

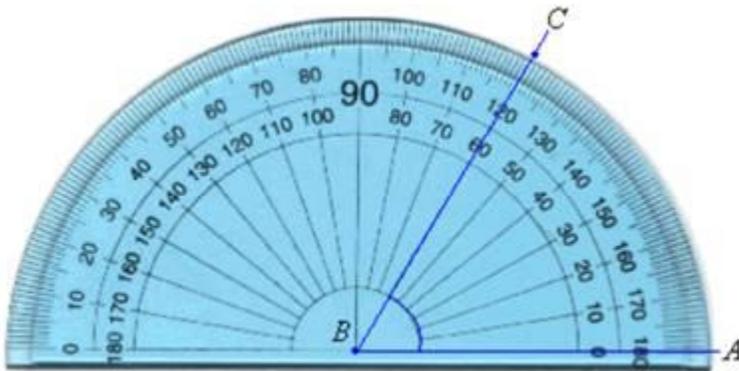
Measurement Of Angles

Exercise 14

Q. 1. A. Using a protractor, draw each of the following angles.

60°

Answer :

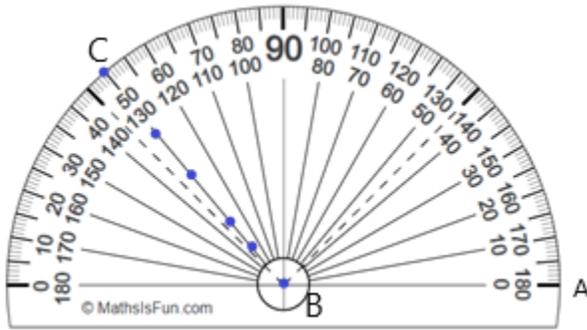


- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 60° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.

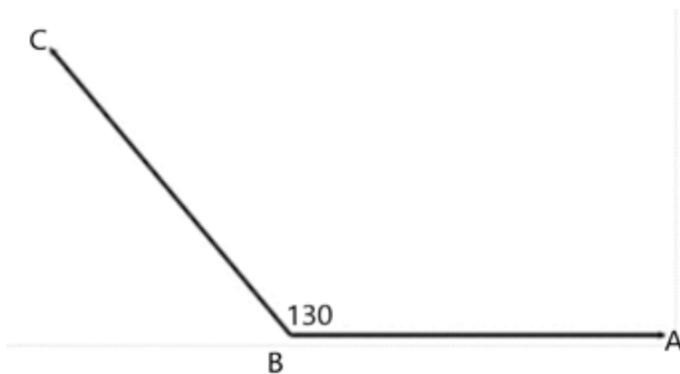
Q. 1. B. Using a protractor, draw each of the following angles.

130°

Answer :



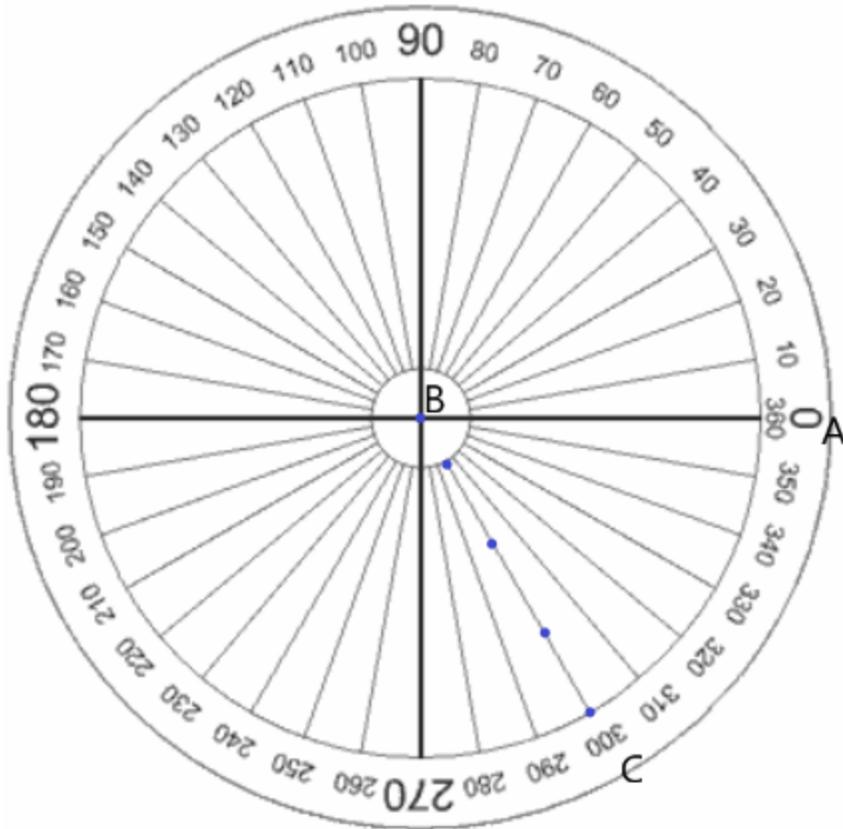
- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 130° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



