

Chapter 3: Trigonometric Functions Exercise 3.1

NCERT · Class 11 · Maths

Questions

Question 1

Find the radian measures corresponding to the following degree measures:

(i) 25° (ii) $-47^\circ 30'$ (iii) 240° (iv) 520°

Solution

(i) 25°

Here $180^\circ = \pi$ radian

It can be written as

$$25^\circ = \frac{\pi}{180} \times 25 \text{ radian}$$

So we get

$$= \frac{5\pi}{36} \text{ radian}$$

(ii) $-47^\circ 30'$

Here $1^\circ = 60'$

It can be written as

$$-47^\circ 30' = -47\frac{1}{2} \text{ degree}$$

So we get

$$= \frac{-95}{2} \text{ degree}$$

Here $180^\circ = \pi$ radian

$$\frac{-95}{2} \text{ degree} = \frac{\pi}{180} \times \left(\frac{-95}{2}\right) \text{ radian}$$

It can be written as

$$= \left(\frac{-19}{36 \times 2}\right) \pi \text{ radian} = \frac{-19}{72} \pi \text{ radian}$$

We get

$$-47^\circ 30' = \frac{-19}{72} \pi \text{ radian}$$

(iii) 240°

Here $180^\circ = \pi$ radian

It can be written as

$$240^\circ = \frac{\pi}{180} \times 240 \text{ radian}$$

So we get

$$= \frac{4}{3} \pi \text{ radian}$$

(iv) 520°

Here $180^\circ = \pi$ radian

It can be written as

$$520^\circ = \frac{\pi}{180} \times 520 \text{ radian}$$

So we get

$$= \frac{26\pi}{9} \text{ radian}$$

Question 2

Find the degree measures corresponding to the following radian measures (Use $\pi = 22/7$).

(i) $11/16$

(ii) -4

(iii) $5\pi/3$

(iv) $7\pi/6$

Solution

(i) $11/16$

Here, π radian = 180°

$$\frac{11}{16} \text{ radian} = \frac{180}{\pi} \times \frac{11}{16} \text{ deg ree}$$

We can write it as

$$= \frac{45 \times 11}{\pi \times 4} \text{ deg ree}$$

So we get

$$= \frac{45 \times 11 \times 7}{22 \times 4} \text{ deg ree}$$

$$= \frac{315}{8} \text{ deg ree}$$

$$= 39 \frac{3}{8} \text{ deg ree}$$

Take $1^\circ = 60'$

$$= 39^\circ + \frac{3 \times 60}{8} \text{ min utes}$$

We get

$$= 39^\circ + 22' + \frac{1}{2} \text{ min utes}$$

Consider $1' = 60''$

$$= 39^\circ 22' 30''$$

(ii) -4

Here, $\pi \text{ radian} = 180^\circ$

$$-4 \text{ radian} = \frac{180}{\pi} \times (-4) \text{ deg ree}$$

We can write it as

$$= \frac{180 \times 7(-4)}{22} \text{ deg ree}$$

By further calculation

$$= \frac{-2520}{11} \text{ deg ree} = -229 \frac{1}{11} \text{ deg ree}$$

Take $1^\circ = 60'$

$$= -229^\circ + \frac{1 \times 60}{11} \text{ min utes}$$

So we get

$$= -229^\circ + 5' + \frac{5}{11} \text{ min utes}$$

Again $1' = 60''$

$$= -229^\circ 5' 27''$$

(iii) $5\pi/3$

Here, $\pi \text{ radian} = 180^\circ$

$$\frac{5\pi}{3} \text{ radian} = \frac{180}{\pi} \times \frac{5\pi}{3} \text{ degree}$$

We get

$$= 300^\circ$$

(iv) $7\pi/6$

Here, $\pi \text{ radian} = 180^\circ$

$$\frac{7\pi}{6} \text{ radian} = \frac{180}{\pi} \times \frac{7\pi}{6}$$

We get

$$= 210^\circ$$

Question 3

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

Solution

It is given that

No. of revolutions made by the wheel in

$$1 \text{ minute} = 360$$

$$1 \text{ second} = 360/60 = 6$$

We know that

The wheel turns an angle of 2π radian in one complete revolution.

