

→ ULTIMATE MATHEMATICS →

(1)

By: AJAY MITTAL: 9891067390

TRIGONOMETRY (CLASS NO. 9) (T-9)Degree and Radians

$$\begin{aligned} (i) \quad 1^\circ &= 60' \text{ (minutes)} \\ (ii) \quad 1' &= 60'' \text{ (seconds)} \end{aligned}$$

Conversions

$$(i) \quad \text{Radian measure} = \frac{\pi}{180} \times \text{degree measure}$$

$$(ii) \quad \text{Degree measure} = \left(\frac{180}{\pi} \times \text{Radian measure} \right)^\circ$$

$$(iii) \quad \pi = \frac{22}{7}$$

Q. No. 1 Convert 4 Radians into degree

$$\text{Sol.} \quad \text{degree measure} = \left(\frac{180}{\pi} \times 4 \right)^\circ$$

$$= \left(\frac{180}{\frac{22}{7}} \times 4 \right)^\circ$$

$$= \left(\frac{11}{22} \times 2520 \right)^\circ$$

$$= \left(229 \frac{1}{11} \right)^\circ$$

$$= 229^\circ \left(\frac{1}{11} \times 60 \right)'$$

$$= 229^\circ \left(5 \frac{5}{11} \right)'$$

$$= 229^\circ 5' \left(\frac{5}{11} \times 60 \right)''$$

$$= 229^\circ 5' \left(\frac{300}{11} \right)''$$

$$\text{degree measure} = 229^\circ 5' 27'' \text{ (Approx)}$$

NOTE

$$1 \text{ Radian} \approx 57^\circ$$

$$\sin(30) \neq \frac{1}{2}$$

class (T-9)

Qn. 2Convert 24° in to Radian measureSoln

$$\text{Radian measure} = \left(\frac{\pi}{180} \times 24 \right) \text{ Radian}$$

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

$$(\pi) = \frac{4 \times 22}{3 \times 7} = \frac{88}{21} \text{ Radian}$$

Qn. 3Convert $36^\circ 36' 36''$ in to Radian MeasureSol

$$36'' = \left(\frac{36}{60} \right)' = \left(\frac{3}{5} \right)'$$

$$36' 36'' = \left(36 \frac{3}{5} \right)'$$

$$36' 36'' = \left(\frac{183}{5} \right)'$$

$$= \left(\frac{183}{5 \times 60} \right)^\circ$$

$$= \left(\frac{61}{100} \right)^\circ$$

$$36^\circ 36' 36'' = \left(36 + \frac{61}{100} \right)^\circ$$

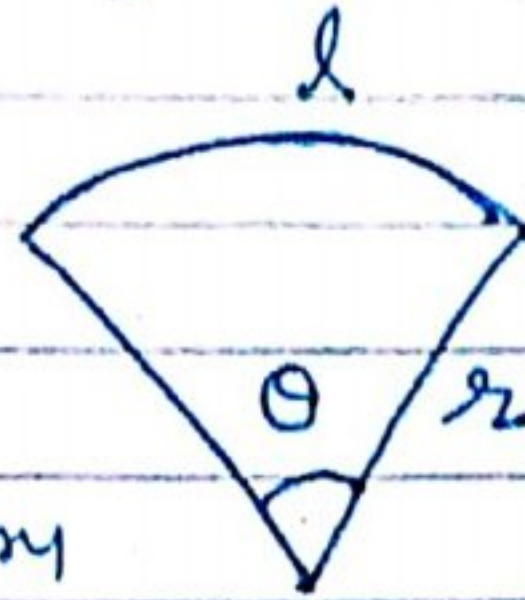
$$= \left(\frac{3661}{100} \right)^\circ$$

$$\text{Radian Measure} = \left(\frac{\pi}{180} \times \frac{3661}{100} \right) \text{ Radian}$$

$$= \left(\frac{3661\pi}{18000} \right) \text{ Radian} \quad \underline{\underline{\text{Ans}}}$$

Formula

$$l = r\theta$$

 $\theta \rightarrow$ must be in Radian

Ques 1 The minute hand of a watch is 1.5 cm long. How far does its tip move in 40 minutes? (use $\pi = 3.14$)

