Basic Geometrical Ideas

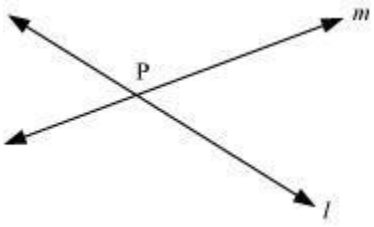
- A **point** determines a location. The tip of a compass, the sharpened end of a pencil, the pointed end of a needle, etc., are the examples of points. Generally, points are denoted by capital letters.
- A **line segment** corresponds to the shortest distance between two points. The line segment joining the points P and Q is denoted as $\overline{PQ}$.

- A **ray** is a portion of a line, which starts at one point and goes endlessly in a direction.

This ray is denoted as $\overrightarrow{PQ}$. Arrow head is towards Q since it is extended along Q.

- When a line segment PQ is extended indefinitely on both sides of points P and Q, it becomes a **line**, $\overleftrightarrow{PQ}$. Line is usually denoted by small letters *l, m, n.*

- Two lines *l* and *m* are said to be **intersecting lines**, if they intersect at a point.



- Two lines are said to be **parallel lines**, if they never intersect each other. We can represent the given lines as *l*||*m.*

- A **plane** is a flat surface having length and width, but no thickness. We can say that a plane is a flat surface, which extends indefinitely in all directions. For example, surface of a wall, floor of a ground, etc.
- **Incidence properties in a plane:**

1. An unlimited number of lines can be drawn passing through a given point.
2. There is exactly one line passing through two distinct points in a plane.
3. Points lying on the same line are known as collinear points and the points which do not lie on the same line are called non-collinear points.
4. Three or more lines passing through a common point are known as concurrent lines and that point is known as point of concurrence.

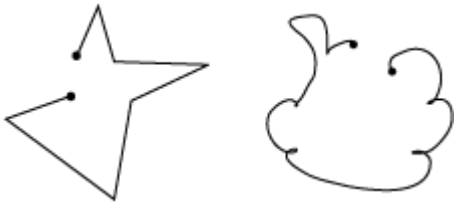
- **Curve:**

  Any drawing (straight or non-straight) done without lifting the pencil is called a **curve**. Line is also a curve.

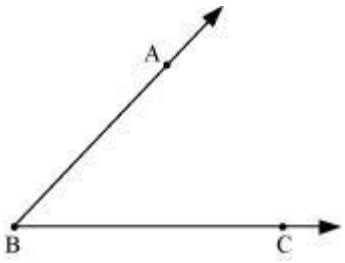
  1. The curve which does not intersect itself is called a **simple curve**.

  2. A curve is said to be **closed**, if it has no starting or ending point.

  3. A curve is said to be **open**, if its end points are not joined.

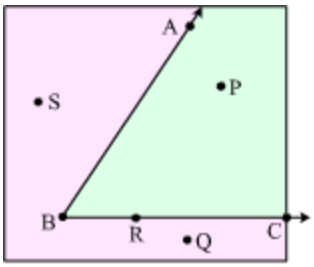


- **Angle:** An angle is made up of two rays starting from a common end point.



In this figure, rays $\overline{BA}$ and $\overline{BC}$ have one common end point, that is, B. The rays $\overline{BA}$ and $\overline{BC}$ are called the arms or sides of the angle. The common end point B is the vertex of the angle.
We can name the above angle as ∠ABC or ∠CBA.

- The given figure represents ∠ABC with some points in its region.

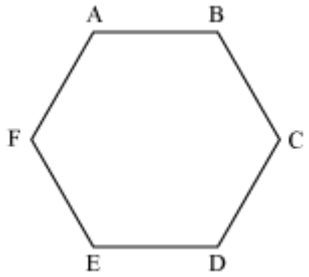


- The region of the angle shaded by green colour lies between the two arms of the angle. This region is called the **interior region of the angle**. Every point in this region is said to lie in the **interior** of the angle. Here, point P is in the interior.

- The region of the angle shaded by pink colour lies outside the two arms of the angle.This region is called the **exterior region of the angle**. Every point in this region is said to lie in the **exterior** of the angle. Here, point Q and S are in the exterior.

- The boundary of ∠ABC is formed by its arms $\overrightarrow{BA}$ and $\overrightarrow{BC}$. Every point lying on the arms is said to lie on the **boundary of the angle**. Here, points A, B, C and R lie on the boundary of the angle.

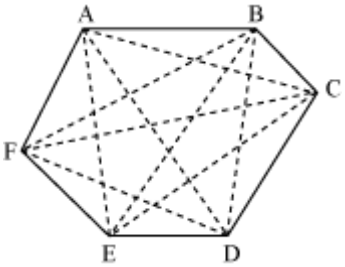
- A **polygon** is a simple closed curve made up of line segments. ABCDEF is a polygon.



