



### EXERCISE 3.1

Question 1:

Find the radian measures corresponding to the following degree measures:

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

Ans:

(i)  $25^\circ$

We know that  $180^\circ = \pi$  radian

$$\therefore 25^\circ = \frac{\pi}{180} \times 25 \text{ radian} = \frac{5\pi}{36} \text{ radian}$$

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

$$-47^\circ 30' = -47\frac{1}{2} \text{ degree } [1^\circ = 60']$$

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

Since  $180^\circ = \pi$  radian

$$\frac{-95}{2} \text{ degree} = \frac{\pi}{180} \times \left(\frac{-95}{2}\right) \text{ radian} = \left(\frac{-19}{36 \times 2}\right) \pi \text{ radian} = \frac{-19}{72} \pi \text{ radian}$$

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

(iii)  $240^\circ$

We know that  $180^\circ = \pi$  radian

$$\therefore 240^\circ = \frac{\pi}{180} \times 240 \text{ radian} = \frac{4}{3} \pi \text{ radian}$$

(iv)  $520^\circ$

We know that  $180^\circ = \pi$  radian

$$\therefore 520^\circ = \frac{\pi}{180} \times 520 \text{ radian} = \frac{26\pi}{9} \text{ radian}$$

(iii)  $240^\circ$

We know that  $180^\circ = \pi$  radian

$$\therefore 240^\circ = \frac{\pi}{180} \times 240 \text{ radian} = \frac{4}{3} \pi \text{ radian}$$

(iv)  $520^\circ$

We know that  $180^\circ = \pi$  radian

$$\therefore 520^\circ = \frac{\pi}{180} \times 520 \text{ radian} = \frac{26\pi}{9} \text{ radian}$$

Question 2:

Find the degree measures corresponding to the following radian measures

$\left( \text{Use } \pi = \frac{22}{7} \right)$

(i)  $\frac{11}{16}$  (ii)  $-4$  (iii)  $\frac{5\pi}{3}$  (iv)  $\frac{7\pi}{6}$

Ans:

(i)  $\frac{11}{16}$

We know that  $\pi$  radian =  $180^\circ$

$$\begin{aligned}\therefore \frac{11}{16} \text{ radian} &= \frac{180}{\pi} \times \frac{11}{16} \text{ deg ree} = \frac{45 \times 11}{\pi \times 4} \text{ deg ree} \\ &= \frac{45 \times 11 \times 7}{22 \times 4} \text{ deg ree} = \frac{315}{8} \text{ deg ree} \\ &= 39\frac{3}{8} \text{ deg ree} \\ &= 39^\circ + \frac{3 \times 60}{8} \text{ min utes} \quad [1^\circ = 60'] \\ &= 39^\circ + 22' + \frac{1}{2} \text{ min utes} \\ &= 39^\circ 22' 30'' \quad [1' = 60'']\end{aligned}$$

(ii)  $-4$

We know that  $\pi$  radian =  $180^\circ$

$$\begin{aligned}-4 \text{ radian} &= \frac{180}{\pi} \times (-4) \text{ deg ree} = \frac{180 \times 7(-4)}{22} \text{ deg ree} \\ &= \frac{-2520}{11} \text{ deg ree} = -229\frac{1}{11} \text{ deg ree} \\ &= -229^\circ + \frac{1 \times 60}{11} \text{ min utes} \quad [1^\circ = 60'] \\ &= -229^\circ + 5' + \frac{5}{11} \text{ min utes} \\ &= -229^\circ 5' 27'' \quad [1' = 60'']\end{aligned}$$

$$(iii) \frac{5\pi}{3}$$

We know that  $\pi$  radian =  $180^\circ$

$$\therefore \frac{5\pi}{3} \text{ radian} = \frac{180}{\pi} \times \frac{5\pi}{3} \text{ degree} = 300^\circ$$

$$(iv) \frac{7\pi}{6}$$

We know that  $\pi$  radian =  $180^\circ$

$$\therefore \frac{7\pi}{6} \text{ radian} = \frac{180}{\pi} \times \frac{7\pi}{6} = 210^\circ$$

Question 3:

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

Ans:

Number of revolutions made by the wheel in 1 minute = 360

$$\therefore \text{Number of revolutions made by the wheel in 1 second} = \frac{360}{60} = 6$$

In one complete revolution, the wheel turns an angle of  $2\pi$  radian.