Sol

$$r = 1.5 \text{ cm} = \frac{3}{2} \text{ cm}$$

$$l = ?$$

Minute hand

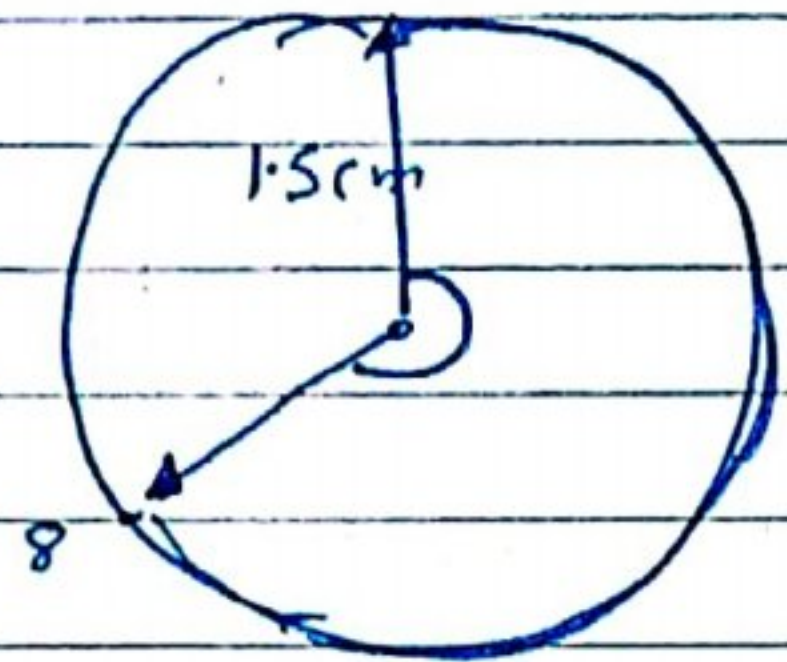
$$60 \text{ Minutes} \rightarrow 360^\circ$$

$$1 \text{ Minute} \rightarrow \frac{360}{60} = 6^\circ$$

$$40 \text{ Minutes} \rightarrow 40 \times 6 = 240^\circ$$

$$\theta = 240^\circ$$

$$\theta = \frac{240}{180} \times 240 = \frac{47}{3}$$



$$l = r\theta$$

$$l = \frac{3}{2} \times \frac{47}{3} = 2\pi = 2 \times 3.14 = 6.28 \text{ cm}$$

$$\therefore l = 6.28 \text{ cm} \quad \underline{\text{Ans}}$$

Ques 2 If the arcs of the same lengths in two circles subtend angles 65° and 110° at the centre find the ratio of their radii.

Soln

$$\text{Given } l_1 = l_2$$

$$\text{To find } r_1 : r_2$$

$$\theta_1 = 65^\circ$$

$$\theta_2 = 110^\circ$$

Class (T-9)

(4)

$$\theta_1 = \frac{\pi}{180} \times 65 \text{ radian}$$

$$\theta_2 = \frac{\pi}{180} \times 110 \text{ radian}$$

$$l_1 = r_1 \theta_1 \quad \text{and} \quad l_2 = r_2 \theta_2$$

divide

$$\frac{l_1}{l_2} = \frac{r_1 \theta_1}{r_2 \theta_2}$$

$$\therefore l_1 = l_2$$

$$l = r_1 \times \frac{\pi}{180} \times 65$$

$$r_2 \times \frac{\pi}{180} \times 110$$

$$\frac{110}{65} = \frac{r_1}{r_2}$$

$$\therefore r_1 : r_2 = 22 : 13 \quad \underline{\underline{\text{Ans}}}$$

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

Sol.

In one Minute → 360 revolutions

60 seconds → 360 revolutions

1 second → $\frac{360}{60} = 6$ revolutions

1 second → $6 \times 360^\circ$

1 second → $\frac{\pi}{180} \times 6 \times 360^2$

= 12π Radians Ans

CLASS (T-9)

(5)

Qn. 4 → In a circle of diameter 40cm, the length of a chord is 20cm. Find the length of the minor arc of the chord.

