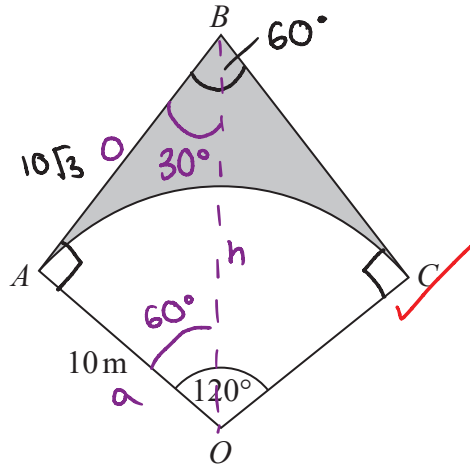1.

OAC is a sector of a circle, centre *O*, radius 10 m.

BA is the tangent to the circle at point *A*.
BC is the tangent to the circle at point *C*.

Angle *AOC* = 120°

Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

$$\angle ABC = 360 - 90 - 90 - 120$$
$$= 60°$$

$$\tan x = \frac{o}{a}$$

$$\tan 60° = \frac{AB}{10}$$

$$10 \times \tan 60° = AB$$
$$10\sqrt{3} = AB$$

$$\text{Area of triangle} = \frac{1}{2} bn$$

$$\text{Area} = \frac{1}{2} \times 10 \times 10\sqrt{3}$$

$$= 50\sqrt{3} \text{ m}^2$$

Area of quadrilateral = 173.21

Shaded area = area of quadrilateral - area of sector

$$\text{Area of circle} = \pi r^2$$
$$\text{Area of sector } AOC = \frac{\pi r^2}{3}$$

Shaded area = 173.21 - 104.72
$$= 68.29$$
$$= 68.5$$

$$\text{Area} = \frac{\pi \times 10^2}{3}$$
$$= 104.72 \text{ m}^2$$

.....................68.5........... m²

(Total for Question   is 5 marks)

2. *OAB* is a sector of a circle with centre *O* and radius 7 cm.
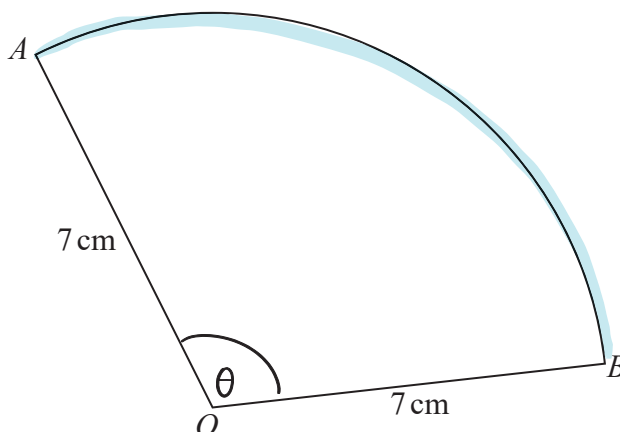
The area of the sector is 40 cm²

Calculate the perimeter of the sector.
Give your answer correct to 3 significant figures.

Sector area = 40.

$$40 = \frac{\theta}{360}(\pi \times 7^2)$$

$$\theta = 93.54\ldots^{\circ} \quad \textcircled{1}$$

$$\boxed{\text{ARC LENGTH} = \frac{\theta}{360}(2\pi r)}$$

$$\text{SECTOR AREA} = \frac{\theta}{360}(\pi r^2)$$

Perimeter = arc length + radius + radius

$$= \frac{\theta}{360}(2\pi r) + r + r \quad \textcircled{1}$$

$$= \left(\frac{93.54\ldots}{360}(2 \times \pi \times 7)\right) + 7 + 7 \quad \textcircled{1}$$

