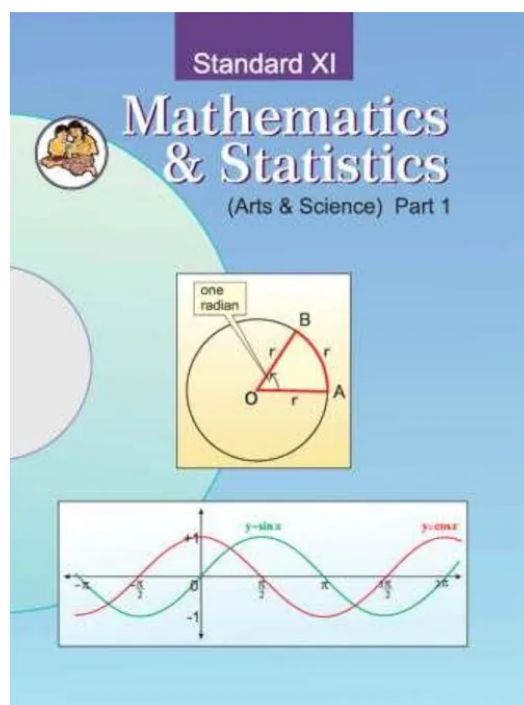


Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 1): Chapter 1- Angle and its Measurement

Class 11 - Chapter 1 Angle and its Measurement



For any clarifications or questions you can write to info@indcareer.com

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Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 1): Chapter 1- Angle and its Measurement

Class 11: Maths Chapter 1 solutions. Complete Class 11 Maths Chapter 1 Notes.

Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 1): Chapter 1- Angle and its Measurement

Maharashtra Board 11th Maths Chapter 1, Class 11 Maths Chapter 1 solutions

Ex 1.1

Question 1.

(A) Determine which of the following pairs of angles are co-terminal.

- i. 210° , 150°
- ii. 360° , -30°
- iii. -180° , 540°
- iv. -405° , 675°
- v. 860° , 580°
- vi. 900° , -900°

Solution:

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$210^\circ, -150^\circ$

$$210^\circ - (-150^\circ) = 210^\circ + 150^\circ$$

$$= 360^\circ$$

$$= 1(360^\circ),$$

which is a multiple of 360° .

$\therefore$ The given pair of angles is co-terminal.

ii. $360^\circ, -30^\circ$

$$360^\circ - (-30^\circ) = 360^\circ + 30^\circ$$

$$= 390^\circ,$$

which is not a multiple of 360° .

$\therefore$ The given pair of angles is not co-terminal.

iii. $-180^\circ, 540^\circ$

$$540^\circ - (-180^\circ) = 540^\circ + 180^\circ$$

$$= 720^\circ$$

$$= 2(360^\circ),$$

which is a multiple of 360° .

$\therefore$ The given pair of angles is co-terminal.

iv. $-405^\circ, 675^\circ$

$$675^\circ - (-405^\circ) = 675^\circ + 405^\circ$$

$$= 1080^\circ$$

$$= 3(360^\circ),$$

which is a multiple of 360° .

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∴ The given pair of angles is co-terminal.

v. $860^\circ, 580^\circ$

$$860^\circ - 580^\circ = 280^\circ$$

which is not a multiple of 360° .

∴ The given pair of angles is not co-terminal.

vi. $900^\circ, 900^\circ$

$$900^\circ - (-900^\circ) = 900^\circ + 900^\circ$$

$$= 1800^\circ$$

$$= 5(360^\circ)$$

which is a multiple of 360°

∴ The given pair of angles is co-terminal.

Question 1.

(B) Draw the angles of the following measures and determine their quadrants.

i. -140°

ii. 250°

iii. 420°

iv. 750°

v. 945°

vi. 1120°

vii. -80°

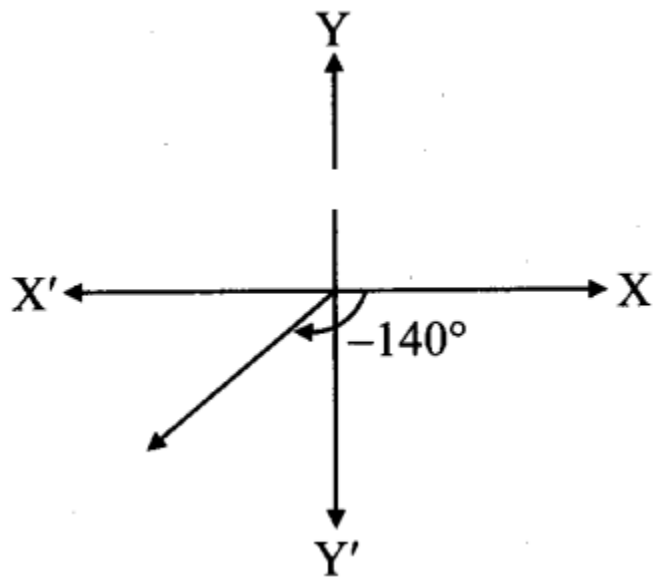
viii. -330°

ix. -500°

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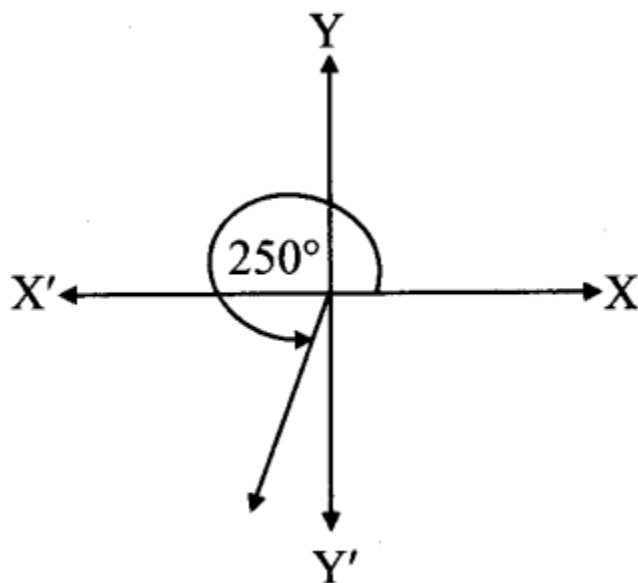
x. -820°

Solution:



From the figure, the given angle terminates in quadrant III.