Hence, in 6 complete revolutions, it will turn an angle of  $6 \times 2\pi$  radian, i.e.,

$12\pi$  radian

Thus, in one second, the wheel turns an angle of  $12\pi$  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  $\pi = \frac{22}{7}$ ).

Ans:

We know that in a circle of radius  $r$  unit, if an arc of length  $l$  unit subtends an angle  $\theta$  radian at the centre, then

$$\theta = \frac{l}{r}$$

Therefore, for  $r = 100$  cm,  $l = 22$  cm, we have

$$\begin{aligned} \theta &= \frac{22}{100} \text{ radian} = \frac{180}{\pi} \times \frac{22}{100} \text{ degree} = \frac{180 \times 7 \times 22}{22 \times 100} \text{ degree} \\ &= \frac{126}{10} \text{ degree} = 12\frac{3}{5} \text{ degree} = 12^\circ 36' \quad [1^\circ = 60'] \end{aligned}$$

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

Question 5:

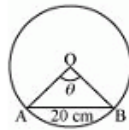
In a circle of diameter 40 cm, the length of a chord is 20 cm. Find the length of minor arc of the chord.

Ans:

Diameter of the circle = 40 cm

$$\therefore \text{Radius } (r) \text{ of the circle} = \frac{40}{2} \text{ cm} = 20 \text{ cm}$$

Let AB be a chord (length = 20 cm) of the circle.



In  $\triangle OAB$ ,  $OA = OB = \text{Radius of circle} = 20 \text{ cm}$

Also,  $AB = 20 \text{ cm}$

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

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

We know that in a circle of radius  $r$  unit, if an arc of length  $l$  unit subtends an angle  $\theta$  radian at the centre, then  $\theta = \frac{l}{r}$ .

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

Thus, the length of the minor arc of the chord is  $\frac{20\pi}{3} \text{ cm}$ .

We know that in a circle of radius  $r$  unit, if an arc of length  $l$  unit subtends an angle  $\theta$  radian at the centre, then  $\theta = \frac{l}{r}$ .

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

Thus, the length of the minor arc of the chord is  $\frac{20\pi}{3} \text{ cm}$ .

Question 6:

If in two circles, arcs of the same length subtend angles  $60^\circ$  and  $75^\circ$  at the centre, find the ratio of their radii.

Ans:

Let the radii of the two circles be  $r_1$  and  $r_2$ . Let an arc of length  $l$  subtend an angle of  $60^\circ$  at the centre of the circle of radius  $r_1$ , while let an arc of length  $l$  subtend an angle of  $75^\circ$  at the centre of the circle of radius  $r_2$ .

$$\text{Now, } 60^\circ = \frac{\pi}{3} \text{ radian and } 75^\circ = \frac{5\pi}{12} \text{ radian}$$

We know that in a circle of radius  $r$  unit, if an arc of length  $l$  unit subtends an angle  $\theta$  radian at the centre, then  $\theta = \frac{l}{r}$  or  $l = r\theta$ .

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

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

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

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

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

Question 7:

Find the angle in 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

Ans:

We know that in a circle of radius  $r$  unit, if an arc of length  $l$  unit subtends an angle  $\theta$  radian at the centre, then  $\theta = \frac{l}{r}$ .

It is given that  $r = 75$  cm

(i) Here,  $l = 10$  cm

$$\theta = \frac{10}{75} \text{ radian} = \frac{2}{15} \text{ radian}$$

(ii) Here,  $l = 15$  cm

$$\theta = \frac{15}{75} \text{ radian} = \frac{1}{5} \text{ radian}$$

(iii) Here,  $l = 21$  cm

$$\theta = \frac{21}{75} \text{ radian} = \frac{7}{25} \text{ radian}$$

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