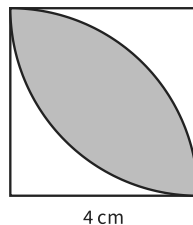


Shaded Areas

1 (4 marks)

Two quarter circles are drawn inside a square of side 4 cm, centred at opposite corners.

Work out the shaded area. Give your answer in terms of π .



$$\text{Quarter circle} = \frac{1}{4} \times \pi \times 4^2 = 4\pi$$

$$\text{Quarter circle} - \text{triangle} = 4\pi - 8 \text{ (half of the shaded part)}$$

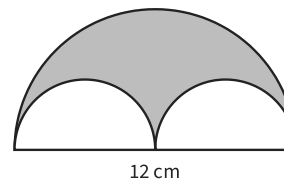
$$\text{Shaded} = 2(4\pi - 8) = \underline{8\pi - 16 \text{ cm}^2}$$

2 (4 marks)

Two small semicircles sit on the diameter of a large semicircle of diameter 12 cm.

(a) Work out the shaded area in terms of π .

(b) Show that the perimeter of the shaded region is the same as the circumference of a circle of radius 6 cm.



$$(a) \frac{1}{2} \times \pi \times 6^2 - 2 \times \frac{1}{2} \times \pi \times 3^2 = 18\pi - 9\pi = \underline{9\pi \text{ cm}^2}$$

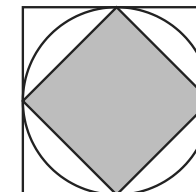
$$(b) \text{Large arc} = 6\pi, \text{ two small arcs} = 2 \times 3\pi = 6\pi$$

$$\text{Total} = \underline{12\pi} = 2 \times \pi \times 6 \checkmark$$

3 (3 marks)

A circle fits exactly inside a square. A smaller square fits exactly inside the circle.

The large square has an area of 50 cm^2 . What is the area of the shaded square?



The small square's diagonal = the circle's diameter = the large square's side

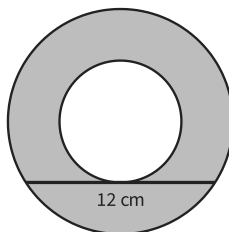
Draw both diagonals of the small square: it is half the large square

$$\text{Shaded area} = \underline{25 \text{ cm}^2}$$

4 (4 marks)

Two circles have the same centre. A chord of the large circle is 12 cm long and just touches the small circle.

Work out the shaded area. Give your answer in terms of π .



$$\text{Right-angled triangle: } R^2 = r^2 + 6^2, \text{ so } R^2 - r^2 = 36$$

$$\text{Shaded} = \pi R^2 - \pi r^2 = \pi(R^2 - r^2)$$

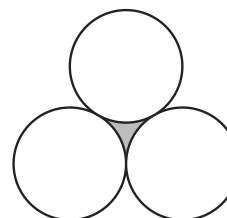
$$= \underline{36\pi \text{ cm}^2}. \text{ You never need the radii}$$

5 (4 marks)

Three circles of radius 2 cm each touch the other two.

Work out the area of the shaded region between them.

Give your answer in an exact form.



Join the centres: an equilateral triangle of side 4

$$\text{Triangle area} = \frac{1}{2} \times 4 \times 4 \times \sin 60^\circ = 4\sqrt{3}$$

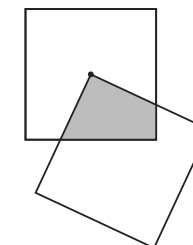
$$\text{Three } 60^\circ \text{ sectors} = 3 \times \frac{60}{360} \times \pi \times 2^2 = 2\pi$$

$$\text{Shaded} = \underline{4\sqrt{3} - 2\pi \text{ cm}^2}$$

6 (3 marks)

Two squares each have sides of 6 cm. One corner of the second square is at the centre of the first.

Show that the shaded area is the same however the second square is turned.



Turning the second square swaps two congruent triangles, so the overlap is always $\frac{1}{4}$ of the first square

$$\text{Shaded} = \frac{1}{4} \times 36 = \underline{9 \text{ cm}^2} \text{ every time}$$