$$= 25.440\ldots$$

$$\approx \underline{25.4 \text{ cm}} \ (3\text{sf.}) \qquad \textcircled{1}$$
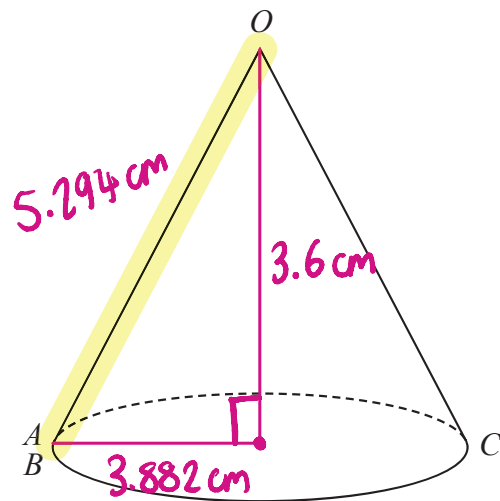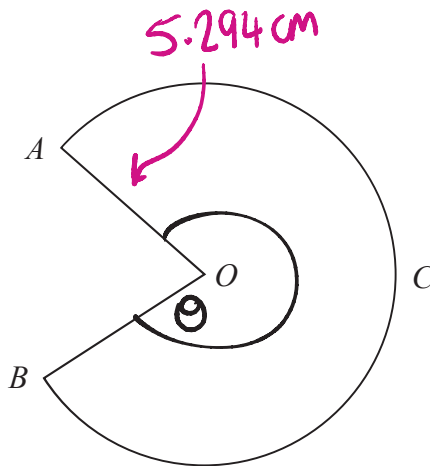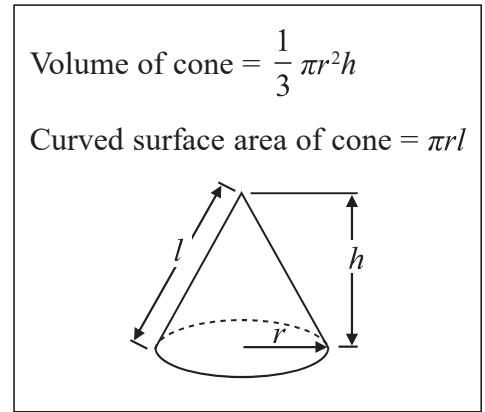
........25.4........ cm

(Total for Question is 4 marks)

3. The diagram shows a sector $OACB$ of a circle with centre O.
The point C is the midpoint of the arc AB.

The diagram also shows a hollow cone with vertex O.
The cone is formed by joining OA and OB.

Volume of cone $= \dfrac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

5.294 cm

A

O

B

C

O

5.294 cm

3.6 cm

A
B

3.882 cm

C

The cone has volume 56.8 cm³ and height 3.6 cm.

Calculate the size of angle AOB of sector $OACB$.
Give your answer correct to 3 significant figures.
You must show all your working.

$V = \dfrac{1}{3}\pi r^2 h$
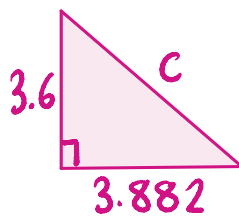
$56.8 = \dfrac{1}{3}\pi r^2 (3.6)$ ①

$\dfrac{56.8}{1.2\pi} = \dfrac{1.2\pi r^2}{1.2\pi}$

$r^2 = \dfrac{56.8}{1.2\pi}$ ⟩ Square root

$r = 3.882$ (3dp) ①

$a^2 + b^2 = c^2$

3.6 C

3.882

$3.882^2 + 3.6^2 = c^2$

$c^2 = 28.030$ (3dp) ⟩ Square root

$c = 5.294$ (3dp) ①

Curved SA cone
$= \pi r l$

Curved SA
cone

$= \pi \times 3.882 \times 5.294$
$= 20.551\pi$ (3dp)

$$\text{Sector Area} = \frac{\theta}{360} \times \pi r^2$$

$$20.551\pi = \frac{\theta}{360} \times \pi (5.294)^2 \quad \textcircled{\small J}$$

$$20.551 \times 360 = \theta \times (5.294)^2$$

$$\theta = \frac{20.551 \times 360}{(5.294)^2} = 263.978 \,(3dp) = 264°\,(3sf) \quad \textcircled{\small J}$$

4. The diagram shows two shaded shapes, **A** and **B**.

Shape **A** is formed by removing a sector of a circle with radius $(3x - 1)$ cm from a sector of the circle with radius $(5x - 1)$ cm.
Shape **B** is a circle of diameter $(2 - 2x)$ cm.

