## CHAPTER 10

# Circles

**Introduction:**

In our daily life, we come across various objects which are round in shape, such as wheels of a vehicle, buttons of shirts, bangles etc. If we trace the boundary of these objects on a paper, then we will get a closed curve, which is called a circle. In this chapter, we will study about circles. Other related terms and some properties of a circle.

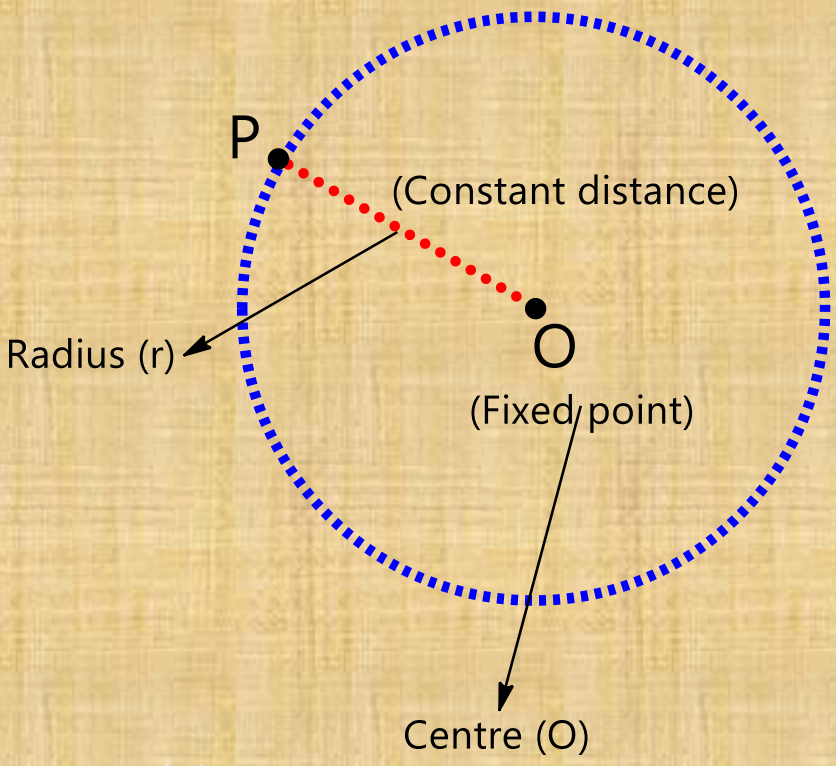
Circles are used to design various circular shape objects like camera lenses, pizzas, rings, pipes, tires, steering wheels, cakes, a satellite's orbit – around the earth etc.

**Synopsis:**

**Circle:**

A set of points in a plane, which are at a constant distance ($r > 0$) from the fixed point (0) is called a circle.

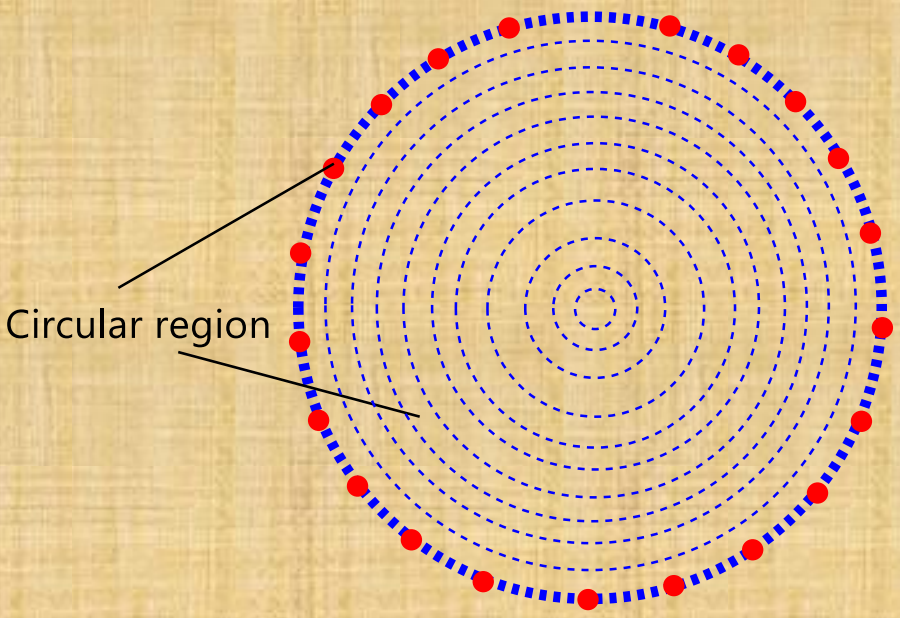
Here, the constant distance is called radius of the circle. It is denoted by (r) and the fixed point is called centre of the circle. It is denoted by 'O'.