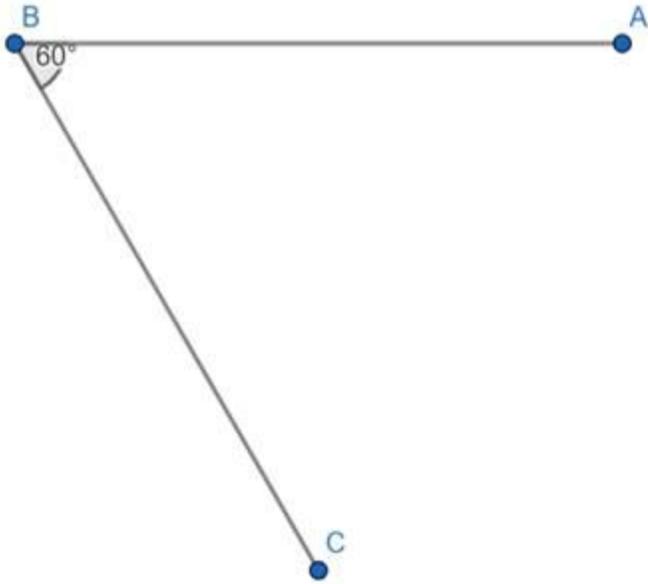
Q. 1. C. Using a protractor, draw each of the following angles.

300°

Answer :



- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 300° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



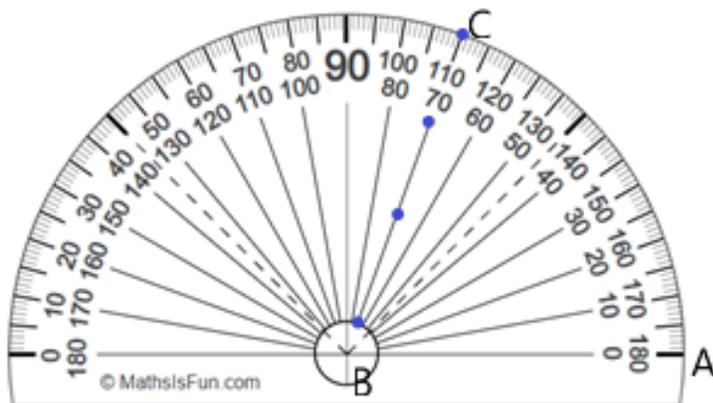
Q. 1. D. Using a protractor, draw each of the following angles.

430°

Answer : The given angle is greater than 360°

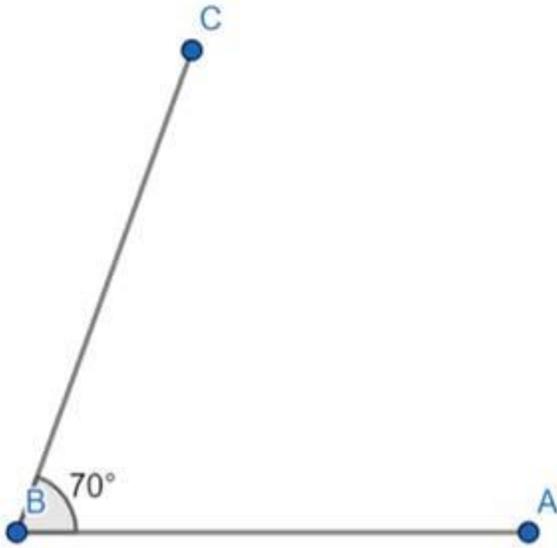
Adding or subtracting 360° from a particular angle does't changes its position.