In 6 complete revolutions, it will turn an angle of $6 \times 2\pi \text{ radian} = 12\pi \text{ radian}$

Therefore, in one second, the wheel turns at an angle of 12π radian.

Question 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 $\pi = 22/7$).

Solution

Consider a circle of radius r unit with l unit as the arc length which subtends an angle θ radian at the centre

$$\theta = l/r$$

Here $r = 100$ cm, $l = 22$ cm

$$\theta = \frac{22}{100} \text{ radian} = \frac{180}{\pi} \times \frac{22}{100} \text{ deg ree}$$

It can be written as

$$= \frac{180 \times 7 \times 22}{22 \times 100} \text{ deg ree}$$

$$= \frac{126}{10} \text{ deg ree}$$

So we get

$$= 12\frac{3}{5} \text{ deg ree}$$

Here $1^\circ = 60'$

$$= 12^\circ 36'$$

Therefore, the required angle is $12^\circ 36'$.

Question 5

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

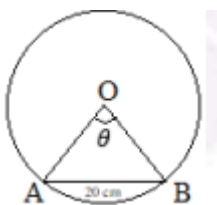
Solution

The dimensions of the circle are

Diameter = 40 cm

Radius = $40/2 = 20$ cm

Consider AB as the chord of the circle, i.e., length = 20 cm



In $\triangle OAB$,

Radius of circle = $OA = OB = 20$ cm

Similarly $AB = 20$ cm

Hence, $\triangle OAB$ is an equilateral triangle.

$$\theta = 60^\circ = \pi/3 \text{ radian}$$

In a circle of radius r unit, if an arc of length l unit subtends an angle θ radian at the centre,

We get $\theta = l/r$

$$\frac{\pi}{3} = \frac{\widehat{AB}}{20} \Rightarrow \widehat{AB} = \frac{20\pi}{3} \text{ cm}$$

Therefore, the length of the minor arc of the chord is $20\pi/3$ cm.

Question 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

Consider r_1 and r_2 as the radii of the two circles.

Let an arc of length l subtend an angle of 60° at the centre of the circle of radius r_1 and an arc of length l subtend an angle of 75° at the centre of the circle of radius r_2 .

Here $60^\circ = \pi/3$ radian and $75^\circ = 5\pi/12$ radian

In a circle of radius r unit, if an arc of length l unit subtends an angle θ radian at the centre

We get

$$\theta = l/r \text{ or } l = r\theta$$

We know that

$$l = \frac{r_1\pi}{3} \text{ and } l = \frac{r_2 5\pi}{12}$$

By equating both we get

$$\frac{r_1\pi}{3} = \frac{r_2 5\pi}{12}$$

On further calculation

$$r_1 = \frac{r_2 5}{4}$$

So we get

$$\frac{r_1}{r_2} = \frac{5}{4}$$

Therefore, the ratio of the radii is 5: 4.

Question 7

Find the angle in the radian through 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

In a circle of radius r unit, if an arc of length l unit subtends an angle θ radian at the centre, then $\theta = l/r$

We know that $r = 75$ cm

(i) $l = 10$ cm

So we get

$$\theta = 10/75 \text{ radian}$$

By further simplification,

$$\theta = 2/15 \text{ radian}$$

(ii) $l = 15$ cm

So, we get

$$\theta = 15/75 \text{ radian}$$

By further simplification,

$$\theta = 1/5 \text{ radian}$$

(iii) $l = 21$ cm

So, we get

$$\theta = 21/75 \text{ radian}$$

By further simplification,

$$\theta = 7/25 \text{ radian}$$