

1 $(2 \times 12.6) + 12.6\theta = 31.7$
 $\theta = 6.5 \div 12.6 = 0.5159^\circ$
 $A = \frac{1}{2} \times (12.6)^2 \times 0.5159 = 40.95 \text{ cm}^2$

3 a $\frac{1}{2}r^2\theta = 40 \therefore \theta = \frac{80}{r^2}$
 $P = 2r + r\theta = 2r + (r \times \frac{80}{r^2})$
 $= (2r + \frac{80}{r}) \text{ cm}$

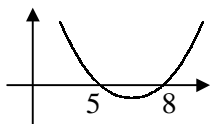
b $2r + \frac{80}{r} < 26$

$2r^2 + 80 < 26r$

$r^2 - 13r + 40 < 0$

$(r - 5)(r - 8) < 0$

$5 < r < 8$



5 a let centre of circle be O
 let midpoint of AB be M
 $AM^2 = OA^2 - OM^2 = 5^2 - 3^2 = 16$
 $AM = 4 \therefore AB = 8 \text{ cm}$

b $\cos(\angle AOM) = \frac{3}{5}$
 $\angle AOB = 2 \times \angle AOM = 1.8546^\circ$
 $\text{arc } AB = 5 \times 1.8546 = 9.2730$
 $P = 2 \times (6 + 14 - 8 + 9.2730) = 42.5 \text{ cm}$

c area of segment
 $= \frac{1}{2} \times 5^2 \times 1.8546 - \frac{1}{2} \times 5^2 \times \sin 1.8546^\circ$
 $= 23.182 - 12 = 11.182$
 area of logo $= (6 \times 14) + (2 \times 11.182)$
 $= 106 \text{ cm}^2 \text{ (3sf)}$

7 let length of wire $= 3l$
 area of $A = \frac{1}{2} \times l^2 \times \sin \frac{\pi}{3} = 0.43301l^2$
 angle at centre of $B = l \div l = 1^\circ$
 area of $B = \frac{1}{2} \times l^2 \times 1 = 0.5l^2$
 $\% \text{ change} = \frac{0.5l^2 - 0.43301l^2}{0.43301l^2} \times 100\%$
 $= 15.5\%, \text{ increase}$

2 a $\frac{1}{2} \times (7.3)^2 \times \theta = 38.4$
 $\theta = 38.4 \div 26.645 = 1.44^\circ \text{ (3sf)}$
b chord $AB = 2 \times 7.3 \sin(\frac{1}{2}\theta) = 9.633$
 $\text{arc } AB = 7.3\theta = 10.521$
 $P = 9.633 + 10.521 = 20.2 \text{ cm (3sf)}$

4 a $AB^2 = 10^2 = 100, AC^2 + BC^2 = 6^2 + 8^2 = 100$
 $AB^2 = AC^2 + BC^2$
 $\therefore \angle ACB = 90^\circ \text{ (converse of Pythagoras')}$

\therefore triangle ABC is right-angled

b $\tan(\angle ABC) = \frac{AC}{BC} = \frac{3}{4} \therefore \angle ABC = 0.64^\circ$

c $\angle BAC = \frac{\pi}{2} - 0.6435 = 0.9273$

area of sectors:

centre $A = \frac{1}{2} \times 4^2 \times 0.9273 = 7.4184$

centre $B = \frac{1}{2} \times 6^2 \times 0.6435 = 11.5830$

centre $C = \frac{1}{4} \times \pi \times 2^2 = 3.1416$

area of triangle $ABC = \frac{1}{2} \times AC \times BC = 24$

shaded area

$= 24 - (7.4184 + 11.5830 + 3.1416)$

$= 1.86 \text{ cm}^2$

6 a $OC = (r + 2) \text{ cm}$
 $A_1 = [\frac{1}{2} \times 8^2 \times \theta] - [\frac{1}{2} \times (r + 2)^2 \times \theta]$
 $= \frac{1}{2} \theta [64 - (r^2 + 4r + 4)]$
 $= \frac{1}{2} \theta (60 - 4r - r^2) \text{ cm}^2$

b $A_2 = \frac{1}{2}r^2\theta$
 $\therefore \frac{1}{2} \theta (60 - 4r - r^2) = 7 \times \frac{1}{2}r^2\theta$
 $60 - 4r - r^2 = 7r^2$
 $2r^2 + r - 15 = 0$
 $(2r - 5)(r + 3) = 0$
 $r > 0 \therefore r = 2.5$