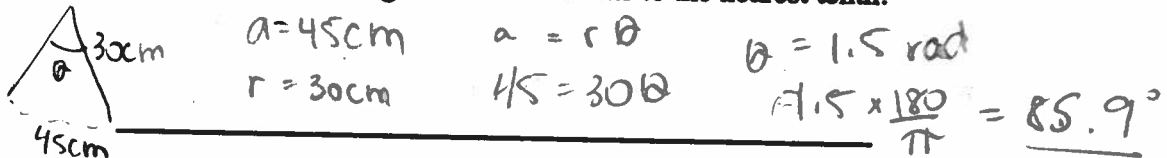




Class Ex. #7
A pendulum 30 cm long swings through an arc of 45 cm. Through what angle does the pendulum swing? Answer in degrees and in radians to the nearest tenth.

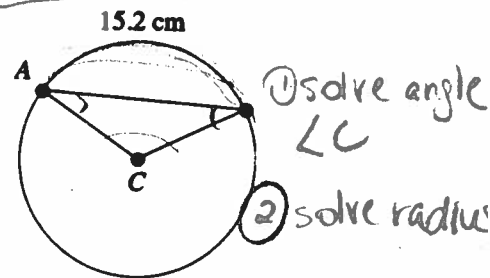


Class Ex. #8
Calculate the arc length (to the nearest tenth of a metre) of a sector of a circle with diameter 9.2 m if the sector angle is 150° .

$\theta = 150^\circ = 150 \times \frac{\pi}{180} = \frac{5\pi}{6} \text{ rads}$
 $r = \frac{1}{2} \cdot 9.2 = 4.6 \text{ m}$
 $a = r\theta$
 $a = 4.6 \left(\frac{5\pi}{6} \right)$
 $= 12.0 \text{ m}$



Class Ex. #9
A circle with centre C and minor arc AB measuring 15.2 cm is shown. If $\angle ABC = \angle BAC = \frac{\pi}{6}$ radians, find the length of the radius of the circle to the nearest tenth of a centimetre.

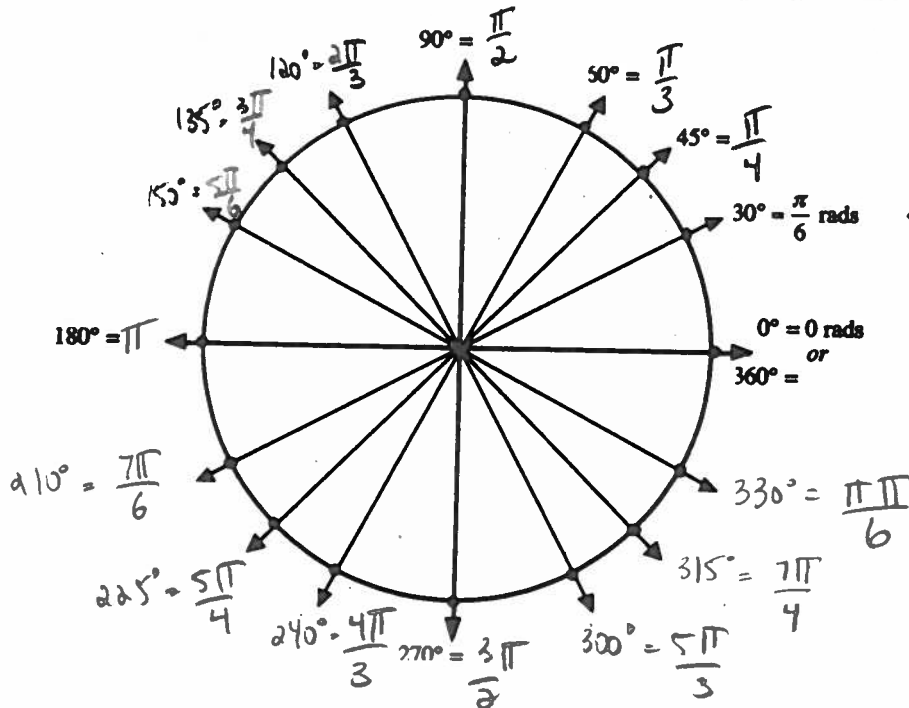


$\angle A + \angle B + \angle C = \pi$
 $\frac{\pi}{6} + \frac{\pi}{6} + \angle C = \pi$
 $\angle C = \frac{2\pi}{3}$
 $a = r\theta$
 $15.2 = r \left(\frac{2\pi}{3} \right)$
 $7.3 = r$

Complete Assignment Questions #8 - #17

Assignment

1. The diagram shows a series of rotation angles in standard position. The lines in the diagram are symmetrical about both the x -axis and the y -axis. Complete the diagram by determining both the degree measure and the radian measure at the end of each line.



