6.

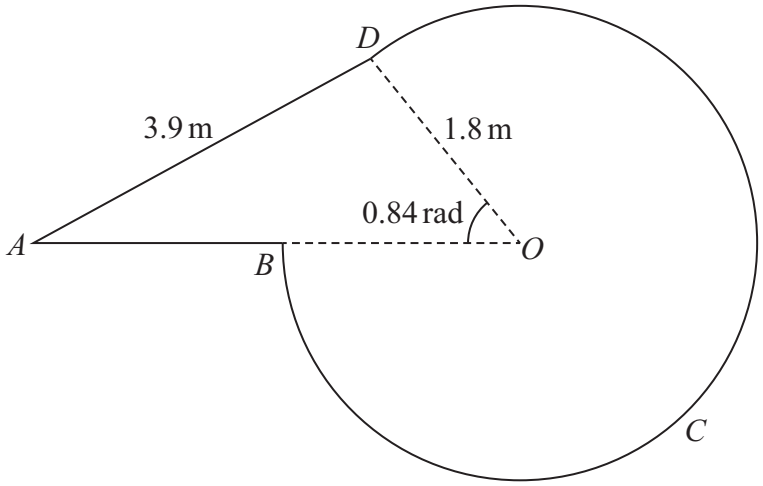

Diagram not drawn to scale

Figure 3

In this question you must show all stages of your working.

Figure 3 shows the design for a shop sign *ABCDA*.

The sign consists of a triangle *AOD* joined to a sector of a circle *DOBCD* with radius 1.8 m and centre *O*.

The points *A*, *B* and *O* lie on a straight line.

Given that *AD* = 3.9 m and angle *BOD* is 0.84 radians,

(a) calculate the size of angle *DAO*, giving the answer in radians to 3 decimal places.

(2)

(b) Find, in m, the length of *AO* giving the answer to 2 decimal places.

(3)

(c) Find, in m^2, the area of the shop sign, giving the answer to one decimal place.

(3)

(d) Find, in m, the perimeter of the shop sign, giving the answer to one decimal place.

(3)

(Total for Question 6 is 11 marks)

7. The curve C has equation $y = f(x)$, $x > 0$ where

$$f'(x) = 3\sqrt{x} - \frac{9}{x\sqrt{x}} + \frac{4}{3}$$

Given that the point $P(9, 20)$ lies on C,

(a) find $f(x)$, simplifying the answer,

(5)

(b) find an equation of the normal to C at the point P, giving the answer in the form $ax + by + c = 0$ where a, b and c are integers.

(4)

(Total for Question 7 is 9 marks)

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8. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

Find the range of values of k for which the quadratic equation

$$kx^2 + 8x + 2(k + 7) = 0$$

has no real roots.

(6)

(Total for Question 8 is 6 marks)

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9. Given that k is a constant, $0 < k < 1$, state the number of solutions of the equation

(a) $\sin x = k$ in the interval $0 < x \leqslant \pi$

(b) $\tan x = k$ in the interval $0 < x \leqslant \pi$

(c) $\cos 2x = k$ in the interval $0 < x \leqslant 100\pi$

(d) $\sin x = k + 1$ in the interval $-100\pi < x \leqslant 100\pi$

(4)

(Total for Question 9 is 4 marks)