Therefore, Angle can also be written at as = $430^\circ - 360^\circ = 70^\circ$



- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.

- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 70° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



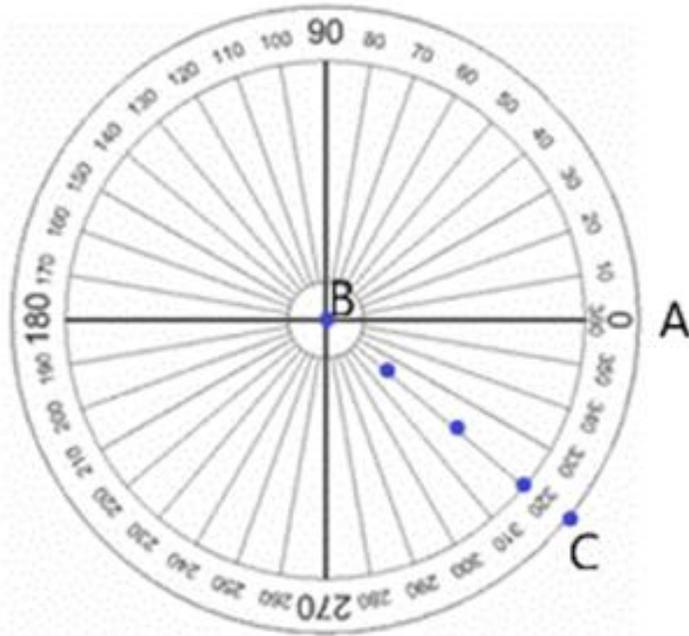
Q. 1. E. Using a protractor, draw each of the following angles.

-40°

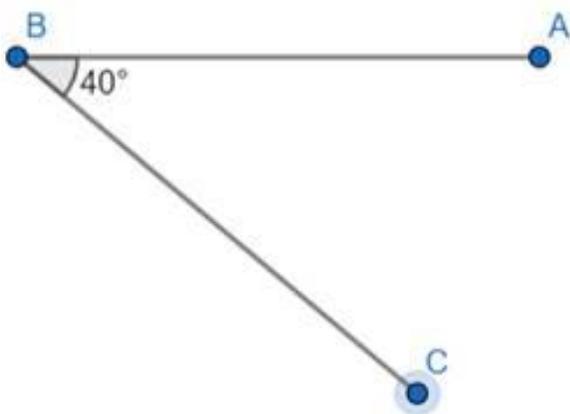
Answer : The given angle is negative

Adding or subtracting 360° from a particular angle does'nt changes its position.

Therefore, Angle can also be written as $-40^\circ + 360^\circ = 320^\circ$



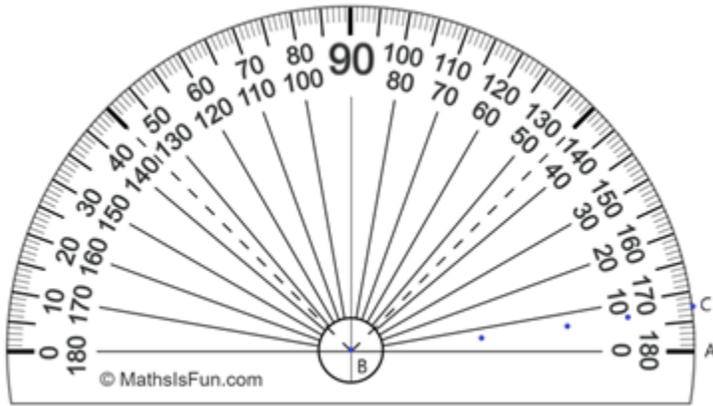
- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 320° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



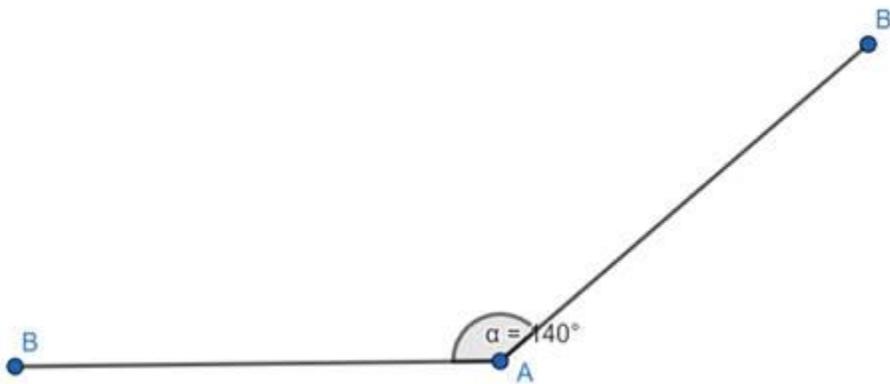
Q. 1. F. Using a protractor, draw each of the following angles.

