1 The diagram shows a sector of a circle with radius 7 cm.
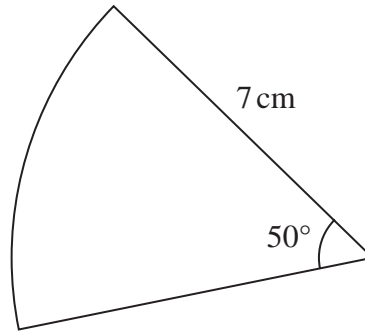
7 cm

50°

Diagram **NOT** accurately drawn

Work out the length of the arc of the sector.
Give your answer correct to one decimal place.

length of arc of a sector :

$$\frac{\theta}{360°} \times 2\pi r$$

$$\frac{50°}{360} \times 2 \times \pi \times 7 = 6.1 \text{ cm}$$

6.1 .... cm

(Total for Question 1 is 2 marks)

2 The diagram shows two circles such that the region **R**, shown shaded in the diagram, is the region common to both circles.

Area of Sector:

$$\frac{\theta}{360°} \times \pi r^2$$
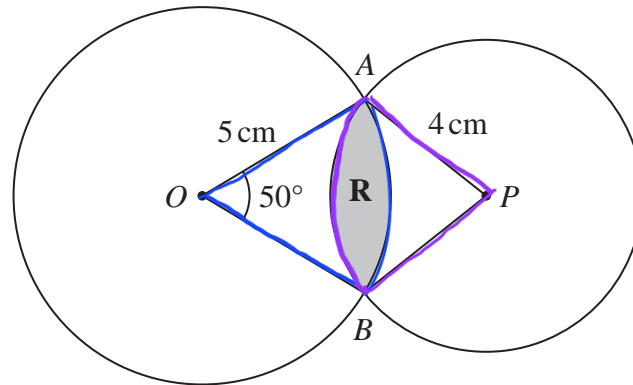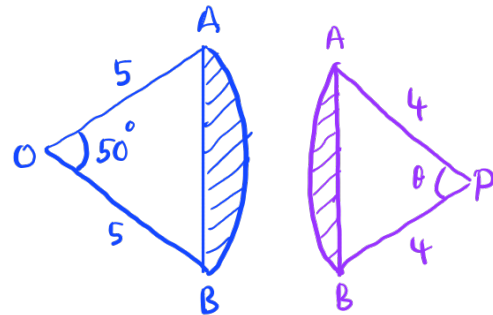
Area of triangle:

$$\frac{1}{2} ab \sin C$$

Diagram **NOT** accurately drawn

One of the circles has centre O and radius $5\,\text{cm}$.
The other circle has centre P and radius $4\,\text{cm}$.
Angle $AOB = 50°$

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

Finding length of AB (using cosine rule):

$$AB^2 = 5^2 + 5^2 - 2(5)(5) \cos 50°$$

$$AB^2 = 17.86\ldots$$

$$AB = 4.226\ldots \text{①}$$

Finding angle APB using known length of AB:

$$4.226\ldots^2 = 4^2 + 4^2 - 2(4)(4) \cos \theta$$

$$\cos \theta = \frac{4.226^2 - 4^2 - 4^2}{-2(4)(4)}$$

$$\cos \theta = 0.4418\ldots$$

$$\theta = \cos^{-1} 0.4418\ldots$$

$$= 63.78°\ldots \text{①}$$

Segment Area = Sector Area - Triangle Area

Large circle :

Segment Area : $\dfrac{50°}{360°} \times \pi \times 5^2 \;-\; \dfrac{1}{2}(5)(5)\sin 50°$

$= 10.908... \;①\; - \; 9.576...$

$= 1.332.....$

Small circle :

Segment Area $= \dfrac{63.78°}{360°} \times \pi \times 4^2 \;-\; \dfrac{1}{2}(4)(4)\sin 63.78°$

$= 8.905... \;①\; - \; 7.1768...$

$= 1.728...$

Total segment area : $1.332... + 1.728...$ ①

$= 3.06$ ①

.... 3.06 .... cm^2

(Total for Question 2 is 6 marks)
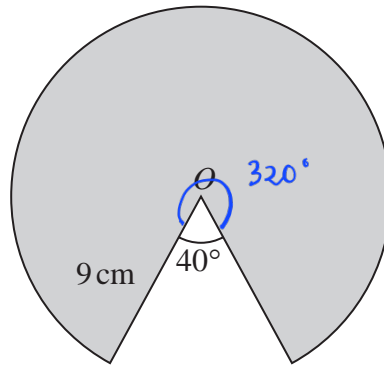
3 A circle centre O has radius 9 cm.

Diagram **NOT**
accurately drawn

320°

O

40°

9 cm

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

(i) $\dfrac{320°}{360°} \times 2\pi(9) = 16\pi$ (1)

↳ Circumference $2\pi r$

Perimeter = $16\pi + 9 + 9$ (1)

= 68.265 ...

= 68.3 (3sf)

68.3 (1)

.... cm

(Total for Question 3 is 4 marks)

4 *A*, *B* and *C* are points on a circle with centre *O*.

