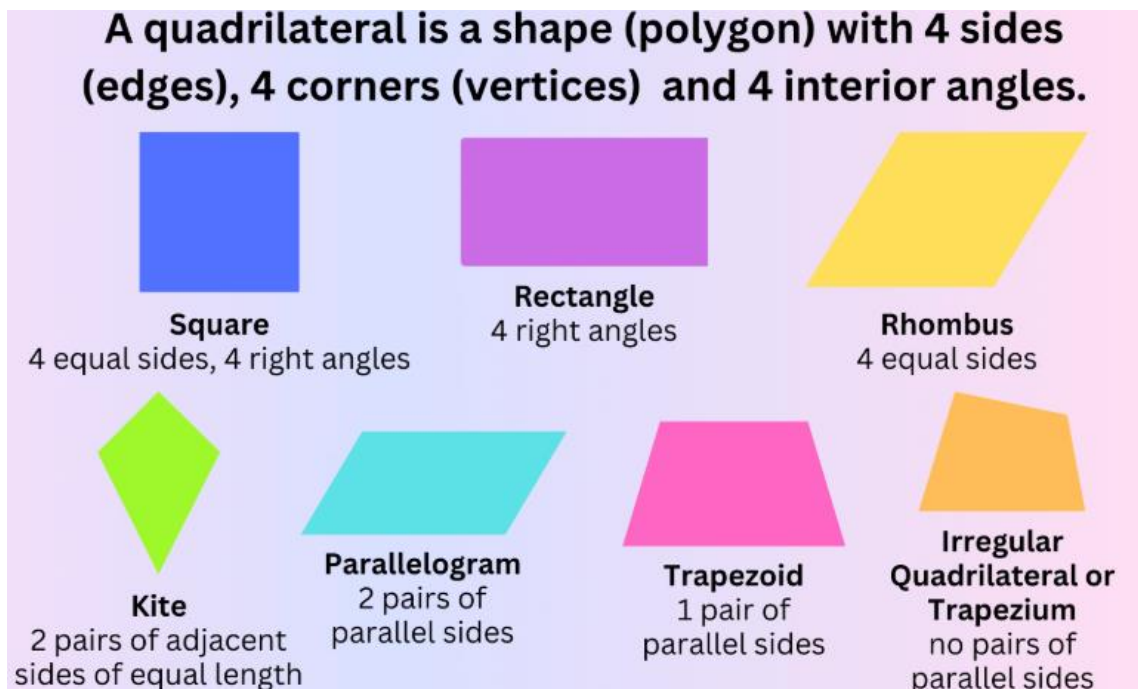


QUADRILATERALS

In geometry, **quadrilaterals** are polygons with **four sides**. The word "quadrilateral" comes from the Latin words "quadri-" (four) and "latus" (side), which together mean "four sides." Quadrilaterals are a very important part of geometry because they help us understand many properties that are used in real-life applications such as engineering, architecture, and design.



Properties of Quadrilaterals

Before diving into the different types of quadrilaterals, let's first look at some general properties that all quadrilaterals share:

1. **Four Sides:** All quadrilaterals have four sides (edges).
- **Four Vertices:** They have four vertices (corners) where two sides meet.
- **Interior Angles:** The sum of the interior angles of any quadrilateral is always **360°**.
- This can be calculated using the formula:

$$\text{Sum of interior angles} = (n-2) \times 180^\circ$$

where n is the number of sides (for quadrilaterals, $n = 4$).

Therefore, $(4-2) \times 180^\circ = 360^\circ$

1. **Diagonals:** A diagonal is a line segment that connects two non-adjacent vertices of a quadrilateral. Depending on the type of quadrilateral, diagonals may have different properties, such as being equal in length, perpendicular, or bisected by other diagonals.

Now that we know the basic properties, let's go over the different types of quadrilaterals and their unique features.

Types of Quadrilaterals

There are many different types of quadrilaterals, and each has specific properties that make it distinct. Here's a breakdown of the most important types:

1. *Parallelogram*

A **parallelogram** is a quadrilateral where opposite sides are **parallel** and **equal** in length.