-220°

Answer : Given angle can be completely written in degree as = -220°



$$-220^\circ = 360^\circ - 220^\circ = 140^\circ$$



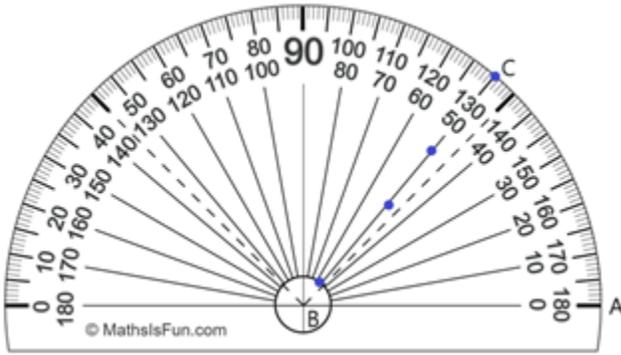
Q. 1. G. Using a protractor, draw each of the following angles.

-310°

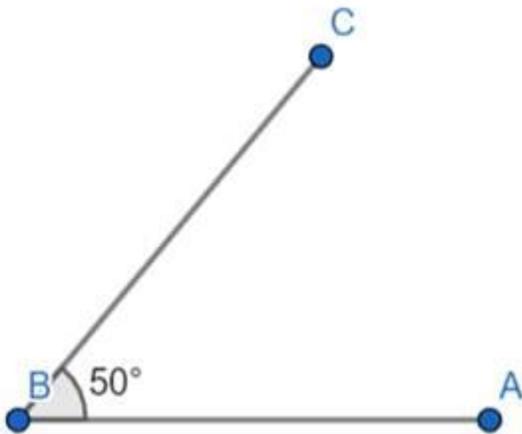
Answer : The given angle is negative

Adding or subtracting 360° from a particular angle does't changes its position.

Therefore, Angle can also be written as=-310° + 360° = 50°



- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 50° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



Q. 1. H. Using a protractor, draw each of the following angles.

-400°

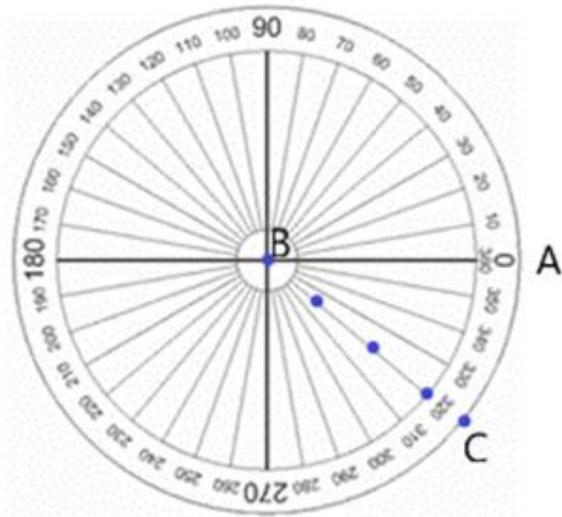
Answer : The given angle is negative

Adding or subtracting 360° from a particular angle does'nt changes its position.

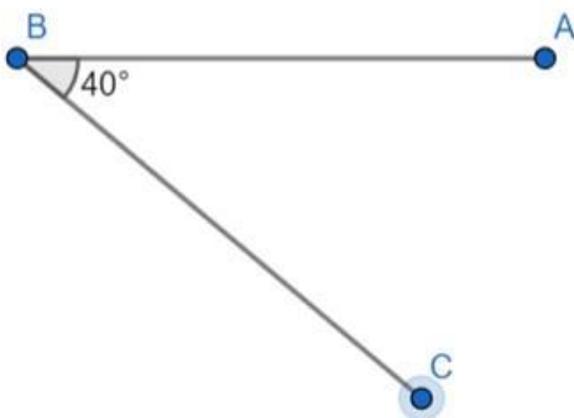
Therefore, Angle can also be written as $-400^\circ + 360^\circ = -40^\circ$

The angle is still negative, so we will further add 360° to it.

