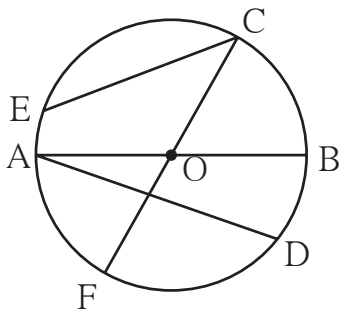
11 Circle

Let's recall.



- Identify the radii, chords and diameters in the circle alongside and write their names in the table below.

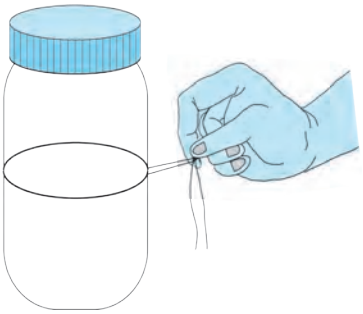
Radii				
Chords				
Diameters				

Circumference of a Circle

Activity I Place a cylindrical bottle on a paper and trace the outline of its base. Use a thread to measure the circumference of the circle.

Activity II Measure the circumference of a bangle with the help of a thread.

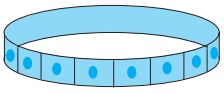
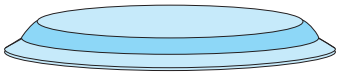
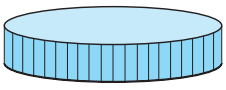
Activity III Measure the circumference of any cylindrical object using a thread.



Let's learn.

Relationship between Circumference and Diameter

Activity Measure the circumference and diameter of the objects given below and enter the ratio of the circumference to its diameter in the table.

Sr. No.	Object	Circumference	Diameter	Ratio $\frac{C}{D}$
1.	 Bangle	19 cm	6 cm	$\frac{19}{6} = 3.16$
2.	Circular dish 	.....	.....	.....
3.	 Lid of a jar	.....	.....	.....

Examine the ratio of the circumference to the diameter. What do we see?

The ratio of the circumference of any circle to its diameter is a little over 3 and remains constant. This constant is represented by the Greek letter π. Great mathematicians have proved through hard work that this number is not a rational number. In practice, the value of π is taken to be $\frac{22}{7}$ or 3.14. If the value of π has not been given in a problem, it is taken to be $\frac{22}{7}$.

If radius is 'r', diameter 'd' and circumference 'c', $\frac{\text{circumference(c)}}{\text{diameter (d)}} = \pi$ $\boxed{c = \pi d}$

But $d = 2r$ $\therefore c = \pi \times 2r$ or $\boxed{c = 2\pi r}$

Example The diameter of a circle is 14 cm. Find its circumference.

Solution: Diameter : $d = 14$ cm
Circumference $= \pi d$
$c = \frac{22}{7} \times 14$
Circumference of the circle = 44 cm

Example The radius of a circle is 35 cm. Find its circumference.

Solution: Radius of the circle $r = 35$ cm
Circumference $= 2\pi r$
$c = 2 \times \frac{22}{7} \times 35$
Circumference of the circle = 220 cm.

Example The circumference of a circle is 198 cm. Find its radius and diameter.

Solution: Circumference c $= 2\pi r$

$$198 = 2 \times \frac{22}{7} \times r$$

$$r = 198 \times \frac{1}{2} \times \frac{7}{22}$$

Radius = 31.5 cm

$\therefore$ Diameter = $2 \times 31.5 = 63$ cm.

Example The circumference of a circle is 62.80 cm. Taking $\pi = 3.14$, find its diameter.

Solution: Circumference $c = \pi d$

$$62.80 = 3.14 \times d$$

$$\frac{62.80}{3.14} = d$$

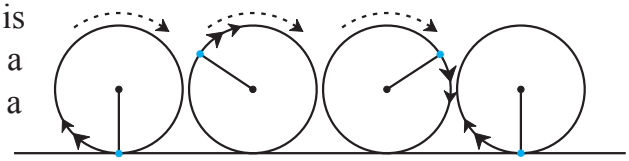
$$20 = d$$

$\therefore$ Diameter = 20 cm

Example The radius of a circular plot is 7.7 metres. How much will it cost to fence the plot with 3 rounds of wire at the rate of 50 rupees per metre?

Solution : Circumference of circular plot $= 2\pi r = 2 \times \frac{22}{7} \times 7.7 = 48.4$
Length of wire required for one round of fencing = 48.4 m.
Cost of one round of fence = length of wire × cost per metre.
= 48.4 × 50
= 2420 rupees.
Cost of 3 rounds of fencing = 3 × 2420 = 7260 rupees

Example The diameter of the wheel of a bus is 0.7 m. How many rotations will a wheel complete while travelling a distance of 22 km?



Solution: Circumference of circle = πd

$$= \frac{22}{7} \times 0.7$$

$$= 2.2 \text{ m}$$

When finding the ratio of like terms, their units must be the same.
22 km = 22 × 1000 = 22000 m.

When the wheel completes one rotation it crosses a distance of 2.2 m.,
(1 rotation = 1 circumference)

$$\text{Total number of rotations} = \frac{\text{distance}}{\text{circumference}} = \frac{22000}{2.2} = \frac{220000}{22} = 10000$$

A wheel completes 10000 rotations to cover the distance of 22 km.

Practice Set 42

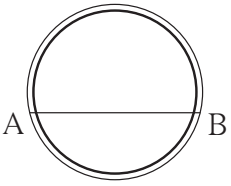
1. Complete the table below.