Sol.

$$d = 40\text{cm}$$

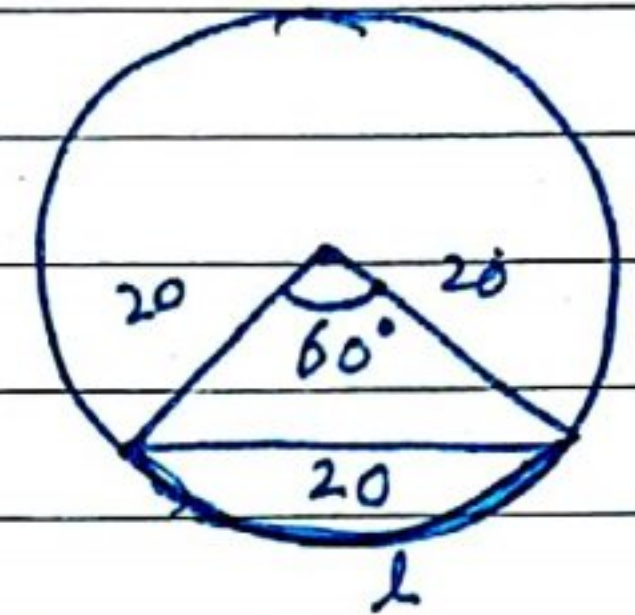
$$\Rightarrow r = 20\text{cm}$$

$$\theta = 60^\circ = \frac{\pi}{180} \times 60 = \frac{\pi}{3}$$

$$l = r\theta$$

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

$$l = 20 \times \frac{3.14}{3} = \frac{62.8}{3} = \boxed{20.93} \text{ cm}$$



Qn. 5 → Find the angle b/w minute hand and hour hand when the time is 7:20 of a watch

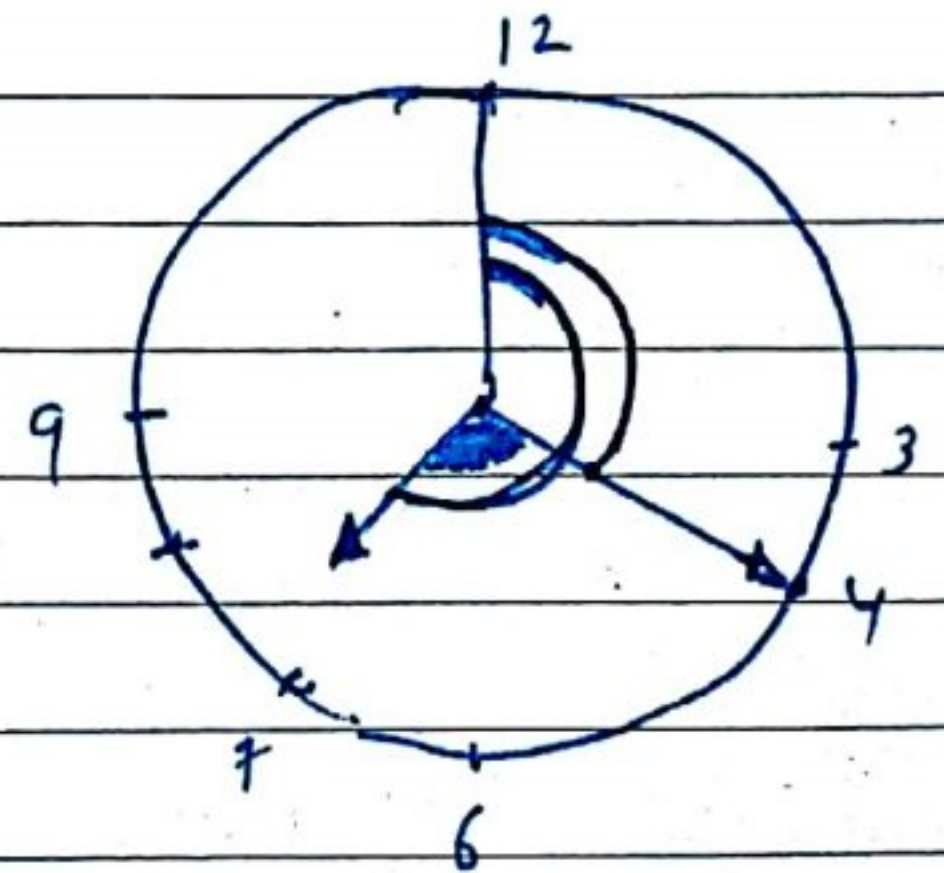
Sol.