Therefore, Angle can also be written as $-40^\circ + 360^\circ = 320^\circ$



- Draw a straight line AB.
- Place a dot at B. This dot represents the vertex of the angle.
- Place the centre of the protractor at B and the baseline of the protractor along the arm BA.
- Find 320° on the scale and mark a small dot at the edge of the protractor.
- Join the vertex B to the small dot with a ruler to form the second arm, BC, of the angle.
- Mark the angle with a small arc as shown below.



Q. 1. Express each of the following angles in radians

36°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = 36 \times \frac{\pi}{180} = \frac{\pi}{5}$$

Q. 2. A. Express each of the following angles in radians

120°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = 120 \times \frac{\pi}{180} = \frac{2\pi}{3}$$

Q. 2. C. Express each of the following angles in radians

225°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = 225 \times \frac{\pi}{180} = \frac{5\pi}{4}$$

Q. 2. D. Express each of the following angles in radians

330°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = 330 \times \frac{\pi}{180} = \frac{11\pi}{6}$$

Q. 2. E. Express each of the following angles in radians

400°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = 400 \times \frac{\pi}{180} = \frac{20\pi}{9}$$

Q. 2. F. Express each of the following angles in radians

7°30.'

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{The angle in radians} = \frac{\text{angle in minutes}}{60}$$

$$\text{Therefore, the total angle} = 7 + \frac{30}{60} = 7.5$$

$$\text{Therefore, Angle in radians} = 7.5 \times \frac{\pi}{180} = \frac{\pi}{24}$$

Q. 2. G. Express each of the following angles in radians

-270°

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in radians} = -270 \times \frac{\pi}{180} = -\frac{3\pi}{2}$$

Q. 2. H. Express each of the following angles in radians

-22°30'

Answer : Formula : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\text{The angle in radians} = \frac{\text{angle in minutes}}{60}$$

$$\text{Therefore, the total angle} = -\left(22 + \frac{30}{60}\right) = -22.5$$

$$\text{Therefore, Angle in radians} = -22.5 \times \frac{\pi}{180} = -\frac{\pi}{8}$$

Q. 3. Express each of the following angles in degrees.

(i) $\frac{5\pi}{12}$

(ii) $-\frac{18\pi}{5}$

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

(iv) -4

Answer : (i) Formula : Angle in degrees = Angle in radians $\times \frac{\pi}{180}$

$$\text{Therefore, Angle in degrees} = \frac{5\pi}{12} \times \frac{180}{\pi} = 75^\circ$$

(ii) Formula : Angle in degrees = Angle in radians $\times \frac{180}{\pi}$

$$\text{Therefore, Angle in degrees} = -\frac{18\pi}{5} \times \frac{180}{\pi} = -648^\circ$$

(iii) Formula : Angle in degrees = Angle in radians $\times \frac{180}{\pi}$

The angle in minutes = Decimal of angle in radian $\times 60$.'

The angle in seconds = Decimal of angle in minutes $\times 60$."

$$\text{Therefore, Angle in degrees} = \frac{5}{6} \times \frac{180}{\pi} = \frac{150}{22/7} = 47.7272^\circ$$

$$\text{Angle in minutes} = 0.7272 \times 60' = 43.632'$$

$$\text{Angle in seconds} = 0.632 \times 60'' = 37.92''$$

$$\text{Final angle} = 47^\circ 43' 38''$$

(iv) Formula : Angle in degrees = $\text{Angle in radians} \times \frac{180}{\pi}$

The angle in minutes = Decimal of angle in radian x 60.'

The angle in seconds = Decimal of angle in minutes x 60."

$$\text{Therefore, Angle in degrees} = -4 \times \frac{180}{\pi} = -\frac{720}{22/7} = -229.0909^\circ$$

$$\text{Angle in minutes} = 0.0909 \times 60' = 5.4545'$$

$$\text{Angle in seconds} = 0.4545 \times 60'' = 27.27''$$

$$\text{Final angle} = -229^\circ 5' 27''$$

Q. 4. The angles of a triangle are in AP, and the greatest angle is double the least. Find all the angles in degrees and radians.

Answer : Let a - d, a, a + d be the three angles of the triangle that form AP.