B

Diagram **NOT**
accurately drawn

75°

O

$75 \times 2 = 150°$ ①

150°

Angle at
Centre is twice
the angle at
Circumference

A

C

Area of triangle $= \frac{1}{2} ab \sin C$
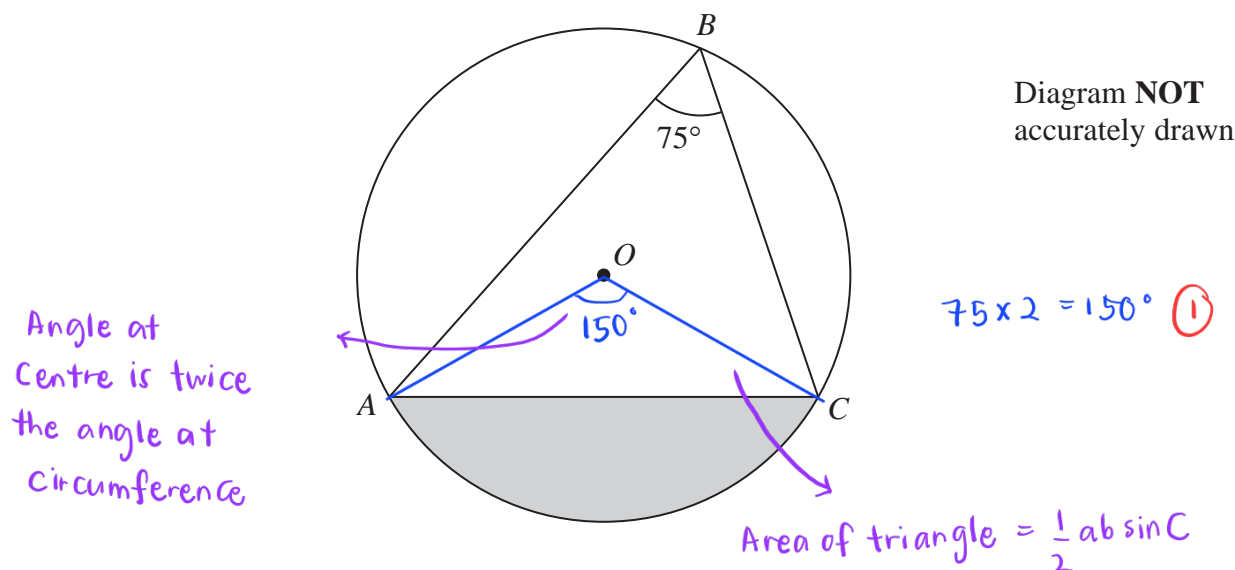
Angle *ABC* = 75°

The area of the shaded segment is 200 cm^2

Calculate the radius of the circle.
Give your answer correct to 3 significant figures.

① $\frac{150°}{360°} \times \pi r^2 = \frac{1}{2} r^2 \sin 150° + 200$ ①

$\frac{5\pi r^2}{12} = \frac{1}{2} r^2 \left(\frac{1}{2}\right) + 200$

$= \frac{1}{4} r^2 + 200$

$\frac{5\pi}{12} r^2 - \frac{1}{4} r^2 = 200$ ①

$(1.0589...) r^2 = 200$

$r^2 = \frac{200}{1.0589...}$

$= 188.85...$

$r = \sqrt{188.85...}$

$r = 13.7 \ (3sf)$

13.7 ①

.... cm

(Total for Question 4 is 5 marks)

5 The diagram shows sector *OPQ* of a circle, centre *O*

Diagram **NOT**
accurately drawn

P

7.1 cm

110°

O

7.1 cm

Q
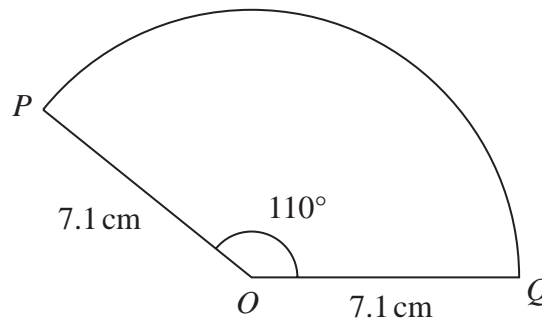
OP = *OQ* = 7.1 cm
Angle *POQ* = 110°

Calculate the area of sector *OPQ*
Give your answer correct to one decimal place.

$$\frac{110}{360} \times \pi \times 7.1^2 \quad ①$$

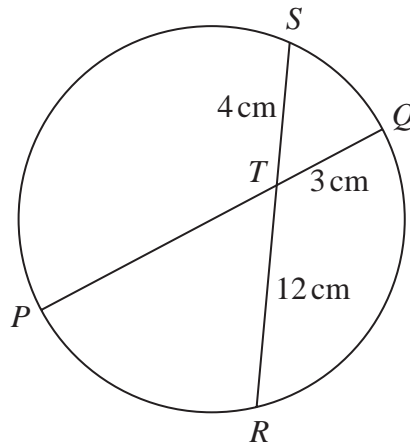$$= 48.4 \text{ cm}^2 \quad ①$$

48.4
.... cm²

(Total for Question 5 is 2 marks)

6

Diagram **NOT**
accurately drawn

PTQ is a diameter of a circle.
RTS is a chord of the circle.

$$TQ = 3\,\text{cm} \qquad ST = 4\,\text{cm} \qquad TR = 12\,\text{cm}$$

Calculate the radius of the circle.