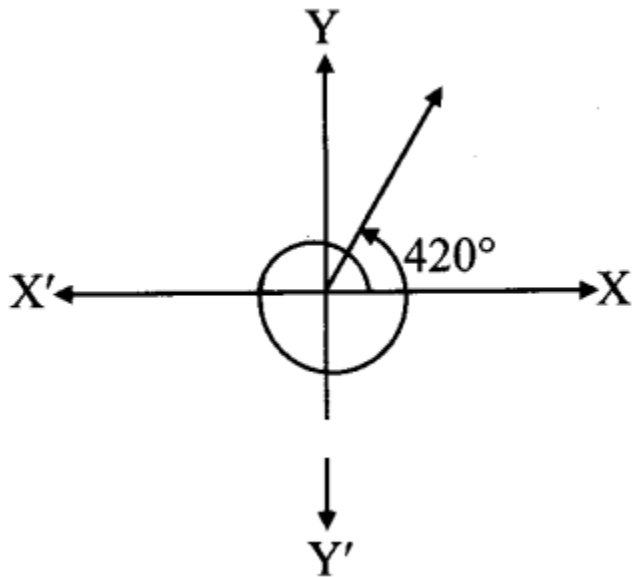
ii.



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From the figure, the given angle terminates in quadrant III.

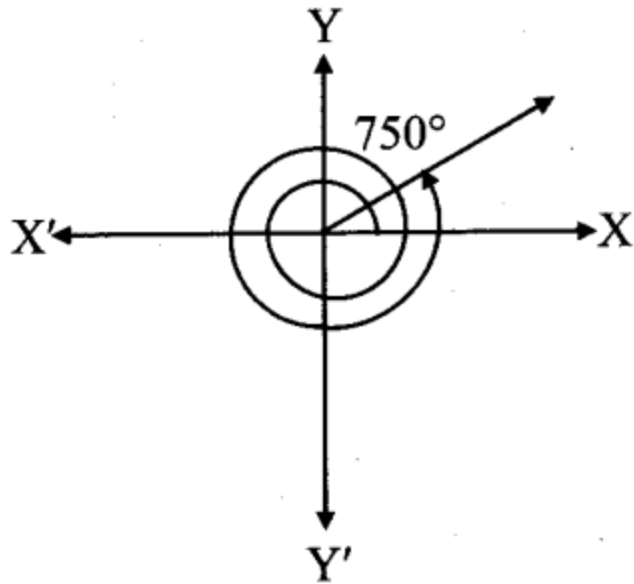
iii.



From the figure, the given angle terminates in quadrant I.

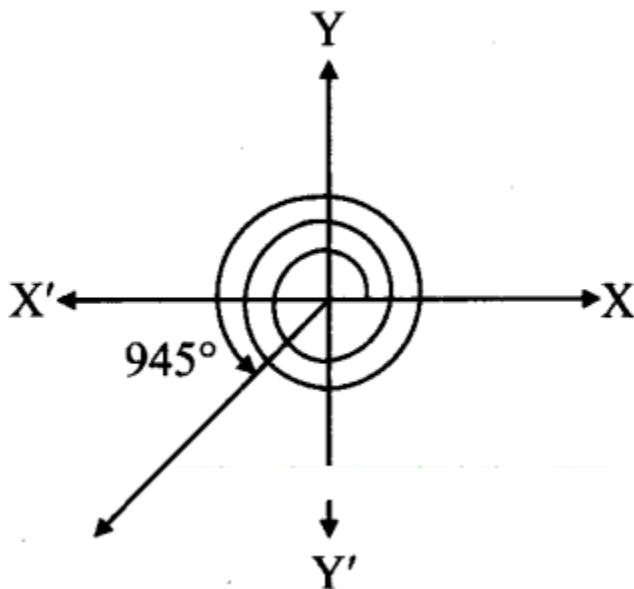
iv.

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From the figure, the given angle terminates in quadrant I.

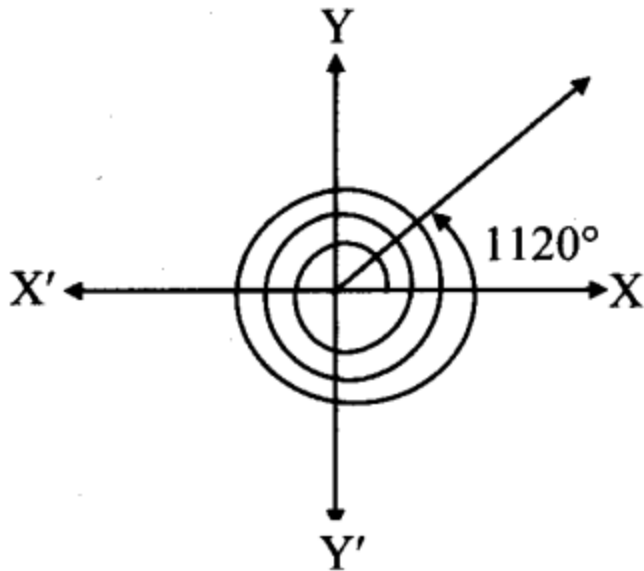
v.



From the figure, the given angle terminates in quadrant III.

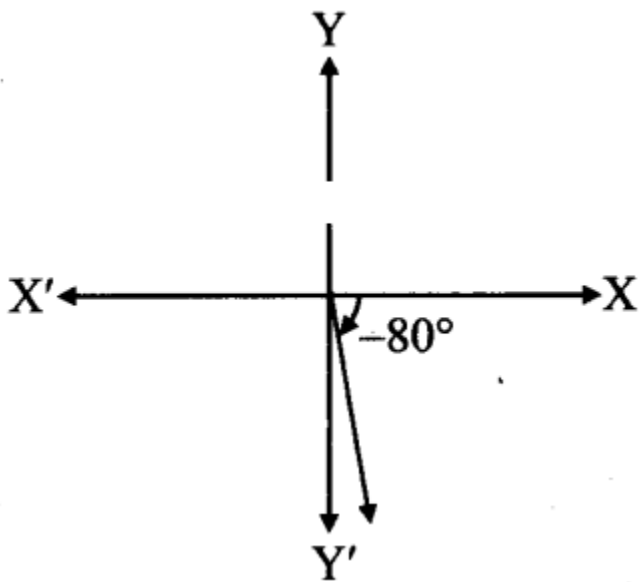
vi.

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From the figure, the given angle terminates in quadrant I.

