TO number (of ways outcome can happen)
Example: The odds against getting a '3' with a single die are 5 to 1 since there are 5 other numbers and only one '3', so there are 5 ways of losing against only 1 way of winning. The probability of getting a 3 is $\frac{1}{6}$ *or* $\frac{1}{5+1}$

Odds of a to b change to a probability of $\frac{b}{(a+b)}$

A probability of $\frac{a}{b}$ changes to odds of $(b-a)$ to a

evens When the **odds** are 1 to 1 they are even. *The probability for evens is* $\frac{1}{2}$

pyramids and prisms

pyramid A pyramid is a **polyhedron** having any polygon as one face with all the other faces being triangles meeting at a common vertex. *The pyramid is named after the polygon forming the face from which the triangles start.*

base The base of a **pyramid** is the polygonal face which names the pyramid.

apex The apex of a **pyramid** is the vertex at which the triangular faces meet.

perpendicular height The perpendicular height of a **pyramid** is the distance of its **apex** from the plane of its **base**.

Volume of pyramid = Area of base × Perpendicular height ÷ 3

altitude ≡ **perpendicular height**

vertex In the case of a **pyramid**, vertex is often used to mean the **apex**.

right pyramid A right pyramid is one having all its triangular faces equal in size. *The base is a regular polygon, the apex is perpendicularly above the centre of the base, and all the triangular faces make the same angle with the base.*

right square-based pyramid A right square-based pyramid is a **right pyramid** having a square base. *It is what is usually meant when only the word 'pyramid' is used and is the type seen in Egypt as a tomb of the Pharaohs.*

oblique pyramid An oblique pyramid is a NON-**right pyramid**.

slant height The slant height of a **pyramid** is the length of a perpendicular from the mid-point of a base-edge to the apex. *The slant heights of a right pyramid are all the same length.*

slant edge The slant edges of a **pyramid** are all those edges joined to the **apex**. *The slant edges of a right pyramid are all the same length.*

frustum of a pyramid A frustum of a pyramid is the part of a **pyramid** cut off between the **base** and a plane which is parallel to the base.

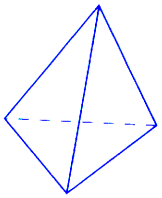
Volume of frustum $= (A + B + \sqrt{AB}) \times h \div 3$ where A,B = areas of top and bottom faces of frustum; h = distance between faces

cross-section A cross-section of any 3-D shape is the 2-D figure shown when that shape is cut across, in some specified place and direction, by a plane.

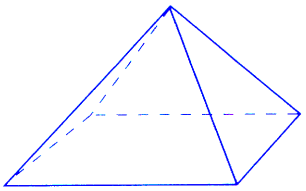
prism A prism is a **polyhedron** having 2 faces identical and parallel to each other (usually referred to as the 'ends' or 'bases'), and any plane cut made parallel to the ends produces a cross-section the same shape and size as the ends. *All faces, other than the ends, are rectangles or parallelograms. Prisms are named after the shape of the cross-section (if it has a name) as in 'triangular prism' or 'hexagonal prism'. If the other faces are rectangles, it is also referred to as a* **right prism**.

The volume of a *prism* can be found by multiplying the area of one of the end faces by the perpendicular distance between the two ends.

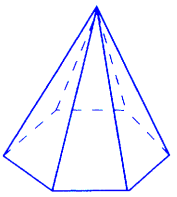
antiprism An antiprism is a **polyhedron** that has 2 faces identical and parallel to each other. All the other faces are identical triangles, with each vertex of every triangle touching a vertex of one of the end faces, so that 4 edges meet at every vertex. *Unlike with a prism, its cross-section varies.*