$PT \times TQ = RT \times TS$

$PT \times 3 = 12 \times 4$

$PT = \dfrac{48}{3} = 16$ ①

$\text{radius} = \dfrac{16+3}{2}$ ① $= 9.5$ ①

9.5

.... cm

(Total for Question 6 is 3 marks)

7 *AEC* and *BED* are chords of a circle.

B

x cm
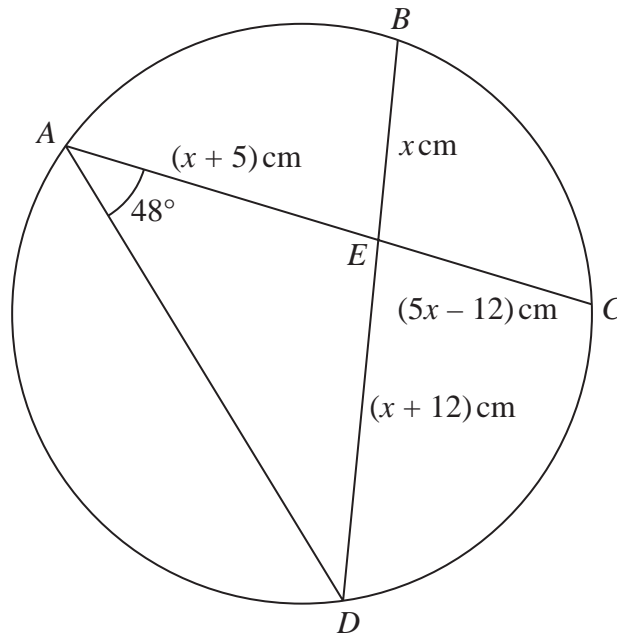
Diagram **NOT**
accurately drawn

A

(*x* + 5) cm

48°

E

(5*x* – 12) cm   C

(*x* + 12) cm

D

$AE = (x + 5)\,\text{cm}$ $BE = x\,\text{cm}$ $CE = (5x - 12)\,\text{cm}$ $DE = (x + 12)\,\text{cm}$

Angle $DAE = 48°$

Work out the size of angle *ADE*
Give your answer correct to one decimal place.

$$(x+5)(5x-12) = x(x+12) \quad ①$$

$$5x^2 - 12x + 25x - 60 = x^2 + 12x$$

$$4x^2 + x - 60 = 0 \quad ①$$

$$(4x - 15)(x + 4) = 0 \quad ①$$

$$x = \frac{15}{4} = 3.75 \text{ cm}$$

$$AE = 3.75 + 5 = 8.75$$

$$ED = 3.75 + 12 = 15.75$$

$$\frac{\sin ADE}{8.75} = \frac{\sin 48°}{15.75}$$

$$ADE = \sin^{-1}\frac{\sin 48°(8.75)}{15.75} \quad ①$$

$$= 24.4 \quad ①$$

24.4   °

(Total for Question 7 is 5 marks)

8 The diagram shows the cross section of a circular water pipe.
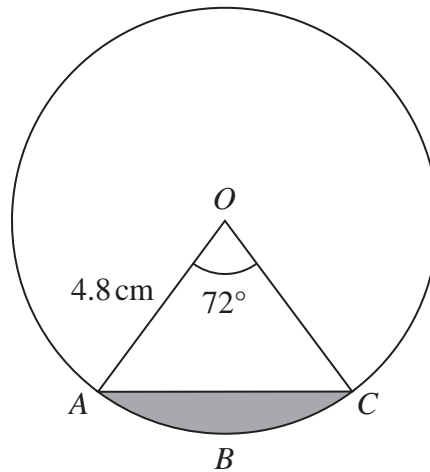

Diagram **NOT** accurately drawn

OABC is a sector of the circle, centre *O*

The shaded region in the diagram represents the water flowing in the pipe.

The water flows at 14 cm/s in the pipe.

Work out the volume of water that has flowed through the pipe in 3 minutes.
Give your answer in cm³ correct to 3 significant figures.

Area of sector: $\pi \times 4.8^2 \times \dfrac{72}{360} = 14.476....$ ①

Area of triangle: $\dfrac{1}{2} \times 4.8^2 \times \sin 72 = 10.956....$ ①

Area of shaded: $14.476... - 10.956....$ ①

$= 3.520....$

Volume: $3.520... \times 14 \text{ cm/s} \times (3\times60)s$ ①

$= 3.520... \times 2520$

$= 8870$ ①

8870 cm³

(Total for Question 8 is 5 marks)