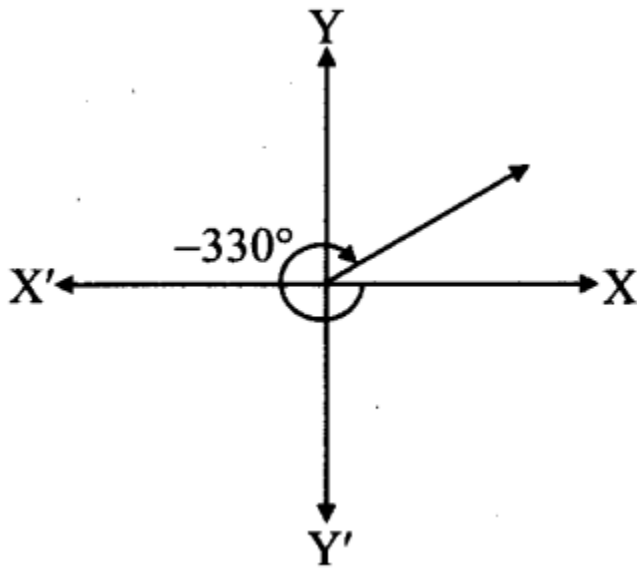
vii.



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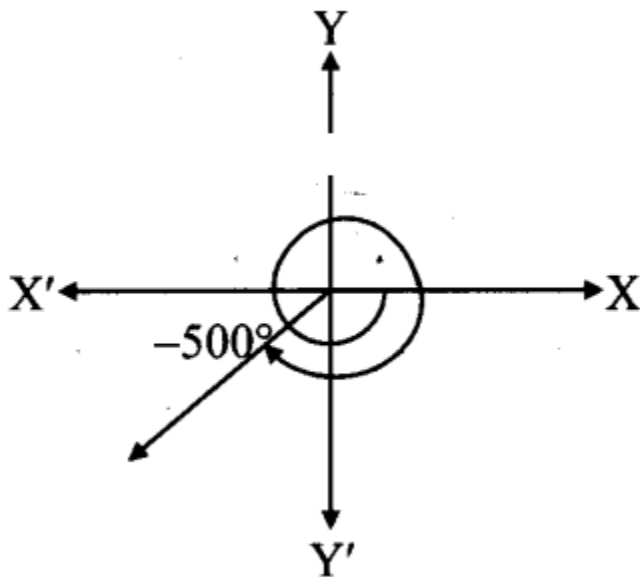
From the figure, the given angle terminates in quadrant IV.

viii.



From the figure, the given angle terminates in quadrant I.

ix.

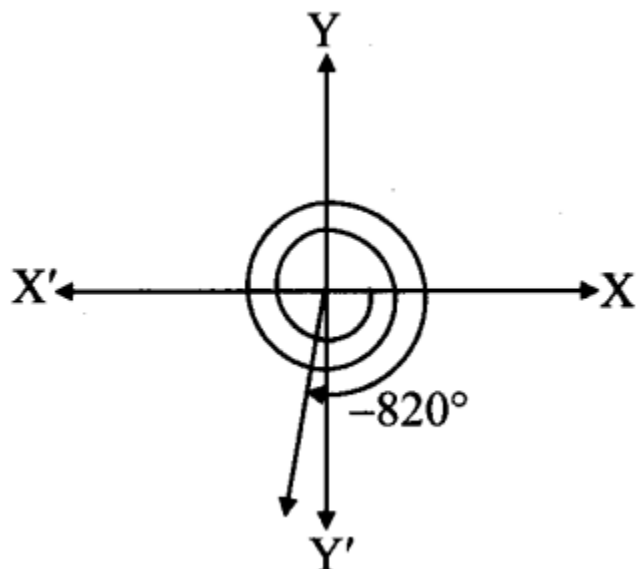


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From the figure, the given angle terminates in quadrant III.

[Note: Answer given in the textbook is 'Angle lies in quadrant II'. However, we found that it lies in quadrant III.]

x.



From the figure, the given angle terminates in quadrant III.

Question 2.

Convert the following angles into radians,

- i. 85°
- ii. 250°
- iii. -132°
- iv. $65^\circ 30'$
- v. $75^\circ 30'$
- vi. $40^\circ 48'$

Solution:

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we know that $\theta^\circ = (\theta \times \pi / 180)^\circ$

i. $85^\circ = (85 \times \pi / 180)^\circ = (17\pi / 36)^\circ$

ii. $250^\circ = (250 \times \pi / 180)^\circ = (25\pi / 18)^\circ$

iii. $132^\circ = (-132 \times \pi / 180)^\circ = (-11\pi / 15)^\circ$

[Note : Answer given in the textbook is $11\pi / 15$ However, as per our calculation it is $(-11\pi / 15)^\circ$]

iv. $65^\circ 30' = 65^\circ + 30'$

$= 65^\circ + (30/60)^\circ \dots [1' = (1/60)^\circ]$

$= 65^\circ + (1/2)^\circ$

$$= \left(65 + \frac{1}{2} \right)^\circ$$

$$= \left(\frac{131}{2} \right)^\circ$$

$$= \left(\frac{131}{2} \times \frac{\pi}{180} \right)^\circ$$

$$= \left(\frac{131\pi}{360} \right)^\circ$$

v. $75^\circ 30' = 75^\circ + 30'$

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$$\begin{aligned} &= 75^\circ + \left(\frac{30}{60}\right)^\circ \quad \dots \left[\because 1' = \left(\frac{1}{60}\right)^\circ \right] \\ &= 75^\circ + \left(\frac{1}{2}\right)^\circ \\ &= \left(75 + \frac{1}{2}\right)^\circ \\ &= \left(\frac{151}{2}\right)^\circ \\ &= \left(\frac{151}{2} \times \frac{\pi}{180}\right)^\circ \\ &= \left(\frac{151 \pi}{360}\right)^\circ \end{aligned}$$

vi. $40^\circ 48' = 40^\circ + 48'$

$$\begin{aligned} &= 40^\circ + \left(\frac{48}{60}\right)^\circ \quad \dots \left[\because 1' = \left(\frac{1}{60}\right)^\circ \right] \\ &= 40^\circ + \left(\frac{4}{5}\right)^\circ \\ &= \left(40 + \frac{4}{5}\right)^\circ \\ &= \left(\frac{204}{5}\right)^\circ \\ &= \left(\frac{204}{5} \times \frac{\pi}{180}\right)^\circ \\ &= \left(\frac{17\pi}{75}\right)^\circ \end{aligned}$$

Question 3.

