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8. The curve C with equation $y = f(x), \quad x > 0,$ passes through the point $P(4, 1)$.

Given that $f'(x) = 4\sqrt{x} - 2 - \dfrac{8}{3x^2}$

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

(4)

(b) Find $f(x)$.

(5)

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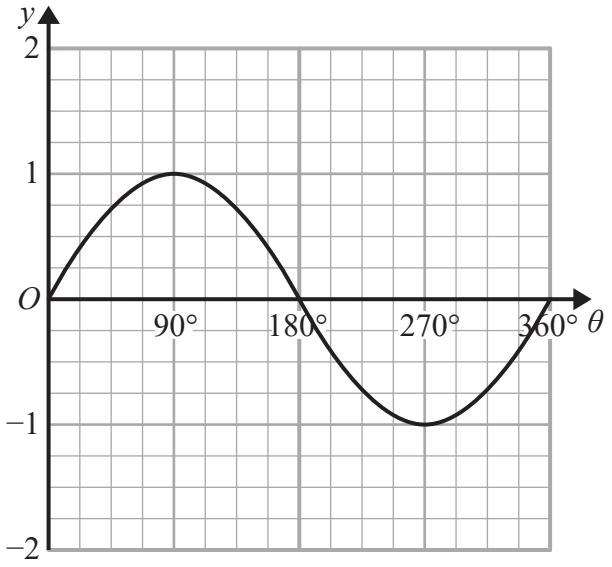

Figure 3

Figure 3 shows a plot of the curve with equation $y = \sin\theta, \quad 0 \leqslant \theta \leqslant 360°$

(a) State the coordinates of the minimum point on the curve with equation

$$y = 4\sin\theta, \quad 0 \leqslant \theta \leqslant 360°$$

(2)

A copy of Figure 3, called Diagram 1, is shown on the next page.

(b) On Diagram 1, sketch and label the curves

(i) $y = 1 + \sin\theta, \quad 0 \leqslant \theta \leqslant 360°$

(ii) $y = \tan\theta, \quad 0 \leqslant \theta \leqslant 360°$

(2)

(c) Hence find the number of solutions of the equation

(i) $\tan\theta = 1 + \sin\theta$ that lie in the region $0 \leqslant \theta \leqslant 2160°$

(ii) $\tan\theta = 1 + \sin\theta$ that lie in the region $0 \leqslant \theta \leqslant 1980°$

(3)

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