**Terms related to a circle:**

**Circular region:**

The set of all points of the plane, which lie on the circle and inside the circle form the circular region. This is also known as circular disc.

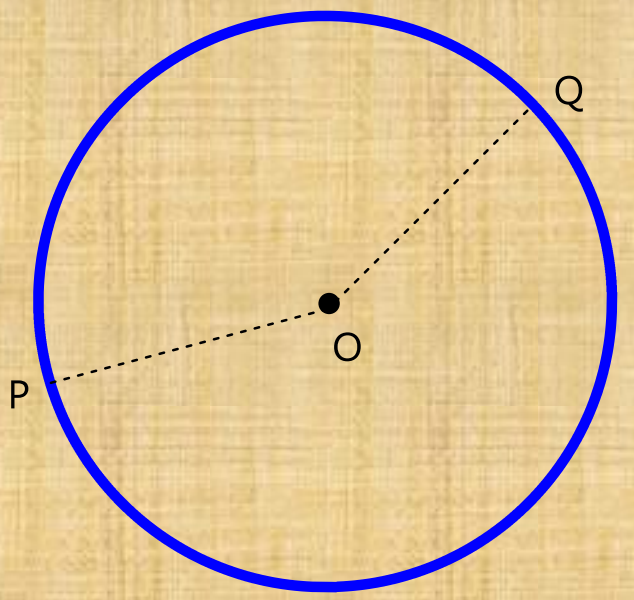



**Radius:**

A line segment joining any point on the circle to its centre is called radius of the circle.



**In adjacent figure:**



- OP is the radius of the circle.
- The plural of radius is radii. The line segment OP and OQ are radii of the circle.
- Clearly, the lengths of all the radii of a circle are equal.

**Circumference:**

The perimeter of a circle is called its circumference.

(OR)

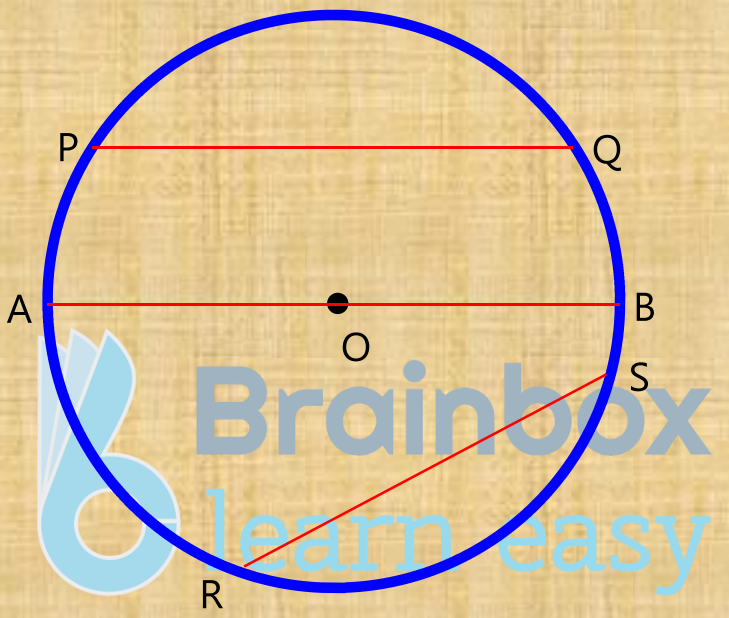
The length of the complete circle is called its circumference.