Convert the following angles in degrees.

- i. 7π rad
- ii. -5π rad
- iii. 5°
- iv. 11π rad
- v. $(-14)^\circ$

Solution:

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We know that $\theta^c = \left(\theta \times \frac{180}{\pi} \right)^\circ$

i. $\frac{7\pi^c}{12} = \left(\frac{7\pi}{12} \times \frac{180}{\pi} \right)^\circ = 105^\circ$

ii. $-\frac{5\pi^c}{3} = \left(-\frac{5\pi}{3} \times \frac{180}{\pi} \right)^\circ = -300^\circ$

iii. $5^c = \left(5 \times \frac{180}{\pi} \right)^\circ = \left(\frac{900}{\pi} \right)^\circ$

iv. $\frac{11\pi^c}{18} = \left(\frac{11\pi}{18} \times \frac{180}{\pi} \right)^\circ = 110^\circ$

v. $\left(-\frac{1}{4} \right)^c = \left(-\frac{1}{4} \times \frac{180}{\pi} \right)^\circ = \left(-\frac{45}{\pi} \right)^\circ$

Question 4.

Express the following angles in degrees, minutes and seconds.

i. $(183.7)^\circ$

ii. $(245.33)^\circ$

iii. $(15)^c$

Solution:

We know that $1^\circ = 60'$ and $1' = 60''$

i. $(183.7)^\circ = 183^\circ + (0.7)^\circ$

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$$= 183^\circ + (0.7 \times 60)'$$

$$= 183^\circ + 42'$$

$$= 183^\circ 42'$$

$$\text{ii. } (245.33)^\circ = 245^\circ + (0.33)^\circ$$

$$= 245^\circ + (0.33 \times 60)'$$

$$= 245^\circ + (19.8)'$$

$$= 245^\circ + 19' + (0.8)'$$

$$= 245^\circ 19' + (0.8 \times 60)''$$

$$= 245^\circ 19' + 48''$$

$$= 245^\circ 19' 48''$$

$$\text{iii. We know that } \theta^\circ = (\theta \times 180\pi)^\circ$$

$$\begin{aligned}\therefore \left(\frac{1}{5}\right)^\circ &= \left(\frac{1}{5} \times \frac{180}{\pi}\right)^\circ \\ &= \left(\frac{36}{\pi}\right)^\circ \\ &= \left(\frac{36}{3.14}\right)^\circ \quad \dots [\because \pi = 3.14]\end{aligned}$$

$$= (11.46)^\circ$$

$$= 11^\circ + (0.46)^\circ$$

$$= 11^\circ + (0.46 \times 60)'$$

$$= 11^\circ + (27.6)'$$

$$= 11^\circ + 27' + (0.6)'$$

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$$= 11^{\circ} + 27' + (0.6 \times 60)''$$

$$= 11^{\circ} 27' + 36''$$

$$= 11^{\circ} 27' 36'' \text{ (approx.)}$$

Question 5.

In $\triangle ABC$, if $m\angle A = \frac{7\pi^c}{36}$, $m\angle B = 120^\circ$, find $m\angle C$ in degree and radian.

Solution:

We know that $\theta^c = \left(\theta \times \frac{180}{\pi}\right)^\circ$

In $\triangle ABC$,

$$m\angle A = \frac{7\pi^c}{36} = \left(\frac{7\pi}{36} \times \frac{180}{\pi}\right)^\circ = 35^\circ$$

$$m\angle B = 120^\circ$$

$$\therefore m\angle A + m\angle B + m\angle C = 180^\circ$$

... [Sum of the angles of a triangle is 180°]

$$\therefore 35^\circ + 120^\circ + m\angle C = 180^\circ \quad m\angle C = 180^\circ - 35^\circ - 120^\circ$$

$$\therefore m\angle C = 25^\circ$$

$$\begin{aligned} &= \left(25 \times \frac{\pi}{180}\right)^c \quad \dots \left[\because \theta^\circ = \left(\theta \times \frac{\pi}{180}\right)^c\right] \\ &= \left(\frac{5\pi}{36}\right)^c \end{aligned}$$

$$\therefore m\angle C = 25^\circ = \left(\frac{5\pi}{36}\right)^c$$

$$\text{i.e., } \left(\frac{5\pi}{9} \times \frac{180}{\pi}\right)^\circ, \left(\frac{5\pi}{18} \times \frac{180}{\pi}\right)^\circ,$$

Question 6.

Two angles of a triangle are $\frac{5\pi}{9}^c$ and $\frac{5\pi}{18}^c$. Find the degree and radian measures of third angle.

Solution:

We know that $\theta^c = [\theta \times \frac{\pi}{180}]^c$. The measures of two angles of a triangle are $\frac{5\pi}{9}^c$, $\frac{5\pi}{18}^c$,

$$\text{i.e., } \left(\frac{5\pi}{9} \times \frac{180}{\pi}\right)^\circ, \left(\frac{5\pi}{18} \times \frac{180}{\pi}\right)^\circ$$

$$\text{i.e., } 100^\circ, 50^\circ$$

Let the measure of third angle of the triangle be x° .

$$\therefore 100^\circ + 50^\circ + x^\circ = 180^\circ$$

...[Sum of the angles of a triangle is 180°]

$$\therefore x^\circ = 180^\circ - 100^\circ - 50^\circ$$

$$\therefore x^\circ = 30^\circ$$

$$= \left(30 \times \frac{\pi}{180}\right)^c \quad \dots \left[\because \theta^c = \left(\theta \times \frac{\pi}{180}\right)^c\right]$$

$$= \left(\frac{\pi}{6}\right)^c$$

$\therefore$ The degree and radian measures of the third angle are 30° and $\left(\frac{\pi}{6}\right)^c$ respectively.

Question 7.

In a right angled triangle, the acute angles are in the ratio 4:5. Find the angles of the triangle in degrees and radians.

Solution:

Since the triangle is a right angled triangle, one of the angles is 90° .

In the right angled triangle, the acute angles are in the ratio 4:5.