2. Convert from radians to degrees. $\times \frac{180}{\pi}$

- a) $\frac{\pi}{2}$ b) $\frac{\pi}{6}$ c) $-\frac{4\pi}{3}$ d) $\frac{3\pi}{4}$ e) $-\frac{5\pi}{6}$
 90° 30° -240° 135° -150°

3. Convert from degrees to radians. Give the answers to 1 decimal place.

- a) 50° b) 205° c) 57.3° d) 250° $\times \frac{\pi}{180}$
 0.9 3.6 1.0 4.4

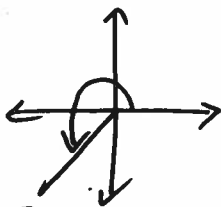
4. Convert from radians to degrees. Give the answers to the nearest tenth.

- a) 0.5 radians b) 3.1 rad c) 1.8π radians $\times \frac{180}{\pi}$
 28.6° 177.6° 324.0°

5. In each of the following

- i) draw the angle θ in standard position ii) state the principal angle
 iii) determine one positive and one negative coterminal angle for the angle θ
 iv) write an expression involving the principal angle that represents all angles in the domain $\theta \in \mathbb{R}$ that are coterminal with the given angle.

a) $\theta = \frac{5\pi}{4}$



- ii) $\frac{5\pi}{4}$
 iii) $\frac{5\pi}{4} + 2\pi = \frac{13\pi}{4}$, $\frac{5\pi}{4} - 2\pi = -\frac{3\pi}{4}$
 iv) $\frac{5\pi}{4} + 2n\pi, n \in \mathbb{I}$
 c) $\theta = -\frac{2\pi}{3}$



- ii) $-\frac{2\pi}{3} + 2\pi = \frac{4\pi}{3}$
 iii) $-\frac{2\pi}{3} - 2\pi = -\frac{8\pi}{3}$
 $\frac{4\pi}{3} + 2\pi = \frac{10\pi}{3}$
 iv) $\frac{4\pi}{3} + 2n\pi, n \in \mathbb{I}$

b) $\theta = \frac{11\pi}{6}$




- ii) $\frac{11\pi}{6}$
 iii) $\frac{11\pi}{6} + 2\pi = \frac{23\pi}{6}$, $\frac{11\pi}{6} - 2\pi = -\frac{\pi}{6}$
 iv) $\frac{11\pi}{6} + 2n\pi, n \in \mathbb{I}$


d) $\theta = \frac{14\pi}{3}$





- ii) $\frac{14\pi}{3} - 2(2\pi) = \frac{2\pi}{3}$
 iii) $\frac{2\pi}{3}$ and $\frac{2\pi}{3} - 2\pi = -\frac{4\pi}{3}$
 iv) $\frac{2\pi}{3} + 2n\pi, n \in \mathbb{I}$


6. Determine the reference angle for the following rotation angles.


a) $\frac{7\pi}{6}$ 
 $\frac{7\pi}{6} - \pi = \frac{\pi}{6}$

b) $\frac{3\pi}{4}$ 
 $\pi - \frac{3\pi}{4} = \frac{\pi}{4}$

c) $-\frac{5\pi}{3}$ 
 $-\frac{5\pi}{3} + 2\pi = \frac{\pi}{3}$

d) $-\frac{\pi}{6}$ 
 $\frac{\pi}{6}$

e) $\frac{11\pi}{6}$ 
 $2\pi - \frac{11\pi}{6} = \frac{\pi}{6}$

f) 5π 
 $= 0$

7. Determine the rotation angle given the reference angle and the quadrant

Reference Angle	Quadrant	Rotation Angle
$\frac{\pi}{3}$	3	$\pi + \frac{\pi}{3} = \frac{4\pi}{3}$
$\frac{\pi}{8}$	1	$\frac{\pi}{8}$
$\frac{\pi}{6}$	4	$2\pi - \frac{\pi}{6} = \frac{11\pi}{6}$
$\frac{\pi}{12}$	2	$\pi - \frac{\pi}{12} = \frac{11\pi}{12}$
$\frac{\pi}{2}$	between 3 and 4	$\frac{3\pi}{2}$

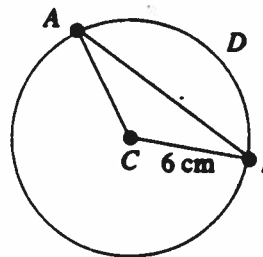
8. A circle has radius 8 cm. Determine (in radians) the measure of the central angle subtended by an arc of length 5.6 cm.

$r = 8 \text{ cm}$ $a = r\theta$ central angle = 0.7 rads.
 $a = 5.6 \text{ cm}$ $5.6 = 8\theta$
 $0.7 = \theta$

9. Calculate the arc length (to the nearest tenth of a metre) of a sector of a circle with radius 8.4 m if the sector angle is 80° .