Given that the greatest angle is double the least. Now, a + d = 2(a - d) 2a - 2d = a + da = 3d (1) Now by angle sum property, (a - d) + a + (a + d) = 180° 3a = 180° a = 60°

..... (2) From (1) and (2), 3d = 60° d = 20° Now, the angles are, a - d = 60° - 20° = 40° a = 60° a + d = 60° + 20° = 80°.

Therefore the required angles are 40° 60° 80°

Q. 5. The difference between the two acute angles of a right triangle is $\left(\frac{\pi}{5}\right)^c$.

$$\text{Answer : The angle in degree} = \frac{\pi}{5} \times \frac{180}{\pi} = 36^\circ$$

$$= 36^\circ$$

Let, two acute angles are x and y

So,

$$\text{ATQ, } x - y = 36^\circ \dots\dots(1)$$

$$x + y = 90^\circ \dots\dots(2)$$

Solving 1 & 2, we get;

$$\Rightarrow 2x = 126^\circ$$

$$\Rightarrow x = 63^\circ$$

Putting the value of x in 2, we get;

$$\Rightarrow 63^\circ + y = 90^\circ$$

$$\Rightarrow y = 27^\circ$$

So, Two acute angles are 63° & 27°

Q. 6. Find the radius of a circle in which a central angle of 45° intercepts an arc of length 33 cm. (Take $\pi = 22/7$)

Answer :

$$\text{Angle in radians} = \text{Angle in degrees} \times \frac{\pi}{180}$$

$$\theta = \frac{l}{r} \text{ where } \theta \text{ is central angle, } l = \text{length of arc, } r = \text{radius}$$

$$\text{Therefore angle} = 45 \times \frac{\pi}{180} = \frac{\pi}{4}$$

Now,

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

$$= \frac{33}{\pi/4} = \frac{132}{22/7} = \frac{924}{22} = 42$$

Therefore radius is 42 cm

Q. 7. Find the length of an arc of a circle of radius 14 cm which subtends an angle of 36° at the centre

Answer : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$\theta = \frac{l}{r}$ where θ is central angle, l =length of arc, r =radius

Therefore angle = $36 \times \frac{\pi}{180} = \frac{\pi}{5}$

Now,

$$l = r \times \theta$$

$$= 14 \times \frac{\pi}{5} = 14 \times \frac{22}{35} = \frac{44}{5} = 8.8$$

Therefore the length of the arc is 8.8 cm

Q. 8. If the arcs of the same length in two circles subtend angles 75° and 120° at the centre, find the ratio of their radii

Answer : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$\theta = \frac{l}{r}$ where θ is central angle, l =length of arc, r =radius

Therefore $\theta_1 = 75 \times \frac{\pi}{180} = \frac{5\pi}{12}$

$\theta_2 = 120 \times \frac{\pi}{180} = \frac{2\pi}{3}$

$$l = r \times \theta$$

Now, as the length is the same

$$\text{Therefore, } r_1 \times \theta_1 = r_2 \times \theta_2$$

$$r_1 \times \frac{5\pi}{12} = r_2 \times \frac{2\pi}{3}$$

$$\frac{r_1}{r_2} = \frac{12}{5\pi} \times \frac{2\pi}{3} = \frac{24}{15} = \frac{8}{5}$$

Therefore the ratio of their radii is 8 : 5

Q. 9. Find the degree measure of the angle subtended at the centre of a circle of diameter 60 cm by an arc of length 16.5 cm.

Answer : Angle in radians = Angle in degrees $\times \frac{\pi}{180}$

$$\theta = \frac{l}{r} \text{ where } \theta \text{ is central angle, } l = \text{length of arc, } r = \text{radius}$$

Now,

$$\theta = \frac{l}{r} \text{ and } r = 0.5 \times \text{diameter}$$

$$= \frac{16.5}{30} \text{ radians}$$

$$\theta \text{ in degrees} = \frac{16.5}{30} \times \frac{180}{\pi} = \frac{16.5}{30} \times \frac{180}{22/7} = \frac{16.5}{30} \times \frac{180 \times 7}{22} = \frac{20790}{660} = 31.5^\circ$$

$$\theta \text{ in minutes} = 0.5 \times 60 = 30'$$

Therefore angle subtended at the center is $31^\circ 30'$

Q. 10. In a circle of diameter 30 cm, the length of a chord is 15 cm. Find the length of the minor arc of the chord.

Answer : Diameter = 30 cm

Length of chord = 15 cm

Radius = 15 cm [r = 0.5 x diameter]