Let the measures of the acute angles of the triangle in degrees be $4k$ and $5k$, where k is a constant.

$$\therefore 4k + 5k + 90^\circ = 180^\circ$$

... [Sum of the angles of a triangle is 180°]

$$\therefore 9k = 180^\circ - 90^\circ$$

$$\therefore 9k = 90^\circ$$

$$\therefore k = 10^\circ$$

$\therefore$ The measures of the angles in degrees are

$$4k = 4 \times 10^\circ = 40^\circ,$$

$$5k = 5 \times 10^\circ = 50^\circ$$

and 90° .

we know that $\theta^\circ = \left(\theta \times \frac{\pi}{180}\right)^\circ$

$\therefore$ The measure of the angles in radius are

$$40^\circ = \left(40 \times \frac{\pi}{180}\right)^\circ = \left(\frac{2\pi}{9}\right)^\circ$$

$$50^\circ = \left(50 \times \frac{\pi}{180}\right)^\circ = \left(\frac{5\pi}{18}\right)^\circ$$

$$90^\circ = \left(90 \times \frac{\pi}{180}\right)^\circ = \left(\frac{\pi}{2}\right)^\circ$$

Question 8.

The sum of two angles is $5\pi^\circ$ and their difference is 60° . Find their measures in degrees.

Solution:

Let the measures of the two angles in degrees be x and y .

Sum of two angles is $5\pi^\circ$

$$x + y = 5\pi^c$$

$$x + y = \left(5\pi \times \frac{180}{\pi}\right) \dots \left[\theta^c = \left(\theta \times \frac{180}{\pi}\right)^\circ\right]$$

$$\therefore x + y = 900^\circ \dots\dots\dots(i)$$

$\therefore$ Difference of two angles is 60° .

$$x - y = 60^\circ \dots\dots(ii)$$

Adding (i) and (ii), we get

$$2x = 960^\circ$$

$$\therefore x = 480^\circ$$

Substituting the value of x in (i), we get

$$480^\circ + y = 900^\circ$$

$$\therefore y = 900^\circ - 480^\circ = 420^\circ$$

$\therefore$ The measures of the two angles in degrees are 480° and 420° .

Question 9.

The measures of the angles of a triangle are in the ratio 3:7:8. Find their measures in degrees and radians.

Solution:

The measures of the angles of the triangle are in the ratio 3:7:8.

Let the measures of the angles of the triangle in degrees be $3k$, $7k$ and $8k$, where k is a constant.

$$\therefore 3k + 7k + 8k = 180^\circ$$

... [Sum of the angles of a triangle is 180°]

$$\therefore 18k = 180^\circ$$

$$\therefore k = 10^\circ$$

$\therefore$ The measures of the angles in degrees are

$$3k = 3 \times 10^\circ = 30^\circ,$$

$$7k = 7 \times 10^\circ = 70^\circ \text{ and}$$

$$8k = 8 \times 10^\circ = 80^\circ.$$

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$$30^\circ = \left(30 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{6}\right)^c$$

$$70^\circ = \left(70 \times \frac{\pi}{180}\right)^c = \left(\frac{7\pi}{18}\right)^c$$

$$80^\circ = \left(80 \times \frac{\pi}{180}\right)^c = \left(\frac{4\pi}{9}\right)^c$$

Question 10.

The measures of the angles of a triangle are in A.P. and the greatest is 5 times the smallest (least). Find the angles in degrees and radians.

Solution:

Let the measures of the angles of the triangle in degrees be $a - d$, a , $a + d$, where $a > d > 0$.

$$\therefore a - d + a + a + d = 180^\circ$$

...[Sum of the angles of a triangle is 180°]

$$\therefore 3a = 180^\circ$$

$$\therefore a = 60^\circ \dots(i)$$

According to the given condition, greatest angle is 5 times the smallest angle.

$$\therefore a + d = 5(a - d)$$

$$\therefore a + d = 5a - 5d$$

$$\therefore 6d = 4a$$

$$\therefore 3d = 2a$$

$$\therefore 3d = 2(60^\circ) \dots[\text{From (i)}]$$

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$$\therefore d = \frac{120^\circ}{3} = 40^\circ$$

$\therefore$ The measures of the angles in degrees are

$$a - d = 60^\circ - 40^\circ = 20^\circ$$

$$a = 60^\circ \text{ and}$$

$$a + d = 60^\circ + 40^\circ = 100^\circ$$

$$\text{We know that } \theta^\circ = \left(\theta \times \frac{\pi}{180} \right)^c$$

$\therefore$ The measures of the angles in radians are

$$20^\circ = \left(20 \times \frac{\pi}{180} \right)^c = \left(\frac{\pi}{9} \right)^c$$

$$60^\circ = \left(60 \times \frac{\pi}{180} \right)^c = \left(\frac{\pi}{3} \right)^c$$

$$100^\circ = \left(100 \times \frac{\pi}{180} \right)^c = \left(\frac{5\pi}{9} \right)^c$$

Question 11.

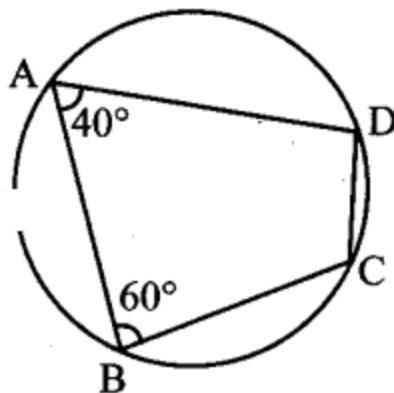
In a cyclic quadrilateral two adjacent angles are 40 and $\frac{\pi^c}{3}$. Find the angles of the quadrilateral in degrees.

Solution:

Let ABCD be the cyclic quadrilateral such that

$$\angle A = 40^\circ \text{ and}$$

$$\angle B = \frac{\pi^c}{3} = \left(\frac{\pi}{3} \times \frac{180}{\pi} \right)^\circ \quad \dots \left[\because \theta^c = \left(\theta \times \frac{180}{\pi} \right)^\circ \right]$$
$$= 60^\circ$$



$$\therefore \angle A + \angle C = 180^\circ$$

$$\therefore 40^\circ + \angle C = 180^\circ$$

$$\therefore \angle C = 180^\circ - 40^\circ = 140^\circ$$

$$\text{Also, } \angle B + \angle D = 180^\circ$$

... [Opposite angles of a cyclic quadrilateral are supplementary]

$$\therefore 60^\circ + \angle D = 180^\circ$$

$$\therefore \angle D = 180^\circ - 60^\circ = 120^\circ$$

$\therefore$ The angles of the quadrilateral in degrees are 40° , 60° , 140° and 120° .

Question 12.

One angle of a quadrilateral has measure $\frac{2\pi^c}{5}$ and the measures of other three angles are in the ratio 2:3:4. Find their measures in degrees and radians.

