Radians

Q1

O is the centre of a circle, radius 4 m.
OA = OB = AB = 25 m.
Angle COD = $\frac{\pi}{3}$ radians.
Find:

(i) the perimeter of the baseball court, [4]

(ii) the area of the baseball court. [5]

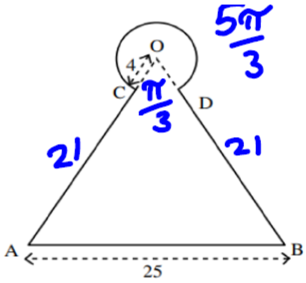
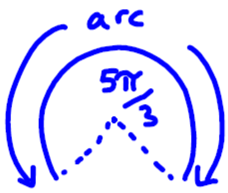


Fig. 2

$$Arc = r\theta$$
$$= 4 \times \frac{5\pi}{3}$$
$$= 20.94$$

O is the centre of a circle, radius 4 m.
OA = OB = AB = 25 m.
Angle COD = $\frac{\pi}{3}$ radians.
Find:

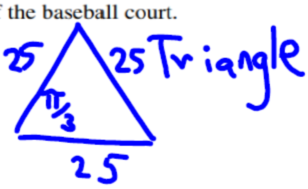
$25 + 21 + 21 + arc$



Ans $87.9m$ (3 sig. fig.)

(i) the perimeter of the baseball court, [4]

(ii) the area of the baseball court. [5]



"$Area = \frac{1}{2} ab \sin C$"

$$Area = \frac{1}{2} \times 25 \times 25 \times \sin\left(\frac{\pi}{6}\right)$$
$$= 270.63 \, m^2$$

$$Area = \frac{1}{2} r^2 \theta$$
$$= \frac{1}{2} \times 4^2 \left(\frac{5\pi}{3}\right)$$
$$= 41.88$$

Total Area = 270.63 + 41.88 = 312.52

Answer $313 \, m^2$ (3sig fig)

Q2

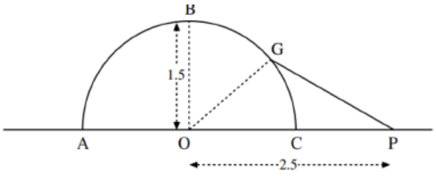


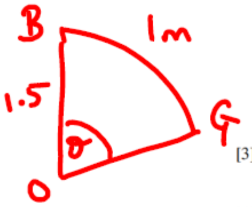
Fig. 2

O is the midpoint of AC.

OP = 2.5 m, OB = 1.5 m and $B\hat{O}C = \frac{\pi}{2}$ radians.

The arc length BG is 1 m.

(i) Show that $B\hat{O}G = \frac{2}{3}$ radians. [3]



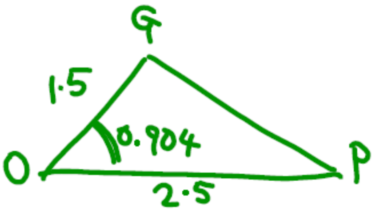
$$Arc = r\theta$$
$$1 = 1.5 \times \theta$$
$$\frac{1}{1.5} = \theta$$
$$\frac{2}{3} = \theta$$

Ans $\frac{2}{3}$ radians

(ii) Find the length of GP. [4]

(iii) Find the angle between the guy rope and the ground. [3]

(ii)

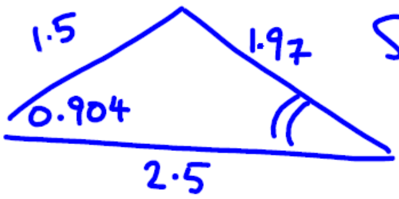


angle $\frac{\pi}{2} - \frac{2}{3} = 0.904$

Cosine Rule

$$GP^2 = 1.5^2 + 2.5^2 - 2 \times 1.5 \times 2.5 \times \cos(0.904)$$
$$GP^2 = 3.8622$$
$$GP = \sqrt{}$$
$$GP = 1.9652$$
$$1.97 \text{ (3s.f.)}$$

(iii)



Sine Rule

$$\frac{1.5}{\sin G\hat{P}O} = \frac{1.97}{\sin(0.904)}$$
$$\sin G\hat{P}O = 0.59979$$
$$G\hat{P}O = 0.6432$$

Q3

Find

(i) AC, [2]

(ii) $A\hat{C}B$ in radians, [2]

(iii) the perimeter of the door, [4]

(iv) the area of the door. [4]

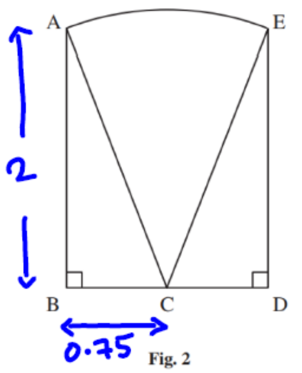


Fig. 2

AB = 2 m BD = 1.5 m

AC by Pythagoras'

$AC = \sqrt{\frac{73}{16}}$

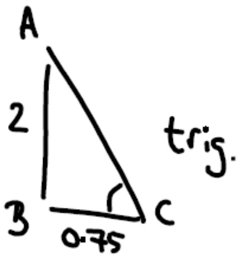
$AC = \frac{\sqrt{73}}{4} = 2.136$

2.14 (3s.f.)

Find

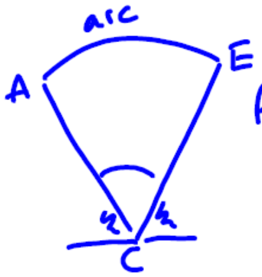
(i) AC, [2]

(ii) $A\hat{C}B$ in radians, [2]



trig.