**Note:**

Circumference of the circle = $2\Pi r$

**Chord:**

A line segment joining any two points on the circle is called a chord. A line segment whose end points lie on a circle. In the figure, PQ, AB, RS and AOB are the chords of a circle with centre O.




**Note:**

Clearly, an infinite number of chords may be drawn in a circle.

**Diameter:**

A chord of a circle passing through the centre is called a diameter of the circle. From the above circle, $\overline{AB}$ is the diameter.

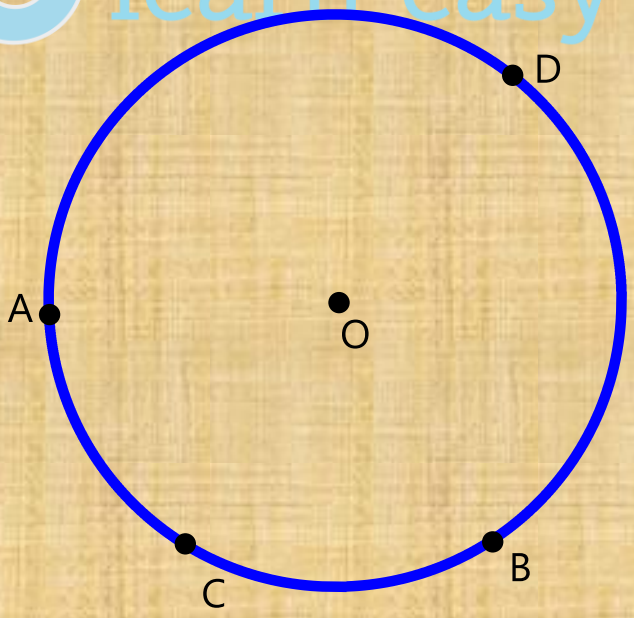
**Note:**

- Diameter = 2 x radius
- A diameter is the longest chord of a circle.
- Any two chords of a circle, the one which is nearer is the centre is longer.

**Arc of the circle:**

A continuous piece of a circle between two points is called an arc of the circle.

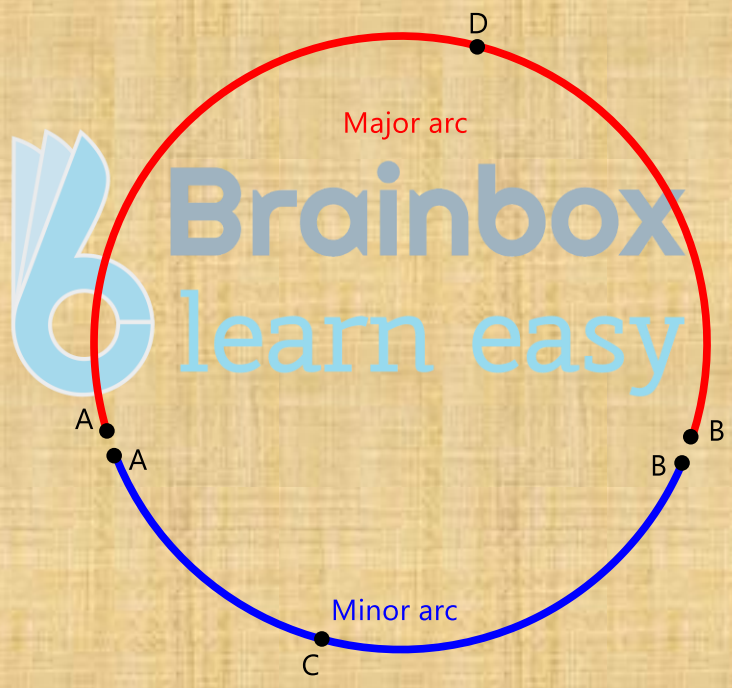
Let A and B be two points on the circle. We denote the arc from A to B in anti – clockwise direction by $ACB$ and the arc from A to B in clockwise direction by $ADB$.



**Major and Minor arcs:**

An arc greater than one – half of the whole arc of a circle is called a major arc of the circle. Thus, in the above figure, ADB is the major arc.

An arc less than one – half of the whole arc of a circle is called a minor arc of the circle. Thus, in the above figure, ACB is the minor arcs.

