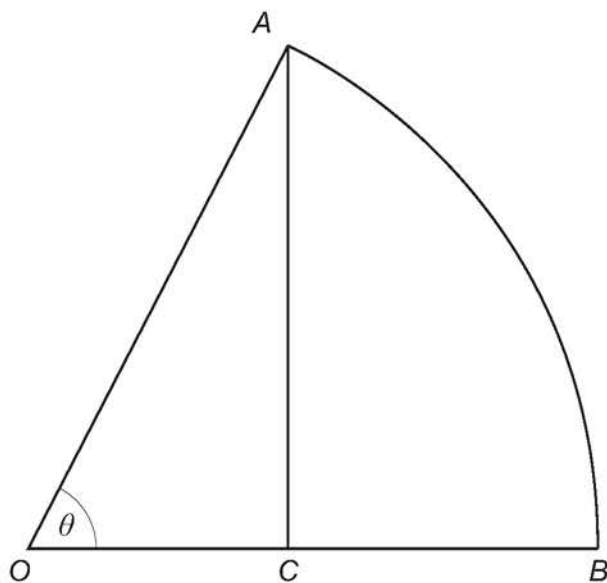**10**   The diagram shows a sector of a circle *OAB*.

The point *C* lies on *OB* such that *AC* is perpendicular to *OB*.

Angle *AOB* is θ radians.

10 (a)   Given the area of the triangle *OAC* is half the area of the sector *OAB*, show that

$$\theta = \sin 2\theta$$

[4 marks]

10 (b)   Use a suitable **change of sign** to show that a solution to the equation

$$\theta = \sin 2\theta$$

lies in the interval given by $\theta \in \left[\dfrac{\pi}{5}, \dfrac{2\pi}{5}\right]$

[2 marks]

10 (c)   The Newton-Raphson method is used to find an approximate solution to the equation

$$\theta = \sin 2\theta$$

10 (c) (i)   Using $\theta_1 = \dfrac{\pi}{5}$ as a first approximation for θ apply the Newton-Raphson method twice to find the value of θ_3

Give your answer to three decimal places.

[3 marks]

10 (c) (ii)   Explain how a more accurate approximation for θ can be found using the Newton-Raphson method.

[1 mark]

10 (c) (iii)   Explain why using $\theta_1 = \dfrac{\pi}{6}$ as a first approximation in the Newton-Raphson method does not lead to a solution for θ.

[2 marks]