Chapter 3

TRIGONOMETRIC FUNCTIONS

EXERCISE 3.1

1. Find the radian measures corresponding to the following degree measures: (i) 25° (ii) – 47° 30′ (iii) 240° (iv) 520°

Solution:

A radian is another unit for the measurement of angle.

2π radian is equal to 360°.

By using 1° = π/180 radian,

we can convert the degree measures into radian measures.

⇒ 1° = π / 180 radian

or 1 radian = 180°/π

(i) 25°

As we know that,

⇒ 1° = π / 180 radian.

We can write

⇒ 25° = π / 180 radian × 25.

By solving this, we get

⇒ 25° = 5π / 36 radian.

(ii) – 47° 30′

We know that 1º = 60'

⇒ 1/2° = 30'

Therefore,

- 47° 30' = - 47 (1/2)°

⇒ - 95 / 2°

To convert it into radian measure,

⇒ 1° = π / 180 radian.

We can write

⇒ - 47 1/2° = π / 180 radian × (-95/2).

By solving this, we get

⇒ - 47 1/2° = - 19π / 72 radian

(iii) 240°

As we know that,

⇒ 1° = π / 180 radian.

We can write

⇒ 240° = π / 180 radian × 240.

By solving this, we get

⇒ 240° = 4π / 3 radian.

(iv) 520°

As we know that,

⇒ 1° = π / 180 radian.

We can write

⇒ 520° = π / 180 radian × 520.

By solving this, we get

⇒ 520° = 26π / 9 radian.

2. Find the degree measures corresponding to the following radian measures (Use π = 22/7).
(i) 11/16 (ii) -4 (iii) 5π/3 (iv) 7π/6

Solution:

Given use π = 22/ 7.

As we know that 1 radian = 180° / π.

(i) 11/16

1 radian = 180° / π.

⇒ 11 / 16 radian = 180° / π × 11 / 16

Use π = 22/7,

11/ 16 radian = 39° 22' 30"

(ii) -4

1 radian = 180° / π.

⇒ - 4 radian = 180° / π × (- 4)

Use π = 22/7, and solve.

- 4 radian = - 229° 5' 27"

(iii) 5π / 3

1 radian = 180° / π.

⇒ 5π / 3 radian = 180° / π × 5π / 3

By solving this, we get

⇒ 5π / 3 radian = 300°

(iv) 7π / 6

1 radian = 180° / π.

⇒ 7π / 6 radian = 180° / π × 7π / 6

By solving this, we get

⇒ 7π / 6 radian = 210°

A radian measure can be converted using 1 radian = 180° / π

3. A wheel makes 360 revolutions in one minute. Through how many radians does it turn in one second?

Solution:

Given,

Number of revolution made by the wheel in 1 minute

= 360

We know 1 minute = 60 seconds

The number of revolution wheels will make in one second

= 360 / 60 = 6.

One complete revolution = 2 π radian

The number of radians wheel will turn in 1 second

= 2 π× 6 = 12 π.

4. Find the degree measure of the angle subtended at the centre of a circle of radius 100 cm by an arc of length 22 cm (Use π = 22/7)

Solution:

Let the radius of the circle be r unit and the arc of 1 unit which suspends and angle Θ radian at the center.

Θ = l / r radian

Given that

r = 100 cm

and l = 22 cm

By substituting the value, we get

Θ = 22 / 100 radian

To find the degree measure, we will use 1 radian = 180° / π

⇒ (180° / π) x (22 / 100)

= 126/10 degree = 12° 36'.

5. In a circle of diameter 40 cm, the length of a chord is 20 cm. Find the length of minor arc of the chord.

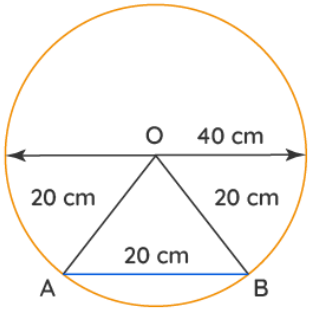
Solution:

Given that the diameter of the circle = 40 cm and the length of the chord is 20 cm.

⇒ Radius of the circle = half of diameter = 20 cm.

Let AB be the chord whose length is 20 cm (given)

By joining the radii to the ends of the chord, we get a triangle AOB.



In triangle AOB, OA = OB = 20 cm (radii of the circle)

AB = 20 cm (given the length of the chord)

∴ Triangle AOB is an equilateral triangle with all sides equal.

⇒ Θ = 60° = π / 3 radian.

As we know that, in a circle of radius r unit, if the length of the arc is l unit subtends at an angle Θ radian at the center, then l = r × Θ

⇒ l = 20 × π / 3

⇒ l = 20 π/3 cm.

6. If in two circles, arcs of the same length subtend angles 60° and 75° at the centre, find the ratio of their radii.

Solution: Let the radii of the circles be r_1 and r_2 be the radii of the two circles.

Let the arc of length l_1 subtend angles 60° at the centre and the arc of the length l_2 be 75° at the centre.

⇒ 60° = π/3 radian and 75° = 5π/12 radian using θ = l / r.

As we know that in a circle or radius r, the arc length l subtend at an angle θ radian at the centre, then θ = l / r or l = r θ

Therefore,

$l = r_1 \times \pi/3$ and $l = r_2 \times 5\pi/12$

$\Rightarrow r_1 \times \pi/3 = r_2 \times 5\pi/12$

On solving them taking r on one side, we get

$\Rightarrow r_1 / r_2 = 5\pi/12 \times 3/\pi$

$\Rightarrow r_1 / r_2 = 5/4$

7. Find the angle in radian though which a pendulum swings if its length is 75 cm and the tip describes an arc of length
(i) 10 cm (ii) 15 cm (iii) 21 cm

Solution:

Given that the length of the pendulum swings is 75 cm. ⇒ radius is 75 cm.

We know that, in a circle of radius r, the length of the arc is l that subtend at an angle θ radian at the centre, then θ = l / r radian

(i) l = 10 cm

⇒ θ = l / r radian

⇒ θ = 10 / 75 radian = 2/15 radian.

(ii) l = 15 cm

⇒ θ = l / r radian

⇒ θ = 15 / 75 radian = 1/5 radian.

(iii) l = 21 cm

⇒ θ = l / r radian

⇒ θ = 21 / 75 radian = 7/25 radian