The attributes with respect to polygon ABCDEF are:

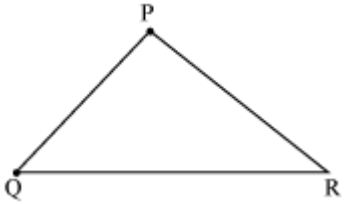
1.

1. The line segments AB, BC, CD, DE, EF, and FA are known as the **sides of the polygon** ABCDEF.
2. Any two sides with common end points are called **adjacent sides**. AB and BC are adjacent sides with common end point B.
3. The meeting point of a pair of sides of a polygon is known as **vertex**. In the polygon ABCDEF, sides AB and BC meets at point B. So, point B is called the vertex of the polygon. Similarly, the other vertices are A, C, D, E, and F.
4. The line joining any two non-adjacent vertices of a polygon is known as its **diagonal**.



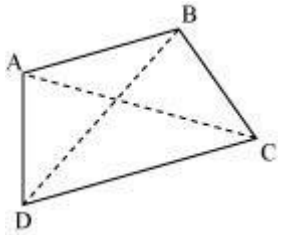
In the polygon ABCDEF, the diagonals are AC, AD, AE, BD, BE, BF, CE, CF, and DF.

- **Triangle:** A triangle is a three-sided polygon. It is the polygon with the least number of sides.



We denote this triangle as ΔPQR. Here, $\overline{PQ}, \overline{QR}$ and $\overline{RP}$ are the sides of ΔPQR. The points P, Q and R are the vertices of ΔPQR and the angles are ∠RPQ, ∠PQR and ∠QRP.

- **Quadrilateral:** A quadrilateral is a four-sided polygon.



For the given quadrilateral ABCD:

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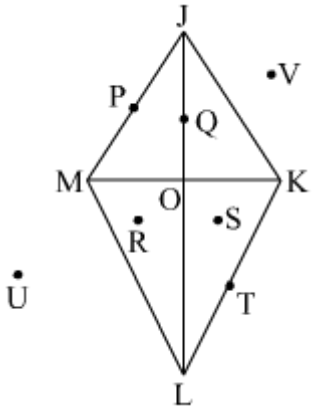
  - Possible names of quadrilateral are □ABCD, □BCDA, □CDAB and □DABC.
  - AB, CD and BC, DA are the pairs of **opposite sides**.
  - AB, BC; BC, CD; CD, DA and DA, AB are the pairs of **adjacent sides**.
  - A, C and B, D are the pairs of **opposite vertices**.
  - AC and BD are the **diagonals** of quadrilateral ABCD.
  - ∠A, ∠C and ∠B, ∠D are pairs of **opposite angles**.
  - ∠B, ∠C; ∠A, ∠B; ∠C, ∠D and ∠D, ∠A are the pairs of **adjacent angles**.

For the given quadrilateral JKLM:



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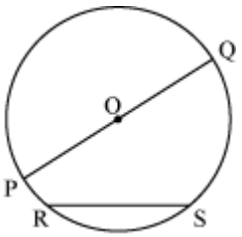
  - Points lying in the **interior** of the quadrilateral are Q, R, S and O.
  - Points lying in the **exterior** of the quadrilateral are V and U.
  - Points lying on the **boundary** of the quadrilateral are P and T.
  - The interior and boundary together form the **region** of the quadrilateral.
- **Circle:** Circle is a simple closed curve.



1.
1. The fixed point O is the centre of the circle.

2.
2. The fixed distance OP = OQ is the **radius** of the circle.

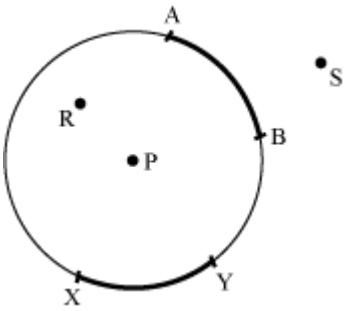
3.
3. The distance around the circle is its **circumference**.

4.
4. A line joining any two points on a circle is known as **chord**. In the given figure, RS and PQ are the chords.

5.
5. The chord passing through the centre of a circle is called **diameter**. The diameter of a circle divides it into two semicircles.

6.
6. The diameter of a circle is the longest chord of the circle and it is twice the radius.

7.
7. The portions on a circle are known as arcs. In the figure, XY and AB are arcs.



8.
8. The region in the interior of a circle enclosed by a chord and an arc is known as **segment.**

9.

9. The region in the interior of a circle enclosed by an arc on one side and a pair of radii on the other side is called **sector.**