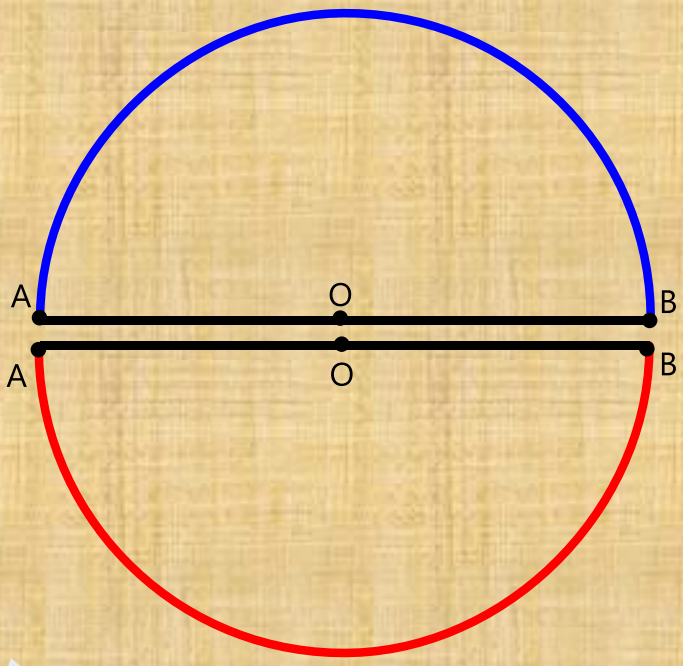



**Semi – circle:**

When A and B are ends of a diameter, then both arcs are equal and each is called a semi-circle.

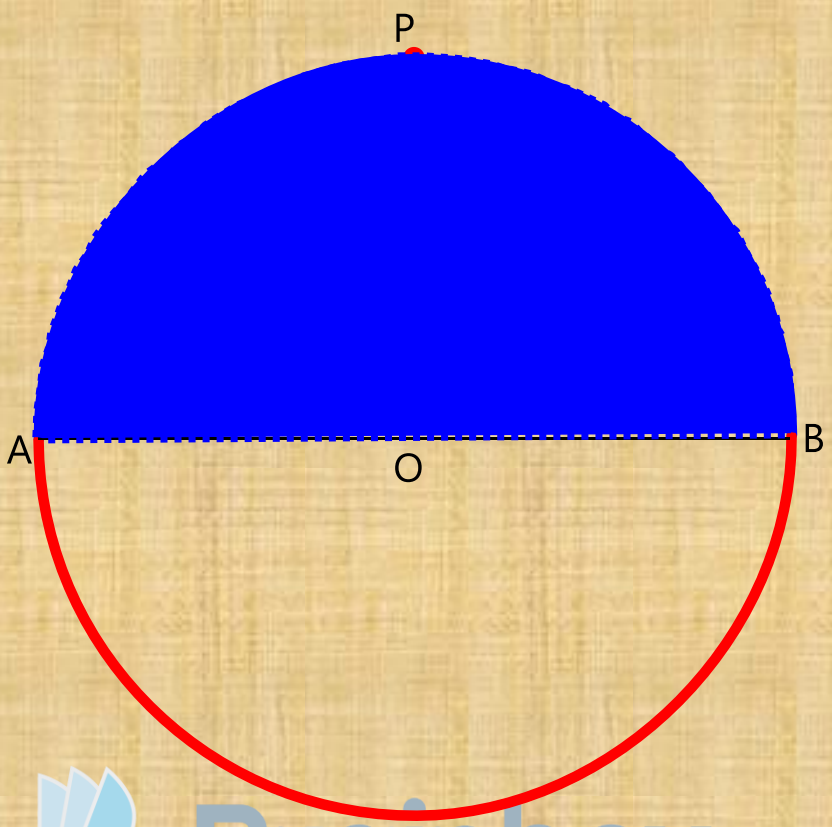
(OR)

One – half of the whole arc of a circle is called a semi-circle.




