Quadrilaterals

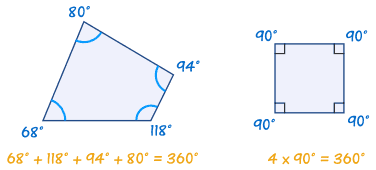
|  |  |
| --- | --- |
| Quadrilaterals | Quadrilateral just means "four sides"  (*quad* means four, *lateral*means side).  **Any four-sided shape is a Quadrilateral**.  But the sides have to be **straight**, and it has to be **2-dimensional**. |

Try for Yourself

|  |
| --- |
|  |
|  |

Properties

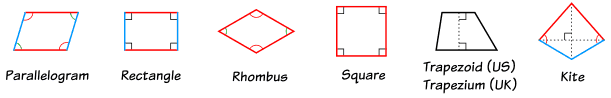
* Four sides (edges)
* Four vertices (corners)
* The interior angles add up to **360 degrees**:



Try drawing a quadrilateral, and measure the angles. They should add to **360°**

Types of Quadrilaterals

There are special types of quadrilateral:



Some types are also included in the definition of other types! For example a **square**, **rhombus**and **rectangle** are also ***parallelograms***. [See below](http://www.mathsisfun.com/quadrilaterals.html#tree) for more details.

Let us look at each type in turn:

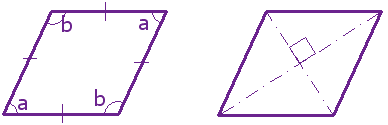
The Rectangle

|  |  |  |
| --- | --- | --- |
| Rectangle |  |  |
| http://www.mathsisfun.com/images/quadrilateral-right-key.gif | *means "right angle"* |
| http://www.mathsisfun.com/images/quadrilateral-equal-key.gifandhttp://www.mathsisfun.com/images/quadrilateral-equal-key2.gif | *show equal sides* |
|  |  |

A [rectangle](http://www.mathsisfun.com/geometry/rectangle.html) is a four-sided shape where every angle is a [right angle](http://www.mathsisfun.com/rightangle.html) (90°).

Also **opposite sides** are [parallel](http://www.mathsisfun.com/geometry/parallel-lines.html) and of equal length.

The Rhombus



A [rhombus](http://www.mathsisfun.com/geometry/rhombus.html) is a four-sided shape where all sides have equal length.

Also opposite sides are parallel *and* opposite angles are equal.

Another interesting thing is that the diagonals (dashed lines in second figure) meet in the middle at a right angle. In other words they "bisect" (cut in half) each other at right angles.

The Square

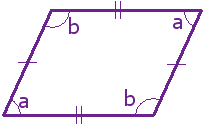
|  |  |  |
| --- | --- | --- |
| Square |  |  |
| http://www.mathsisfun.com/images/quadrilateral-right-key.gif | *means "right angle"* |
| http://www.mathsisfun.com/images/quadrilateral-equal-key.gif | *show equal sides* |
|  |  |

A [square](http://www.mathsisfun.com/geometry/square.html) has equal sides and every angle is a right angle (90°)

Also opposite sides are parallel.

A square also fits the definition of a **rectangle** (all angles are 90°), and a **rhombus** (all sides are equal length).

The Parallelogram



A [parallelogram](http://www.mathsisfun.com/geometry/parallelogram.html) has opposite sides parallel and equal in length. Also opposite angles are equal (angles "a" are the same, and angles "b" are the same).

NOTE: Squares, Rectangles and Rhombuses are all Parallelograms!

Example:

|  |  |
| --- | --- |
| square | A **parallelogram** with:   * all sides equal and * angles "a" and "b" as right angles   is a **square**! |

The Trapezoid (UK: Trapezium)

|  |  |
| --- | --- |
| Trapezoid (or Trapezium) | |
| Trapezoid | Isosceles Trapezoid |

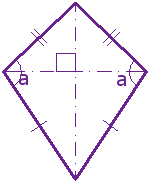
A [trapezoid](http://www.mathsisfun.com/geometry/trapezoid.html) (called a trapezium in the UK) has a pair of opposite sides parallel.

It is called an **Isosceles** trapezoid if the sides that aren't parallel are equal in length and both angles coming from a parallel side are equal, as shown.

And a **trapezium** (UK: trapezoid) is a quadrilateral with NO parallel sides:

|  |  |  |
| --- | --- | --- |
|  | Trapezoid | Trapezium |
| US: | a pair of parallel sides | NO parallel sides |
| UK: | NO parallel sides | a pair of parallel sides |

The Kite



Hey, it looks like a [kite](http://www.mathsisfun.com/geometry/kite.html). It has two pairs of sides. Each pair is made up of adjacent sides that are equal in length. The angles are equal where the pairs meet. Diagonals (dashed lines) meet at a right angle, and one of the diagonal bisects (cuts equally in half) the other.

... and that's it for the special quadrilaterals.

Irregular Quadrilaterals

The only [regular](http://www.mathsisfun.com/geometry/regular-polygons.html) quadrilateral is a square. So all other quadrilaterals are **irregular**.

The "Family Tree" Chart

Quadrilateral definitions are **inclusive**.

Example: a square is also a rectangle.

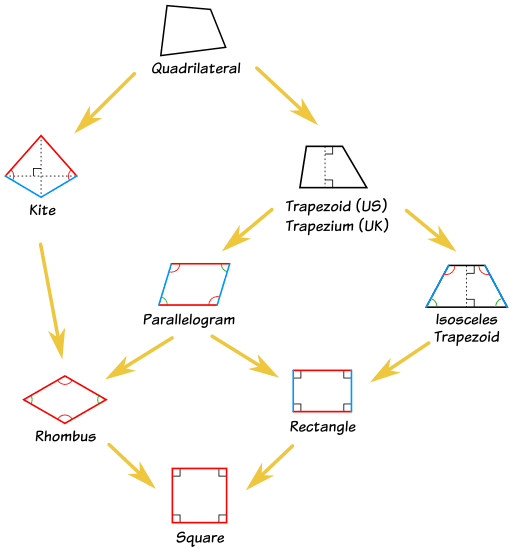
So we **include** a square in the definition of a rectangle.

*(We****don't****say "Having all 90° angles makes it a rectangle except when all sides are equal then it is a square.")*

This may seem odd, as in daily life we think of a square as **not** being a rectangle ... but in mathematics it **is**.

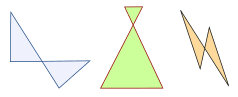
Using the chart below you can answer such questions as:

* Is a Square a type of Rectangle? (Yes)
* Is a Rectangle a type of Kite? (No)



Complex Quadrilaterals

Oh Yes! when two sides cross over, you call it a "Complex" or "Self-Intersecting" quadrilateral like these:



They still have 4 sides, but two sides cross over.

Polygon

A quadrilateral is a [polygon](http://www.mathsisfun.com/geometry/polygons.html). In fact it is a 4-sided polygon, just like a triangle is a 3-sided polygon, a pentagon is a 5-sided polygon, and so on.