$(2 - 2x)$ cm $\rightarrow r = \frac{1}{2}(2 - 2x)$

$r = 1 - x$

$2x$ cm

$(3x - 1)$ cm   **A**

$45°$

B
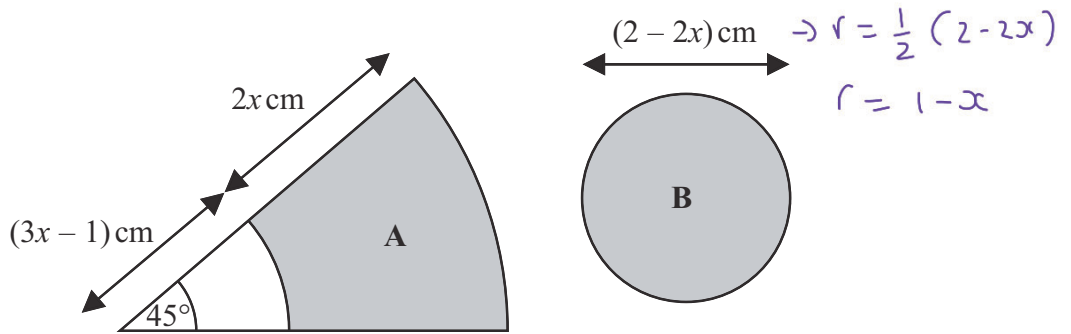
The area of shape **A** is equal to the area of shape **B**.

Find the value of x.
You must show all your working.

$a.s = \frac{\theta}{360} \times \pi r^2$

Area of Shape A = area of Sector - Cutout.

$\qquad$ area of Sector = $\frac{45°}{360°} \times \pi \times (5x - 1)^2$ cm²

$\qquad\qquad = \frac{1}{8} \times \pi \times (5x - 1)^2$

$\qquad$ Cutout = $\frac{45°}{360°} \times \pi \times (3x - 1)^2$ cm²

$(5x-1)(5x-1)$
$25x^2 - 5x - 5x + 1$

$\qquad\qquad = \frac{1}{8} \times \pi (3x - 1)^2$

$\qquad = \frac{1}{8}\pi\left((5x-1)^2 - (3x-1)^2\right)$ ✓₁

$(3x-1)(3x-1)$
$9x^2 - 3x - 3x + 1$

$\qquad = \frac{1}{8}\pi\left((25x^2 - 10x + 1) - (9x^2 - 6x + 1)\right)$

$\qquad = \frac{1}{8}\pi\left(16x^2 - 4x\right)$ ✓₂

$(1-x)(1-x)$
$1 - x - x + x^2$

area of $B = \pi(1-x)^2 = \pi(x^2 - 2x + 1)$

$x_1, x_2 = \frac{-3 \pm \sqrt{3^2 - 4(2)(-2)}}{2 \times 2}$

$\times 8 \left(\frac{1}{8}\left(16x^2 - 4x\right)\pi = \pi(x^2 - 2x + 1)\right) \times 8$

$-(8x^2-10x+8) \left(16x^2 - 4x = 8x^2 - 16x + 8 \right) -(8x^2 - 10x + 8)$

$\qquad 8x^2 + 12x - 8 = 0$

$\qquad 2x^2 + 3x - 2 = 0$ ✓₃

$= \frac{1}{2}, -2$ ✓₄

$\underline{x = \frac{1}{2}}$ ✓₅

(Total for Question   is 5 marks)

5.   The diagram shows a sector *OPQR* of a circle, centre *O* and radius 8 cm.
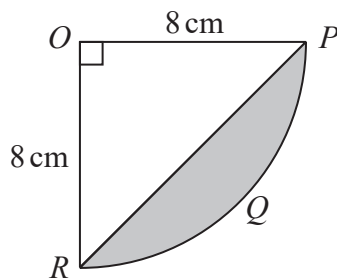
OPR is a triangle.

Work out the area of the shaded segment *PQR.*
Give your answer correct to 3 significant figures.

Shaded area = Area of Sector − Area of triangle.

Area of Sector = $\frac{\theta}{360}$ (πr^2) ①

= $\frac{90}{360}$ $(\pi)(8^2)$ = 16π.

Area of triangle = $\frac{\text{base} \times \text{height}}{2}$ = $\frac{8 \times 8}{2}$ = 32.   ①

PQR = (16π) − 32 = 18.26548...
   ①

≈ 18.3 cm² (3 s.f.)

   ①

........................18·3........................ cm²

(Total for Question   is 4 marks)