Minute hand

$$60 \text{ minutes} \rightarrow 360^\circ$$

$$1 \text{ Minute} \rightarrow \frac{360}{60} = 6^\circ$$

$$20 \text{ Minutes} \rightarrow 20 \times 6 = 120^\circ$$

Hour hand

$$12 \text{ hours} \rightarrow 360^\circ$$

$$1 \text{ hr} \rightarrow \frac{360}{12} = 30^\circ$$

$$\left(\frac{22}{3}\right) \text{ hr} \rightarrow \frac{22}{3} \times 30 = 220^\circ$$

$$\text{Reqd angle} = 220^\circ - 120^\circ = 100^\circ$$

Ans

$$7:20$$

$$\left(7 \frac{20}{60}\right) \text{ hr}$$

$$= \left(7 \frac{1}{3}\right) \text{ hr}$$

$$= \left(\frac{22}{3}\right) \text{ hr}$$

CLASS (T-9)

(6)

Q. 6 → Find the angle in radians and also in degree through which a pendulum swings if its length is 75 cm and the tip describes an arc of length 15 cm.

Sol

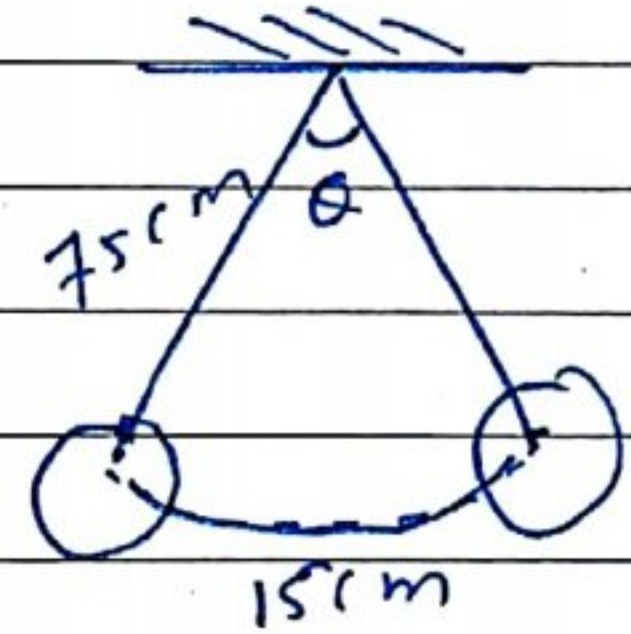
$$l = 15 \text{ cm}, \quad r = 75 \text{ cm}$$

$$\theta = ?$$

$$l = r\theta$$

$$15 = 75\theta$$

$$\theta = \frac{1}{5} \text{ Radian}$$



$$\text{Degree measure} = \left(\frac{180}{\pi} \times \frac{1}{5} \right)^\circ$$

$$= \left(\frac{180 \times 7 \times 1}{22 \times 5} \right)^\circ$$

$$= \left(\frac{90 \times 7 \times 1}{11 \times 5} \right)^\circ$$

$$= \left(\frac{18 \times 7}{11} \right)^\circ$$

$$= \left(\frac{126}{11} \right)^\circ$$

$$= \left(11 \frac{5}{11} \right)^\circ$$

$$= 11^\circ \left(\frac{5}{11} \times 60 \right)'$$

$$= 11^\circ \left(\frac{300}{11} \right)'$$

$$= 11^\circ \left(27 \frac{3}{11} \right)'$$

$$= 11^\circ 27' \left(\frac{3}{11} \times 60 \right)''$$

$$= 11^\circ 27' \left(\frac{180}{11} \right)''$$

$$= 11^\circ 27' 16'' \text{ Appx}$$