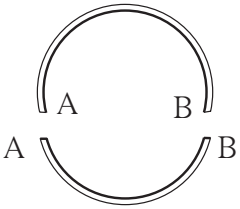
Sr. No.	Radius (r)	Diameter (d)	Circumference (c)
(i)	7 cm	.....	.....
(ii)	.....	28 cm	.....
(iii)	.....	.....	616 cm
(iv)	.....	.....	72.6 cm

2. If the circumference of a circle is 176 cm, find its radius.
3. The radius of a circular garden is 56 m. What would it cost to put a 4-round fence around this garden at a rate of 40 rupees per metre ?
4. The wheel of a bullock cart has a diameter of 1.4m. How many rotations will the wheel complete as the cart travels 1.1 km ?

Let's recall.

Arc of the Circle





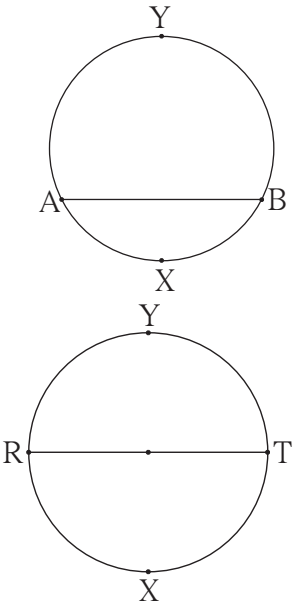
A plastic bangle is shown alongside. Suppose it breaks at points A and B. What is each of these pieces called as a part of a circle?

Let's learn.

The chord AB divides the circle alongside into two parts. Of these, the arc AXB is smaller and is called a **minor arc**. Arc AYB is bigger and is called the **major arc**. Minor arc AXB is also expressed as arc AB.

If two arcs of a circle have common end points and the arcs make one complete circle, the arcs are said to be corresponding arcs. Here, arc AYB and arc AXB are mutually corresponding arcs.

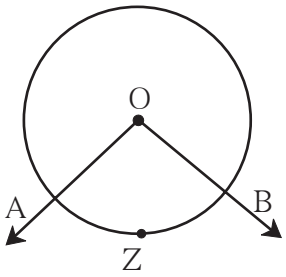
In the figure alongside, chord RT is a diameter of the circle. The diameter gives rise to two equal arcs. They are called **semicircular arcs.**



✸ Central Angle and the Measure of an Arc

In the figure, 'O' is the vertex of the ∠AOB. An angle whose vertex is the centre of the circle is called a **central angle**.

The ∠AOB in the figure is the central angle corresponding to arc AZB. **The measure of the angle subtended at the centre by an arc is taken to be the measure of the arc**.

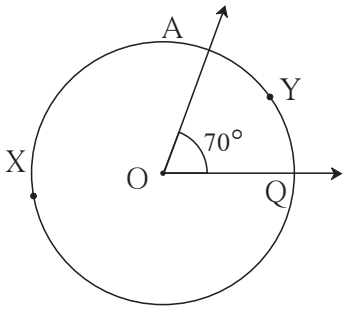


✸ The measure of a minor arc

In the figure alongside, the measure of ∠AOQ = 70°.

∴ Measure of the minor arc AYQ is 70°

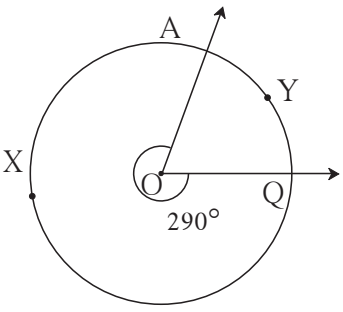
It is written as *m*(arc AYQ) = 70°



✸ The measure of a major arc

Measure of a major arc = 360° − measure of the corresponding minor arc

∴ Measure of major arc AXQ in the figure = 360° − 70° = 290°

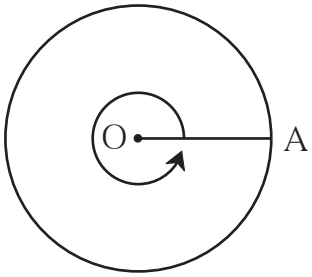


✸ The measure of a circle

When the radius OA of a circle turns anti-clockwise, as shown in the figure alongside, through a complete angle, it turns through an angle that measures 360°. Its end point A completes one circle.

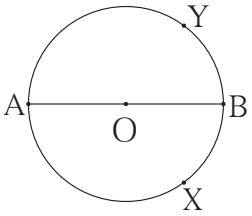
∴ The angle subtended at the centre by the circle is 360°.

∴ The measure of the complete circle is 360°.



✸ Measure of a semicircular arc

Now, look at the figure and determine the measures of the semicircular arcs AXB and AYB.



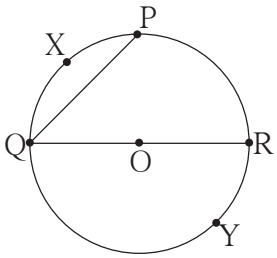
Now I know!

- The measure of a minor arc is equal to its correcsponding central angle.
- The measure of a major arc = 360° − measure of corresponding minor arc.
- The measure of a semicircular arc = 180°

Practice Set 43

1. Choose the correct option.
   If arc AXB and arc AYB are corresponding arcs and m(arc AXB) = 120° then m(arc AYB) = ☐ .
   (i) 140° (ii) 60° (iii) 240° (iv) 160°

2. Some arcs are shown in the circle with centre 'O'. Write the names of the minor arcs, major arcs and semicircular arcs from among them.



3. In a circle with centre O, the measure of a minor arc is 110°. What is the measure of the major arc PYQ?

ICT Tools or Links

Using the MOVE option of the Geogebra software, observe the relationship between a central angle and its corresponding arc, for different measures of the arc.