- **Properties:**
 - Opposite sides are equal and parallel.
 - Opposite angles are equal.
 - The diagonals bisect each other (they cut each other in half).
 - Consecutive angles are supplementary (add up to 180°).
- **Example:** A rectangle and a rhombus are both types of parallelograms.

2. *Rectangle*

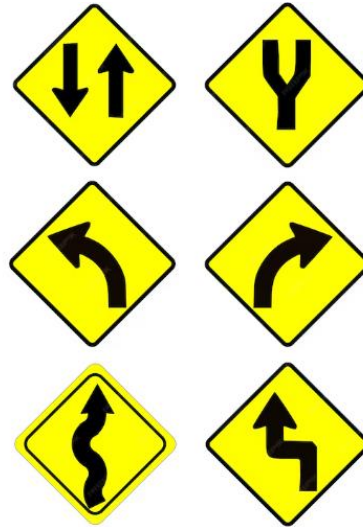
A **rectangle** is a type of parallelogram where all angles are **right angles** (90°).

- **Properties:**
 - All the properties of a parallelogram apply (opposite sides are equal, opposite angles are equal, etc.).
 - All angles are right angles (90°).
 - The diagonals are **equal in length**.
- **Example:** A door or a piece of paper is often a rectangle.

3. *Rhombus*

A **rhombus** is a type of parallelogram where all four sides are of **equal length**.

- **Properties:**
 - All sides are equal in length.
 - Opposite angles are equal.
 - The diagonals bisect each other at right angles (90°).
 - The diagonals divide the rhombus into four congruent triangles.
- **Example:** A diamond shape is a rhombus.



4. Square

A **square** is a special type of parallelogram that has all the properties of both a **rectangle** and a **rhombus**.

- **Properties:**
 - All sides are equal in length.
 - All angles are right angles (90°).
 - Opposite sides are parallel.
 - The diagonals are equal in length and bisect each other at right angles.
- **Example:** A chessboard square is an example of a square.



5. Trapezoid (or Trapezium in some countries)

A **trapezoid** is a quadrilateral that has exactly **one pair of parallel sides**.

- **Properties:**
 - One pair of opposite sides is parallel.
 - The non-parallel sides are called legs.
 - The angles between the parallel sides are supplementary (add up to 180°).
- **Example:** The shape of a table or a roof with sloping sides can be modeled as a trapezoid.

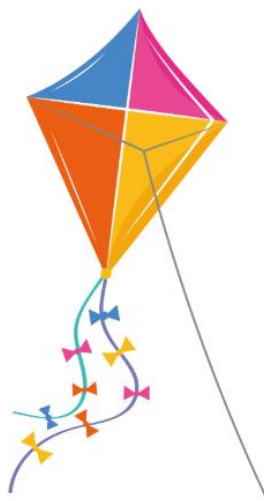


6. Kite

A **kite** is a quadrilateral that has two pairs of adjacent sides that are **equal** in length.

- **Properties:**
 - Two pairs of adjacent sides are equal.

- One pair of opposite angles are equal (the angles between the unequal sides).
- The diagonals intersect at right angles (90°).
- One diagonal bisects the other diagonal.
- **Example:** A kite you fly in the sky is shaped like this.



Summary of Quadrilateral Types

Quadrilateral	Properties	Example
Parallelogram	Opposite sides are parallel and equal	General parallelogram
Rectangle	Right angles, opposite sides equal	A book, a window
Rhombus	All sides equal, opposite angles equal	Diamond shape
Square	All sides equal, right angles, diagonals equal	A chessboard square
Trapezoid	One pair of parallel sides	Roof, table
Kite	Two pairs of equal adjacent sides	A flying kite

In summary, quadrilaterals are four-sided polygons with many different types, each with its unique properties. Understanding these properties helps in solving problems involving areas, perimeters, and angles. Each type of quadrilateral has different rules that apply to its sides, angles, and diagonals, so it's important to know how they differ from each other.

Make sure you understand the properties of each quadrilateral, and practice drawing and labeling them to strengthen your understanding.