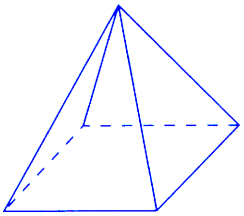
triangle-based pyramid
≡ tetrahedron



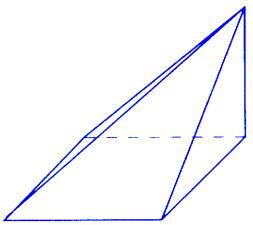
rectangle-based pyramid

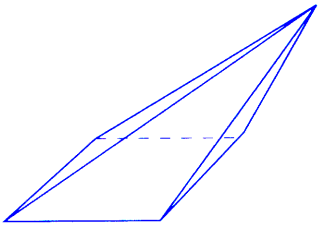


hexagon-based pyramid

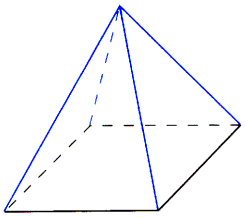


right square-based
pyramid

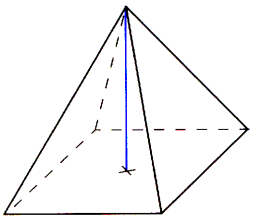




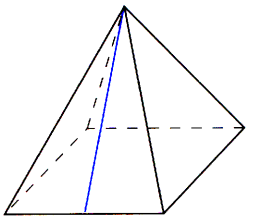
oblique pyramids



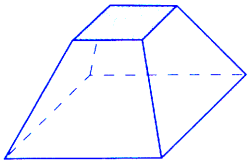
slant edges



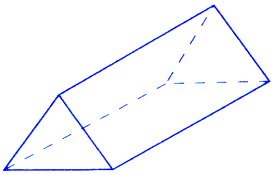
perpendicular height



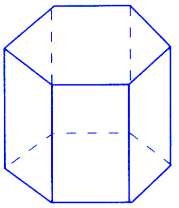
slant height



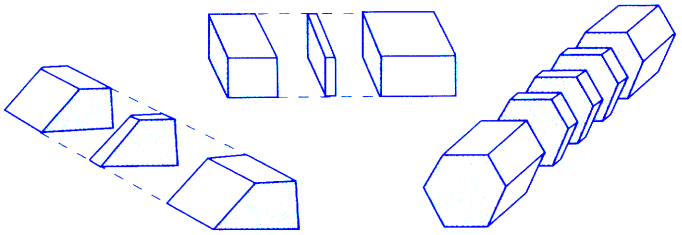
frustum of a right
square-based pyramid



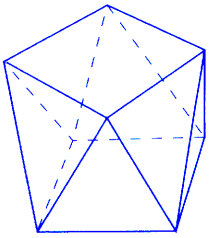
triangular prism



hexagonal prism



some prisms and their cross-sections



square antiprism

quadrilaterals

quadrilateral A quadrilateral is a **polygon** which has 4 edges. *Its 4 interior vertex angles (=corners) add up to 360 degrees.*

trapezium A trapezium is a **quadrilateral** with only one pair of parallel edges.

trapezoid ≡ **trapezium** in N. American usage, but in UK usage it is a quadrilateral in which no two opposite edges are parallel.

isosceles trapezium An isosceles trapezium is a **trapezium** in which the two opposite edges, which are not parallel, are the same length. *It has one line of symmetry and both diagonals are the same length.*

parallelogram A parallelogram is a **quadrilateral** which has two pairs of parallel edges. *It has rotational symmetry of order 2, and its diagonals bisect each other. Usually one pair of edges is longer than the other pair, no interior vertex angle (=corner) is a right angle and it has no lines of symmetry.*

rhombus A rhombus is a **quadrilateral** whose edges are all the same length. *Its diagonals bisect each other at right angles and both are also lines of symmetry. Usually no interior vertex angle (=corner) is a right angle and then it is sometimes referred to as a* **diamond**, **lozenge**, *or* **rhomb**.

rhomboid A rhomboid is a **parallelogram** having adjacent edges of different lengths. *The word is little used because of possible confusion.*

The area of a trapezium, parallelogram or rhombus can be found by adding together the lengths of one pair of parallel edges, dividing by 2, and multiplying this by the perpendicular distance between them.

rectangle A rectangle is a **quadrilateral** in which every interior vertex angle *(= corner)* is a right angle.

oblong An oblong is a **rectangle** in which one pair of edges is longer than the other pair. *It has two lines of symmetry and rotational symmetry of order 2. Both diagonals are the same length and bisect each other.*

square A square is a **rectangle** whose edges are all the same length. *It has four lines of symmetry and rotational symmetry of order 4. Both diagonals are the same length and bisect each other at right angles.*

kite A kite is a **quadrilateral** which has two pairs of adjacent edges *(= edges which are next to each other)* of the same length, and no interior vertex angle *(= corner)* is bigger than 180 degrees. *It has one line of symmetry and its diagonals cross each other at right angles.*

arrowhead An arrowhead is a **quadrilateral** which has two pairs of adjacent edges of the same length and ONE interior vertex angle *(= corner)* which is bigger than 180 degrees. *It has one line of symmetry and its diagonals do not cross. It is also known as a* **dart** *or* **deltoid**.

regular quadrilateral ≡ **square**.

irregular quadrilateral Strictly speaking, an irregular quadrilateral is any **quadrilateral** that is not a square, but it is usually taken to be one not having a special name.

golden rectangle A golden rectangle is an **oblong** with its two edge-lengths sized in the proportions of the **golden ratio** (≈ 1.618 : 1).

Length of longer edge ≈ 1.618 × length of shorter edge.