Since the radius is equal to the length of the chord

Hence the formed triangle in the circle is an equilateral triangle.

$$\theta = 60^\circ$$

We know that $l = r \times \theta$

$$l = 15 \times 60 \times \frac{\pi}{180} = 5 \times \pi = 5 \times 3.14 = 15.7$$

Therefore, the length of the minor arc is 15.7 cm

Q. 11. Find the angle in radians as well as in degrees through which a pendulum swings if its length is 45 cm and its tip describes an arc of length 11 cm

Answer : We know that $l = r \times \theta$

Here $l =$ length of arc = 11 cm

$R =$ radius = length of pendulum = 45 cm

We need to find θ

$$11 = 45 \times \theta$$

$$\theta = \frac{11}{45} \text{ radian}$$

$$\theta \text{ in degree} = \frac{11}{45} \times \frac{180}{\pi} = \frac{44}{22/7} = 14^\circ$$

Q. 12. The large hand of a clock is 42 cm long. How many centimetres does its extremity move in 20 minutes?

Answer : For 20 minutes = $\theta = 4 \times 30^\circ = 120^\circ$

We know that $l = r \times \theta$

$$l = 42 \times 120 \times \frac{\pi}{180} = 28 \times \frac{22}{7} = 88$$

Therefore, the length is equal to 88 cm.

Q. 13. A wheel makes 180 revolutions in 1 minute. Through how many radians does it turn in 1 second?

Answer : Given that Number of revolutions per minute = 180

Then per second, it will be = $180/60 = 3$

We know that In one complete revolution, the wheel turns at an angle of 2π rad.

Then for 3 complete revolutions, it will take $3 \times 2\pi = 6\pi$ radians.

Q. 14. A train is moving on a circular curve of radius 1500 m at the rate of 66 km per hour. Through what angle has it turned in 10 seconds?

Answer : Radius = 1500 m.

Train speed at rate of 66km/hr = 18.33 m/s

Therefore, Distance covered in 1 second = 18.33 m

Distance covered in 10 second = $18.33 \times 10 = 183.33$ m

We know that $\theta = \text{Distance} / \text{radius}$

$$\theta = 183.33 / 1500$$

$$= 0.122 \text{ radian}$$

$$\text{Therefore } \theta = 0.122 \times \frac{180}{\pi} = 7^\circ$$

Q. 15. A wire of length 121 cm is bent so as to lie along the arc of a circle of radius 180 cm. Find in degrees; the angle subtended at the centre by the arc.

Answer : θ will be in degrees.

Arc-length can be given by the formula : $\theta / 360^\circ \times 2\pi r$

Hence it is given that 121 cm is the arc length.

$$\begin{aligned} \Rightarrow 121 &= \theta / 360^\circ \times 2\pi r \\ &= 121 = \theta / 360^\circ \times 2 \times 22 / 7 \times 180 \\ &= 121 = \theta / 360^\circ \times 360 \times 22 / 7 \\ &= 121 = \theta \times 22 / 7 \\ \Rightarrow \theta &= 121 \times 7 / 22 \\ &= 38.5^\circ \end{aligned}$$

Hence the angle subtended at the middle is 38.5°

Which can also be written as $38^\circ 30'$.

Q. 16. The angles of a quadrilateral are in AP, and the greatest angle is double the least. Express the least angle in radians.

Answer : Let the smallest term be x , and the largest term be $2x$

Then AP formed = $x, ?, ?, 2x$

So,

$$S_n = \frac{n}{2} [2a + (n - 1)d]$$

$$S_n = \frac{n}{2} [a + (a + (n - 1)d)] = \frac{n}{2} [\text{First term} + (\text{Last term})]$$

$$360^\circ = 4/2 [x + 2x] \dots [\text{We know that } \rightarrow a + (n-1)d = \text{last term} = 2x]$$

$$\Rightarrow 180^\circ = 3x$$

$$\Rightarrow x = 60^\circ$$

Now, 60° is least angle.

$$= 60^\circ = \pi/180^\circ \times 60^\circ$$

$$\Rightarrow 60^\circ = \pi/3 \text{ rad}$$