**Note:**

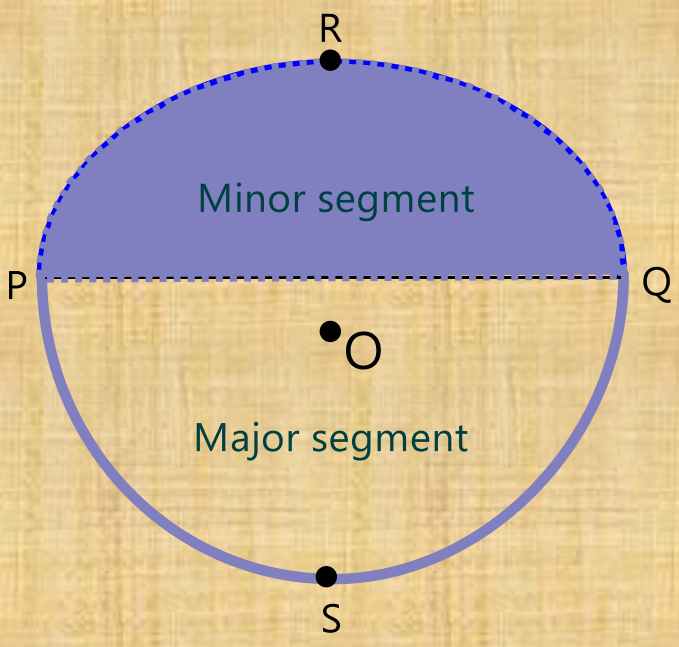
- Length of minor arc < Length of the semicircle.
- Length of major arc > Length of the semicircle.
- The shaded region enclosed by semicircle APB and the diameter AOB together with the semicircle and the diameter is called a semi – circular region.






**Segment of a circle:**

The part of the circular region enclosed by an arc and the chord joining the end points of the arc together with the arc and the chord is called a segment of the circle.




- The segment containing the minor arc is called the minor segment.

  In the given figure, PRQP is the minor segment of the circle.

- The segment containing the major arc is called the major segment.

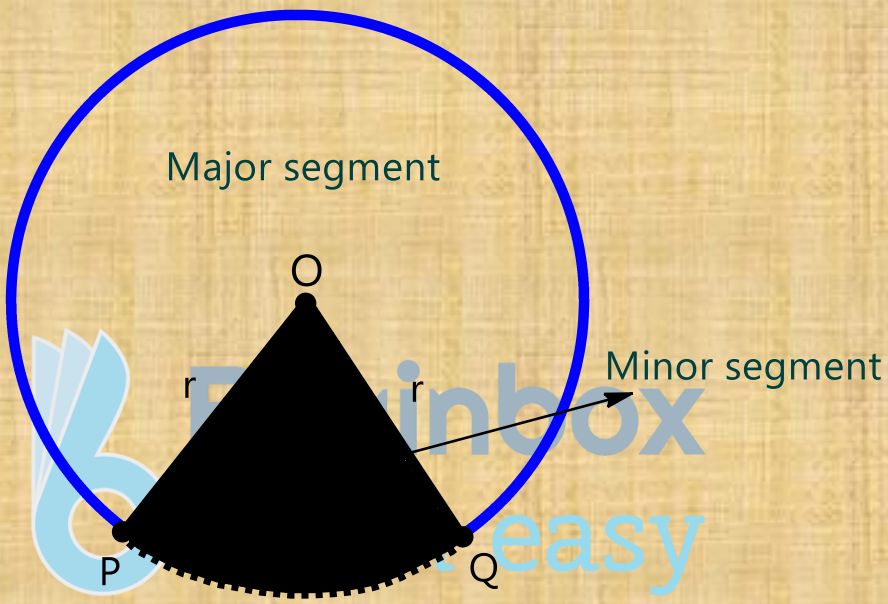
  In the given figure, PSQP is the major segment of the c circle.

**Note:**

The major and minor segments of a circle are called the alternate segments of each other.

**Sector of a circle:**

The part of the circular region bounded by an arc and the two radii at the ends of the arc together with the arc and the radii is called a sector of the circle.




- The sector containing the minor arc is called the minor sector.