$\theta = 80^\circ$ $a = r\theta = \frac{4\pi}{9}(8.4)$
 $r = 8.4 \text{ m}$
 $80 \times \frac{\pi}{180} = \frac{4\pi}{9} \text{ rads}$ $= 11.7$
 arc length = 11.7 m

10. In the diagram the circle with centre C has radius 6 cm. Determine the length of arc ADB , to the nearest 0.1 cm, if $\angle CAB = \frac{\pi}{8}$.



$$\begin{aligned} \angle A + \angle B + \angle C &= 2\pi \\ \frac{\pi}{8} + \frac{\pi}{8} + \angle C &= 2\pi \\ \angle C &= \frac{3\pi}{4} \end{aligned}$$

$$\begin{aligned} a &= r\theta \\ &= 6 \left(\frac{3\pi}{4} \right) = 14.1 \end{aligned}$$

$$r = 6 \text{ cm}$$

$$\text{arc length} = \underline{14.1 \text{ cm}}$$

11. A pendulum swings through an angle of 45° . Find the length of the pendulum (to the nearest cm) if the end of the pendulum swings through an arc of length 32 cm.



$$\begin{aligned} a &= 32 \text{ cm} \\ \theta &= 45^\circ \left(\frac{\pi}{180} \right) = \frac{\pi}{4} \end{aligned}$$

$$\begin{aligned} a &= r\theta \\ 32 &= r \left(\frac{\pi}{4} \right) \end{aligned}$$

$$\begin{aligned} r &= \frac{128}{\pi} = 40.74\dots \\ r &= \underline{41 \text{ cm}} \end{aligned}$$

Multiple Choice

12. An angle with radian measure 2.36 has degree measure of

- A. 424.80
 B. 135.22
 C. 67.61
 D. 0.04

$$2.36 \times \frac{180}{\pi} = 135.22$$

13. An arc of a circle subtends a central angle of x° . If the length of the arc is 1.2 cm and the diameter of the circle is 4 cm, then the value of x to the nearest whole number is

- A. 17
 B. 34
 C. 54
 D. 108

$$\begin{aligned} a &= 1.2 \\ r &= \frac{4}{2} = 2 \text{ cm} \end{aligned}$$

$$\begin{aligned} a &= r\theta \\ 1.2 &= 2\theta \\ 0.6 \text{ rad} &= \theta \end{aligned}$$

$$\begin{aligned} 0.6 \times \frac{180}{\pi} \\ &= 34.3 \end{aligned}$$

Numerical Response

14. Correct to the nearest tenth of a degree, $\frac{3\pi}{8}$ rad is equal to _____°.

(Record your answer in the numerical response box from left to right.)

$$\frac{3\pi}{8} \times \frac{180}{\pi} = 67.5$$

15. An arc DE of a circle, centre O , is $\frac{1}{6}$ of the circumference. The size of $\angle DOE$, to the nearest one hundredth of a radian, is _____.

(Record your answer in the numerical response box from left to right.)



$$\frac{1}{6}(360^\circ) = 60^\circ$$

$$\text{or } C = 2\pi r \rightarrow (\pi d)$$

$$60 \times \frac{\pi}{180} = \frac{\pi}{3}$$

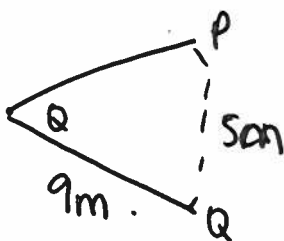
$$= 1.05 \text{ rads.}$$

$$\text{arc} = \frac{1}{6}(2\pi r) = \frac{1}{3}\pi r$$

$$a = r\theta \Rightarrow \theta = \frac{a}{r} = \frac{\frac{1}{3}\pi r}{r} = \frac{1}{3}\pi = \frac{\pi}{3} = 1.05.$$

16. A person on a Ferris wheel moves a distance of 5 metres from position P to position Q . If the diameter of the wheel is 18 metres, the measure of the central angle, to the nearest tenth of a degree, is _____.

(Record your answer in the numerical response box from left to right.)



$$\text{radius} = \frac{1}{2}(18) = 9\text{m.}$$

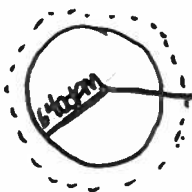
$$a = r\theta$$

$$\theta = \frac{a}{r} = \frac{5}{9} \text{ rads.}$$

$$= \frac{5}{9} \times \frac{180}{\pi} = 31.8^\circ$$

17. A satellite makes one complete revolution of the earth in 90 min. Assume that the orbit is circular and that the satellite is situated 280 km above the equator. If the radius of the earth at the equator is 6400 km, then the speed of the satellite, in kilometres per second, to the nearest one hundredth, is _____.

(Record your answer in the numerical response box from left to right.)



$$\begin{aligned} \text{radius of orbit} &= 6400 + 280 \\ &= 6680 \text{ km} \end{aligned}$$

arc length for 1 complete rotation

$$\begin{aligned} &= 2\pi(6680) \\ &= 13360\pi \text{ km.} \end{aligned}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{13360\pi}{90 \times 60 \text{ (kms)}}.$$

$$= 7.77 \text{ km/s.}$$