Solution:

We know that $\theta^c = \left(\theta \times \frac{180}{\pi}\right)^\circ$

One angle of the quadrilateral has measure $\frac{2\pi^c}{5} = \left(\frac{2\pi}{5} \times \frac{180}{\pi}\right)^\circ = 72^\circ$

Measures of other three angles are in the ratio 2:3:4.

Let the measures of the other three angles of the quadrilateral in degrees be $2k$, $3k$, $4k$, where k is a constant.

$$\therefore 72^\circ + 2k + 3k + 4k = 360^\circ$$

...[Sum of the angles of a quadrilateral is 360°]

$$\therefore 9k = 288^\circ$$

$$k = 32^\circ$$

$\therefore$ The measures of the angles in degrees are

$$2k = 2 \times 32^\circ = 64^\circ$$

$$3k = 3 \times 32^\circ = 96^\circ$$

$$4k = 4 \times 32^\circ = 128^\circ$$

We know that $\theta^\circ = \left(\theta \times \frac{\pi}{180}\right)^c$

$\therefore$ The measures of the angles in radians are

$$64^\circ = \left(64 \times \frac{\pi}{180}\right)^c = \left(\frac{16\pi}{45}\right)^c$$

$$96^\circ = \left(96 \times \frac{\pi}{180}\right)^c = \left(\frac{8\pi}{15}\right)^c$$

$$128^\circ = \left(128 \times \frac{\pi}{180}\right)^c = \left(\frac{32\pi}{45}\right)^c$$

Question 13.

Find the degree and radian measures of exterior and interior angles of a regular

- i. pentagon
- ii. hexagon
- iii. septagon
- iv. octagon

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Solution:

i. Pentagon:

Number of sides = 5

Number of exterior angles = 5

Sum of exterior angles = 360°

$$\begin{aligned}\therefore \text{Each exterior angle} &= \frac{360^\circ}{\text{no. of sides}} = \frac{360^\circ}{5} = 72^\circ \\ &= \left(72 \times \frac{\pi}{180}\right)^c = \left(\frac{2\pi}{5}\right)^c\end{aligned}$$

Interior angle + Exterior angle = 180°

$\therefore$ Each interior angle = $180^\circ - 72^\circ = 108^\circ$

= \(\

ii. Hexagon:

Number of sides = 6

Number of exterior angles = 6

Sum of exterior angles = 360°

$$\begin{aligned}\therefore \text{Each exterior angle} &= \frac{360^\circ}{\text{no. of sides}} = \frac{360^\circ}{6} = 60^\circ \\ &= \left(60 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{3}\right)^c\end{aligned}$$

Interior angle + Exterior angle = 180°

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$\therefore$ Each interior angle = $180^\circ - 60^\circ = 120^\circ$

$$= (120 \times \frac{\pi}{180})^\circ = (\frac{2\pi}{3})^\circ$$

iii. Septagon:

Number of sides = 7

Number of exterior angles = 7

Sum of exterior angles = 360°

$\therefore$ Each exterior angle = $\frac{360^\circ}{\text{no. of sides}} = \frac{360^\circ}{7}$

$$= (51.43)^\circ$$

$$= \left(\frac{360}{7} \times \frac{\pi}{180} \right)^c = \left(\frac{2\pi}{7} \right)^c$$

$$\text{Interior angle} + \text{Exterior angle} = 180^\circ$$

$$\therefore \text{Each interior angle} = 180^\circ - \left(\frac{360}{7} \right)^\circ$$

$$\therefore \text{Each interior angle} = 180^\circ - \left(\frac{360}{7} \right)^\circ$$

$$= \left(\frac{1260 - 360}{7} \right)^\circ$$

$$= \left(\frac{900}{7} \right)^\circ = (128.57)^\circ$$

$$= \left(\frac{900}{7} \times \frac{\pi}{180} \right)^c = \left(\frac{5\pi}{7} \right)^c$$

iv. Octagon:

Number of sides = 8

Number of exterior angles = 8

Sum of exterior angles = 360°

$$\therefore \text{Each exterior angle} = \frac{360^\circ}{\text{no. of sides}} = \frac{360^\circ}{8}$$

$$= 45^\circ$$

$$= \left(45 \times \frac{\pi}{180} \right)^c = \left(\frac{\pi}{4} \right)^c$$

$$\text{Interior angle} + \text{Exterior angle} = 180^\circ$$

$$\text{Each interior angle} = 180^\circ - 45^\circ = 135^\circ$$

$$= \left(135 \times \frac{\pi}{180}\right)^c = \left(\frac{3\pi}{4}\right)^c$$

Question 14.

Find the angle between hour-hand and minute-hand in a clock at

- i. ten past eleven
- ii. twenty past seven
- iii. thirty five past one
- iv. quarter to six
- v. 2:20
- vi. 10:10

Solution:

- i. At 11:10, the minute-hand is at mark 2 and hour-hand has crossed $\left(\frac{1}{6}\right)^{\text{th}}$ of the angle between 11 and 12.



Angle between two consecutive marks = $\frac{360^\circ}{12} = 30^\circ$

Angle traced by hour-hand in 10 minutes

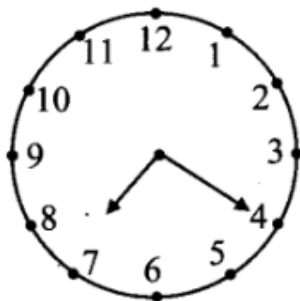
$$= \frac{1}{6} (30^\circ) = 5^\circ$$

Angle between marks 11 and 2 = $3 \times 30^\circ = 90^\circ$



∴ Angle between two hands of the clock at ten past eleven = $90^\circ - 5^\circ = 85^\circ$

ii. At 7 : 20 the minute -hand is at mark 4 and hour -hand has crossed $\left(\frac{1}{3}\right)$ rd of angle between 7 and 8.



Angle between two consecutive marks

$$= 360^\circ / 12 = 30^\circ$$

Angle traced by hour-hand in 20 minutes

$$= \frac{1}{3}(30^\circ) = 10^\circ$$

Angle between marks 4 and 7 = $3 \times 30^\circ = 90^\circ$

Angle between two hands of the clock at twenty past seven = $90^\circ - 10^\circ = 80^\circ$

iii. At 1 : 35 the minute -hand is at mark 7 and hour -hand has crossed $\left(\frac{7}{12}\right)$ th of angle between 1 and 2.



