

Quadrilateral

There are many different kinds of quadrilaterals, but all have several things in common: all of them have four sides, are coplanar, have two diagonals, and the sum of their four interior angles equals 360 degrees. This is how they are alike, but what makes them different?

Quadrilaterals are either simple (not self-intersecting) or complex (self-intersecting). Simple quadrilaterals are either convex or concave.

Convex quadrilaterals are further classified as follows:

Trapezoid: two opposite sides are parallel.

Isosceles trapezoid: two opposite sides are parallel, the two other sides are of equal length, and the two ends of each parallel side have equal angles. This implies that the diagonals are of equal length.







Parallelogram: both pairs of opposite sides are parallel. This implies that opposite sides are of equal length, opposite angles are equal, and the diagonals bisect each other.

Kite: two adjacent sides are of equal length and the other two sides also of equal length. This implies that one set of opposite angles is equal, and that one diagonal perpendicularly bisects the other. (It is common, especially in the discussions on plane tessellations, to refer to a concave kite as a dart or arrowhead.)

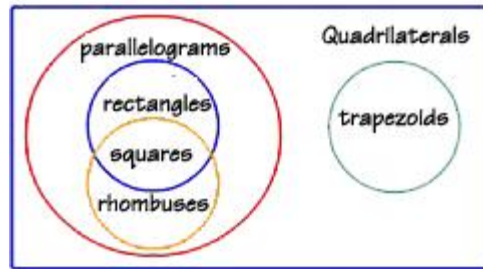
Rhombus or rhombi: all four sides are of equal length. This implies that opposite sides are parallel, opposite angles are equal, and the diagonals perpendicularly bisect each other.

Rectangle (or Oblong): all four angles are right angles. This implies that opposite sides are parallel and of equal length, and the diagonals bisect each other and are equal in length.

Square (regular quadrilateral): all four sides are of equal length (equilateral), and all four angles are equal (equiangular), with each angle a right angle. This implies that opposite sides are parallel (a square is a parallelogram), and that the diagonals perpendicularly bisect each other and are of equal length. A quadrilateral is a square if and only if it is both a rhombus and a rectangle.

	A parallelogram has two parallel pairs of opposite sides.
	A rectangle has two pairs of opposite sides parallel, and four right angles. It is also a parallelogram, since it has two pairs of parallel sides.
	A square has two pairs of parallel sides, four right angles, and all four sides are equal. It is also a rectangle and a parallelogram.
	A rhombus is defined as a parallelogram with four equal sides. Is a rhombus always a rectangle? No, because a rhombus does not have to have 4 right angles.
	Trapezoids only have one pair of parallel sides. It's a type of quadrilateral that is not a parallelogram. (British name: Trapezium)
	Kites have two pairs of adjacent sides that are equal.

Venn Diagram



A Venn diagram uses overlapping circles to show relationships between groups of objects. All "quadrilaterals" can be separated into three sub-groups: general quadrilaterals, parallelograms and trapezoids. Is a rectangle always a rhombus? No, because all four sides of a rectangle don't have to be equal. However, the sets of rectangles and rhombuses do intersect, and their intersection is the set of squares—all squares are both a rectangle and a rhombus. We can put squares in the intersection of the two circles. From this diagram, you can see that a square is a quadrilateral, a parallelogram, a rectangle, and a rhombus! Is a trapezoid a parallelogram? No, because a trapezoid has only one pair of parallel sides. That is why we must show the set of trapezoids in a separate circle on the Venn diagram. What about kites? Kites are quadrilaterals that **can** be parallelograms. If their two pairs of sides are equal, it becomes a rhombus, and if their angles are equal, it becomes a square.

