NCERT Solutions for Class-XI Maths

Chapter-2 Exercise-3.1

NCERT Math Class 11

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

1. **(i) 25°**

Explanation:

Given: 25°

We know that $1° = \frac{\pi}{180}$ radians

$\therefore 25° = 25 \times \frac{\pi}{180} = \frac{5\pi}{36}$ radians

$\therefore 25° = \frac{5\pi}{36}$ radians

(ii) – 47°30′

Ans:

Explanation:

Given: – 47°30′

We know that 1° = 60’

$\Rightarrow 1' = \frac{1}{60}°$

$\therefore -30' = -\frac{30}{60}° = -0.5°$

$\therefore -47° 30' = -47.5°$

We know that $1° = \frac{\pi}{180}$ radians

$\therefore -47.5° = -47.5 \times \frac{\pi}{180} = -26388 \times \pi = -0.8290$ radians

$\therefore -47.5° = -0.8290$ radians

(iii) 240°

Ans:

Explanation:

Given: 240°

We know that $1° = \frac{\pi}{180}$ radians

$\therefore 240° = 240 \times \frac{\pi}{180} = \frac{4\pi}{3}$ radians

$\therefore 240° = \frac{4\pi}{3}$ radians

(iv) 520°

Ans:

Explanation:

Given: 520°

We know that $1° = \frac{\pi}{180}$ radians

$\therefore 520° = 520 \times \frac{\pi}{180} = \frac{26\pi}{9} = 9.075$ radians

$\therefore 520° = 9.075$ radians

2. Find the degree measures corresponding to the following radian measures (Use $\pi = \frac{22}{7}$)

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

(ii) -4

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

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

2. **(i)** $\frac{11}{16}$

We know that π radian $= 180^o$

$\therefore \frac{11}{16}$ radain

$= \frac{180}{\pi} \times \frac{11}{16}$ deg ree $= \frac{45 \times 11}{\pi \times 4}$ deg ree

$= \frac{45 \times 11 \times 7}{22 \times 4}$ deg ree $= \frac{315}{8}$ deg ree

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

$= 39^{o} + \frac{3 \times 60}{8}$ min utes $\left[1^{o} = 60^{'}\right]$

$= 39^{o} + 222^{'} + \frac{1}{2}$ min utes

$= 39^{o}22^{'}30^{''}\left[1' = 60^{''}\right]$

(ii) -4

We know that π radian $= 180^{o}$

-4 radian

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

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

$= -229^{o} + \frac{1 \times 60}{11}$ minutes $\left[1^{o} = 60^{'}\right]$

$= -229^{o} + 5' + \frac{5}{11}$ minutes

$= -229^{o}5'27^{''}$

$\left[1' = 60^{''}\right]$

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

We know that π radian $= 180^{o}$

$\therefore \frac{5\pi}{3}$ radian $= \frac{180}{\pi} \times \frac{5\pi}{3}$ deg ree $= 300^{o}$

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

We know that π radian $= 180^{o}$

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

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

3. Given: A wheel makes 360 revolutions in one minute.

Here, Number of revolutions made in 1 second = $\frac{360}{60}$ = 6 revolutions/sec (∵ 1 min = 60 sec)

We know that a wheel is in circular shape and any circular structure makes 360° in 1 complete revolution.

∴ 360° = 360 × $\frac{\pi}{180}$ = 2π radians. (for 1 revolution)

Therefore, for 6 revolutions

2π × 6 radians = 12π radians

∴ A wheel revolves 12π radians in 1 second.

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 $\pi = \frac{22}{7}$)

4. We know that in a circle of radius r unit, if an arc of length / unit subtends an angle θ radian at the centre, then

$\theta = \frac{1}{r}$

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

$\theta = \frac{22}{100}$ radian $= \frac{180}{\pi} \times \frac{22}{100}$ deg ree $= \frac{180 \times 7 \times 22}{22 \times 100}$ deg ree

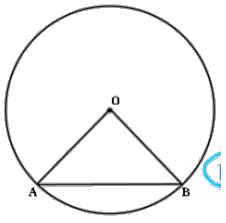
$= \frac{126}{10}$ deg ree $= 12\frac{3}{5}$ deg ree $= 12^{o}36^{'}$ $\left[1^{o} = 60^{'}\right]$

Thus, the required angle is $12^{o}36^{'}$.

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.

5. Given: A circle of diameter 40 cm ⇒ radius = 20cm

The length of a chord is 20 cm.



Here, we can see that, the figure forms a equilateral triangle with side length 20 cm (both radii=20cm and length of chord=20cm)

∴ ∠AOB = 60° (∵ Angles in an equilateral triangle are 60° each)

$\Rightarrow 60° = 60 \times \frac{\pi}{180} = \frac{\pi}{3}$ radians

That is, The Chord AB makes $\frac{\pi}{3}$ radians at the centre of the circle.

Now, We know that $\theta = \frac{l}{r}$ (here, θ is angle subtended by arc)

$\therefore \frac{\pi}{3} = \frac{l}{20}$

$\Rightarrow l = \frac{20\pi}{3}$

$\therefore$ Length of the arc AB is $\frac{20\pi}{3}$ cm.

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

6. Let the radii of the two circles be r_1 and r_2. Let an arc of length / subtend an angle of 60^o at the centre of the circle of radius r_1, while let an arc of length / subtend an angle of 75^o at the centre of the circle of radius r_2.

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

We know that in a circle of radius r unit, if an arc of length / unit subtends an angle θ

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

$\therefore l = \frac{r_1 \pi}{3}$ 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 $5:4$.

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

7. (i) 10 cm

Given: l=10cm (length of arc) and r=75cm(radius of circle)

We know that $\theta = \frac{l}{r}$ (here, θ is angle subtended by arc)

$\therefore \theta = \frac{10}{75} = \frac{2}{15}$ radians

∴The angle by which the pendulum of length 75 cm swings if it describes an arc of 21 cm is $\frac{2}{15}$ radians.

(ii) 15 cm

Ans:

Explanation:

Given: l=15cm (length of arc) and r=75cm(radius of circle)

We know that $\theta = \frac{l}{r}$ (here, θ is angle subtended by arc)

$\therefore \theta = \frac{15}{75} = \frac{1}{5}$ radians.

∴The angle by which the pendulum of length 75 cm swings if it describes an arc of 21 cm is $\frac{1}{5}$ radians.

(iii) 21 cm

Ans:

Explanation:

Given: l=21 cm (length of arc) and r=75 cm (radius of circle)

We know that $\theta = \frac{l}{r}$ (here, θ is angle subtended by arc)

$\therefore \theta = \frac{21}{75} = \frac{7}{25}$ radians

∴The angle by which the pendulum of length 75 cm swings if it describes an arc of 21 cm is $\frac{7}{25}$ radians.