Angle between two consecutive marks

$$= 360^\circ / 12 = 30^\circ$$

Angle traced by hour-hand in 35 minutes

$$= \frac{7}{12}(30^\circ) = \left(\frac{35}{2}\right)^\circ = \left(17\frac{1}{2}\right)^\circ \frac{1}{3}$$

Angle between marks 1 and 7 = $6 \times 30^\circ = 180^\circ$

$$\begin{aligned} \text{Angle between two hands of the clock at thirty five past one} &= 180^\circ - \left(17\frac{1}{2}\right)^\circ = \left(162\frac{1}{2}\right)^\circ \\ &= 162^\circ + \frac{1}{2} = 162^\circ 30' \end{aligned}$$

iv. At 5:45, the minute-hand is at mark 9 and hour- hand has crossed ($\frac{3}{4}$)th of the angle between 5 and 6.



Angle between two consecutive marks

$$= 360^\circ / 12 = 30^\circ$$

Angle traced by hour-hand in 45 minutes

$$\frac{3}{4}(30^\circ) = (22.5)^\circ = \left(22\frac{1}{2}\right)^\circ$$

Angle between marks 5 and 9

$$= 4 \times 30^\circ = 120^\circ$$

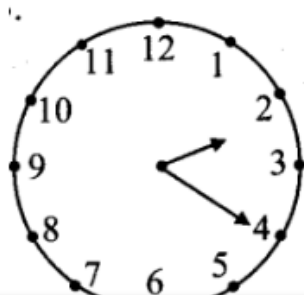
$$\therefore \text{Angle between two hands of the clock at quarter to six} = 120^\circ - \left(22\frac{1}{2}\right)^\circ$$

$$= \left(97\frac{1}{2}\right)^\circ$$

$$= 97^\circ + \frac{1^\circ}{2}$$

$$= 97^\circ 30'$$

v. At 2 : 20, the minute-hand is at mark 4 hour hand has crossed $\frac{1}{3}$ rd of the angle between 2 and 3.



Angle between two consecutive marks = $360^\circ/12 = 30^\circ$

Angle traced by hour-hand in 20 minutes

$$= \frac{1}{3}(30^\circ) = 10^\circ$$

Angle between marks 2 and 4 = $2 \times 30^\circ = 60^\circ$

$\therefore$ Angle between two hands of the clock at 2:20 = $60^\circ - 10^\circ = 50^\circ$

vi. At 10:10, the minute-hand is at mark 2 and hour-hand has crossed $\frac{1}{6}$ th between 10 and 11.



Angle between two consecutive marks

$$360^\circ/12 = 30^\circ$$

Angle traced by hour-hand in 10 minutes

$$= \frac{1}{6}(30^\circ) = 5^\circ$$

Angle between marks 10 and 2 = $4 \times 30^\circ = 120^\circ$

... Angle between two hands of the clock at 10:10

$$= 120^\circ - 5^\circ = 115^\circ$$

Ex 1.2

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Question 1.

Find the length of an arc of a circle which subtends an angle of 108° at the centre, if the radius of the circle is 15 cm.

Solution:

Here, $r = 15\text{cm}$ and

$$\theta = 108^\circ = \left(108 \times \frac{\pi}{180}\right)^c = \left(\frac{3\pi}{5}\right)^c$$

Since $S = r.\theta$

$$S = 15 \times \frac{3\pi}{5}$$

$$= 9\pi \text{ cm.}$$

Question 2.

The radius of a circle is 9 cm. Find the length of an arc of this circle which cuts off a chord of length equal to length of radius.

Solution:

Here, $r = 9\text{cm}$

Let the arc AB cut off a chord equal to the radius of the circle.

Since $OA = OB = AB$,

ΔOAB is an equilateral triangle.

$$m\angle AOB = 60^\circ$$

$$\theta = 60^\circ$$

$$= \left(60 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{3}\right)^c$$

Since $S = r.\theta$,

$$S = 9 \times \frac{\pi}{3} = 3\pi \text{ cm.}$$

Question 3.

Find the angle in degree subtended at the centre of a circle by an arc whose length is 15 cm, if the radius of the circle is 25 cm.

Solution:

Here, $r = 25 \text{ cm}$ and $S = 15 \text{ cm}$

Since $S = r.\theta$,

$$15 = 25 \times \theta$$

$$\therefore \theta = \left(\frac{15}{25}\right)^c$$

$$\therefore \theta = \left(\frac{3}{5}\right)^c = \left(\frac{3}{5} \times \frac{180}{\pi}\right)^\circ$$

$$= \left(\frac{108}{\pi}\right)^\circ = \left(\frac{108}{3.14}\right)^\circ \quad \dots[\because \pi = 3.14]$$

$$= (34.40)^\circ \text{ (approx.)}$$

∴ The required angle in degree is $\left(\frac{108}{\pi}\right)^0$ or $(34.40)^\circ$ (approx.).

Question 4.

A pendulum of length 14 cm oscillates through an angle of 18° . Find the length of its path.

Solution:

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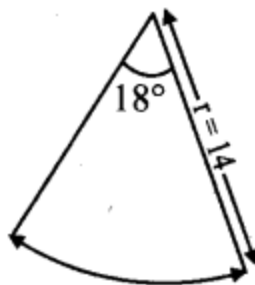
Here, $r = 14$ cm and

$$\theta = 18^\circ = \left(18 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{10}\right)^c$$

Since $S = r.\theta$,

$$S = 14 \times \frac{\pi}{10}$$

$$\begin{aligned} \therefore S &= \frac{7\pi}{5} = \frac{7(3.14)}{5} \quad \dots[\because \pi = 3.14] \\ &= \frac{21.98}{5} = 4.4 \text{ cm. (approx.)} \end{aligned}$$



Question 5.

Two arcs of the same length subtend angles of 60° and 75° at the centres of the two circles. What is the ratio of radii of two circles?

Solution:

Let r_1 and r_2 be the radii of the two circles and let their arcs of same length S subtend angles of 60° and 75° at their centres.