$A\hat{C}B = 1.212$ radians



Angle $A\hat{C}E = \pi - 2 \times$ angle in triangle

$= \pi - 2 \times 1.212$

$= 0.7175$

$Arc = r\theta = 2.136 \times 0.7175$

$= 1.5327$

$= 1.53$

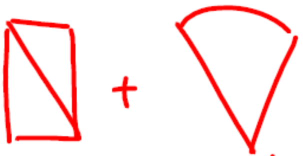
$Perimeter = 2 + 1.5 + 2 + 1.53 =$

Answer

7.03 m

3 sig. fig.

Area =



$= 2 \times 0.75 + \frac{1}{2} r^2 \theta$

$= 1.5 + \frac{1}{2} \times 2.136^2 \times 0.7175$

$= 1.5 + 1.637$

Answer

$3.137\ m^2$

Q4

A javelin is thrown from C and lands in the zone at point J.
Angle JAC = 0.5 radians and AJ = 50 m.

(ii) Find the distance of J from C. [3]

(iii) Find in radians the angle CJ makes with the line CA. [3]

Spectators stand all along the edge CB of the zone.
The spectator standing at point M on CB is closest to J.

(iv) Find the distance of M from J. [4]

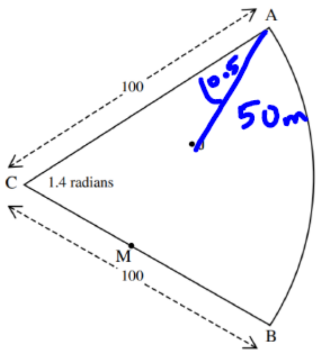


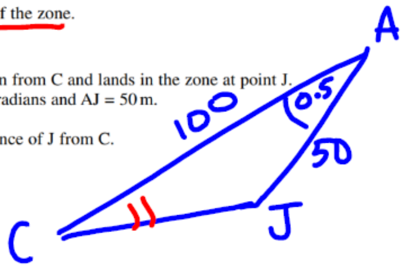
Fig. 1

$$\text{Area} = \frac{1}{2} \times r^2 \times \theta$$
$$= \frac{1}{2} \times 100^2 \times 1.4$$
$$= 7000\,m^2$$

(i) Find the area of the zone. [2]

A javelin is thrown from C and lands in the zone at point J.
Angle JAC = 0.5 radians and AJ = 50 m.

(ii) Find the distance of J from C. [3]

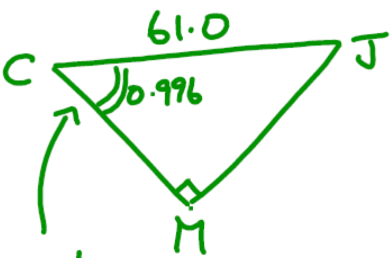


Cosine Rule

$$CJ^2 = 100^2 + 50^2 - 2 \times 100 \times 50 \cos(0.5)$$
$$CJ^2 = 3724$$
$$CJ = 61.0\,m$$

Angle using Sine Rule

$$\frac{\sin \hat{C}}{50} = \frac{\sin(0.5)}{61.0} \quad \text{leads to} \quad \sin \hat{C} = 0.3929$$
$$\hat{C} = 0.404 \text{ radians}$$



angle is
$1.4 - 0.404$

now just

$S\frac{O}{H}$ $C\frac{A}{H}$ $T\frac{O}{A}$

$$\text{opp} = 61.0 \times \tan(0.996)$$
$$\text{opp} = 94.2\,m$$

Answer.

Q5

The radius of the circle is r and the angle AOB is x radians.

(i) Write down the area of the minor sector OAB. [1]

(ii) Write down the area of the triangle AOB. [1]

The areas of the two parts of the medal divided by the line AB are in the ratio 5 : 1

(iii) Show that

$$\sin x = x - \frac{\pi}{3}$$ [8]

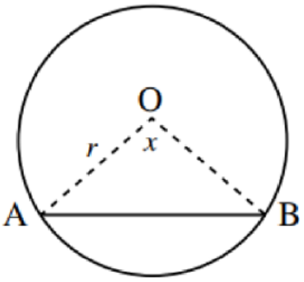


Fig. 3

(i) Area sector

Area $= \frac{1}{2} r^2 x$

x is in radians.

(ii)

"Area triangle $= \frac{1}{2} ab \sin C$"

Area $= \frac{1}{2} r^2 \sin(x)$

(iii) Area of circle $= \pi r^2$

Area of  $= \frac{1}{2} r^2 x - \frac{1}{2} r^2 \sin(x)$

Area of  $= \pi r^2 - \left(\frac{1}{2} r^2 x - \frac{1}{2} r^2 \sin(x)\right)$

So $5 \times$  $=$ 

$$5\left(\frac{1}{2} \cancel{r^2} x - \frac{1}{2} \cancel{r^2} \sin(x)\right) = \pi \cancel{r^2} - \frac{1}{2} \cancel{r^2} x + \frac{1}{2} \cancel{r^2} \sin x$$

$$\frac{5}{2} x - \frac{5}{2} \sin x = \pi - \frac{1}{2} x + \frac{1}{2} \sin x$$

$$3x = \pi + 3 \sin x$$

$$3x - \pi = 3 \sin x$$

$$x - \frac{\pi}{3} = \sin x$$