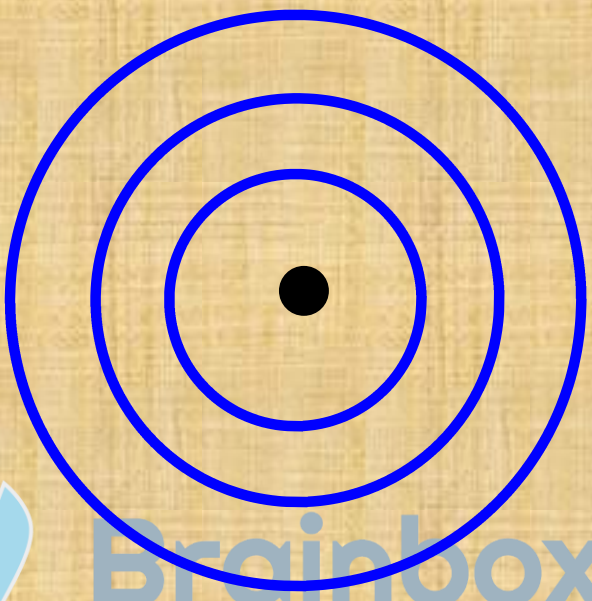
  In the given figure, the region OPQ is the minor sector.

- While the one containing the major arc is called the major sector.

  In the given figure, the remaining part of the circular region is called the major sector.

**Concentric circles:**

Circles having the same centre are said to be concentric circles.

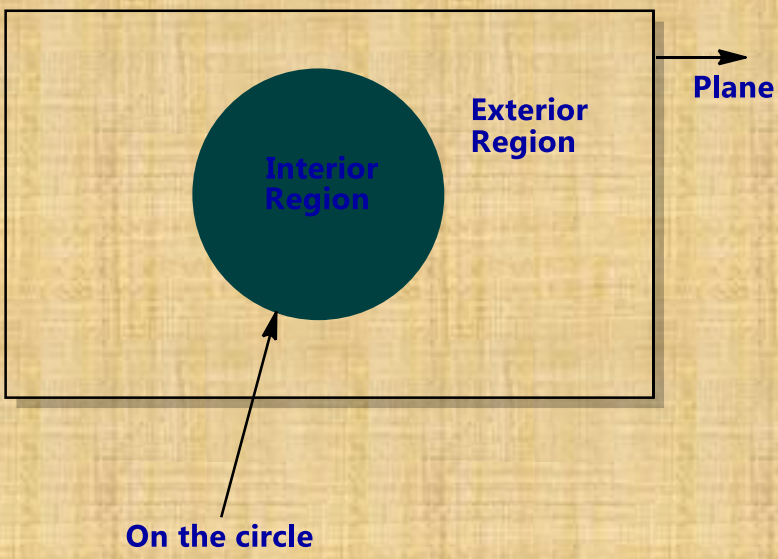




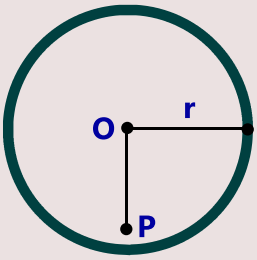
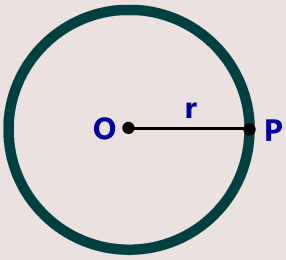
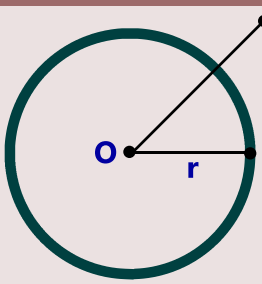
**Position of a point with respect to a circle:**

A circle divides the plane into 3 regions.

- Inside the circle, known as interior region of the circle.
- The boundary of the circle, known as on the circle.
- Outside the circle, known as exterior region of the circle.




Let us consider a circle with centre 'O' and radius 'r'. Let 'P' be a any point then, 3 cases are array.

| 'P' lie inside | 'P' lie on | 'P' lie outside |
|---|---|---|
|  |  |  |
| CP < r | CP = r | CP > r |