Angle subtended at the centre of the first circle,

$$\theta_1 = 60^\circ = \left(60 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{3}\right)^c$$

$$\therefore S = r_1\theta_1 = r_1\left(\frac{\pi}{3}\right)$$

Angle subtended at the centre of the second circle,

$$\theta_2 = 75^\circ = \left(75 \times \frac{\pi}{180}\right)^c = \left(\frac{5\pi}{12}\right)^c$$

$$\therefore S = r_2\theta_2 = r_2\left(\frac{5\pi}{12}\right) \quad \dots(ii)$$

From (i) and (ii), we get

$$r_1\left(\frac{\pi}{3}\right) = r_2\left(\frac{5\pi}{12}\right)$$

$$\therefore \frac{r_1}{r_2} = \frac{15}{12}$$

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

$$\therefore r_1 : r_2 = 5 : 4.$$

Question 6.

The area of the circle is 2571 sq.cm. Find the length of its arc subtending an angle of 144° at the centre. Also find the area of the corresponding sector.

Solution:

$$\text{Area of circle} = \pi r^2$$

But area is given to be 2571 sq.cm

$$\therefore 2571 = \pi r^2$$

$$\therefore r^2 = 25$$

$$\therefore r = 5 \text{ cm}$$

$$\theta = 144^\circ = \left(144 \times \frac{\pi}{180}\right)^c = \left(\frac{4\pi}{5}\right)^c$$

Since $s = r\theta$

$$s = 5\left(\frac{4\pi}{5}\right) = 4\pi$$

$$\text{Also, } A(\text{sector}) = \frac{1}{2} \times r \times s = \frac{1}{2} \times 5 \times 4\pi$$

$$= 10\pi \text{ sq. cm}$$

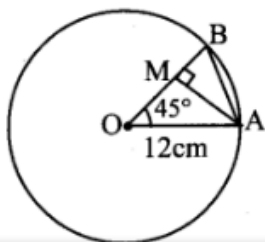
Question 7.

OAB is a sector of the circle having centre at O and radius 12 cm. If $m\angle AOB = 45^\circ$, find the difference between the area of sector OAB and ΔAOB .

Solution:

Here, $r = 12 \text{ cm}$

$$\theta = 45^\circ = \left(45 \times \frac{\pi}{180}\right)^c = \left(\frac{\pi}{4}\right)^c$$



Draw $AM \perp OB$

In ΔOAM ,

$$\begin{aligned}\therefore \frac{1}{\sqrt{2}} &= \frac{AM}{12} \\ \therefore AM &= \frac{12}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = 6\sqrt{2} \text{ cm} \\ \therefore A(\text{sector OAB}) - A(\triangle AOB) \\ &= \frac{1}{2}r^2\theta - \frac{1}{2} \times OB \times AM \\ &= \frac{1}{2} \times (12)^2 \times \frac{\pi}{4} - \frac{1}{2} \times 12 \times 6\sqrt{2} \\ &= \frac{1}{2} \times 144 \times \frac{\pi}{4} - 36\sqrt{2} = 18\pi - 36\sqrt{2} \\ &= 18(\pi - 2\sqrt{2}) \text{ sq.cm.}\end{aligned}$$

[Note: The question has been modified.]

Question 8.

OPQ is the sector of a circle having centre at O and radius 15 cm. If $m\angle POQ = 30^\circ$, find the area enclosed by arc PQ and chord PQ.

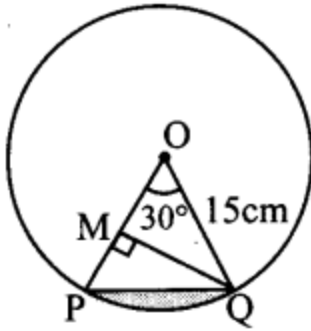
Solution:

Here, $r = 15 \text{ cm}$

$m\angle POQ = 30^\circ$

$$\left(30 \times \frac{\pi}{180}\right)^c$$

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$$\therefore \theta = \left(\frac{\pi}{6}\right)^c$$

Draw $QM \perp OP$

In $\triangle OQM$,

$$\sin 30^\circ = \frac{QM}{15}$$

$$QM = 15 \times \frac{1}{2} = \frac{15}{2}$$

Shaded portion indicates the area enclosed by arc PQ and chord PQ.

$\therefore$ A(shaded portion)

$$= A(\text{sector OPQ}) - A(\triangle OPQ)$$

$$= \frac{1}{2}r^2\theta - \frac{1}{2} \times OP \times QM$$

$$= \frac{1}{2} \times (15)^2 \times \frac{\pi}{6} - \frac{1}{2} \times 15 \times \frac{15}{2}$$

$$= \frac{225\pi}{12} - \frac{225}{4}$$

$$= \frac{225}{4} \left(\frac{\pi}{3} - 1 \right) \text{sq.cm.}$$

Question 9.

The perimeter of a sector of the circle of area 25π sq.cm is 20 cm. Find the area of sector.

Solution:

$$\text{Area of circle} = \pi r^2$$

But area is given to be 25π sq.cm.

$$\therefore 25\pi = \pi r^2$$

$$\therefore r^2 = 25$$

$$\therefore r = 5 \text{ cm}$$

$$\text{Perimeter of sector} = 2r + S$$

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But perimeter is given to be 20 cm.

$$\therefore 20 = 2(5) + S$$

$$\therefore 20 = 10 + S$$

$$\therefore S = 10 \text{ cm}$$

$$\text{Area of sector} = \frac{1}{2} \times r \times S$$

$$= \frac{1}{2} \times 5 \times 10$$

$$= 25 \text{sq.cm.}$$

Question 10.

The perimeter of a sector of the circle of area 64 sq.cm is 56 cm. Find the area of the sector.

Solution:

$$\text{Area of circle} = \pi r^2$$

But area is given to be 64 sq.cm.

$$\therefore 64 = \pi r^2$$

$$\therefore r^2 = 64$$

$$\therefore r = 8 \text{ cm}$$

$$\text{Perimeter of sector} = 2r + S$$

But perimeter is given to be 56 cm.

$$\therefore 56 = 2(8) + S$$

$$\therefore 56 = 16 + S$$

$$\therefore S = 40 \text{ cm}$$

$$\text{Area of sector} = \frac{1}{2} \times r \times S$$

$$= \frac{1}{2} \times 8 \times 40$$

$$= 160 \text{sq.cm.}$$



Maharashtra Board Solutions

Class 11 Arts & Science Maths

(Part 1)

- Chapter 1- Angle and its Measurement
- Chapter 2- Trigonometry – I
- Chapter 3- Trigonometry – II
- Chapter 4- Determinants and Matrices
- Chapter 5- Straight Line
- Chapter 6- Circle
- Chapter 7- Conic Sections
- Chapter 8- Measures of Dispersion
- Chapter 9- Probability

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The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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