8. A curve C has equation $y = \mathrm{f}(x),\ x > 0$

The point P with x coordinate $\frac{1}{4}$ lies on C.

Given that

- $\mathrm{f}'(x) = 10 + \dfrac{5\sqrt{x} - 4}{2x^2}$
- the tangent to C at P has equation $y = kx + 2$, where k is a constant

(a) (i) find the value of k

(ii) find the equation of the normal to C at P.
Give the answer in the form $y = mx + c$, where m and c are constants.

(6)

(b) Find $\mathrm{f}(x)$.

(5)

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 11 marks)

9.

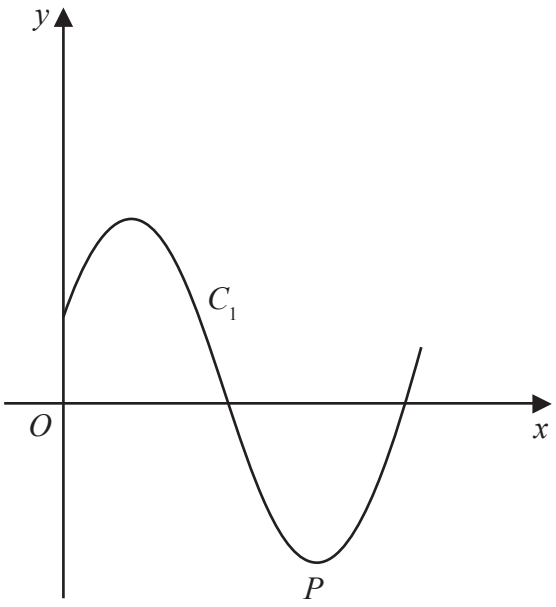


Figure 4

The curve C_1 has equation $y = \sin\left(x + \frac{\pi}{8}\right)$

Figure 4 shows a sketch of C_1 in the interval $0 \leqslant x < 2\pi$

The point P is a minimum turning point on C_1 and is shown in Figure 4.

(a) State the x coordinate of P.

(1)

(b) State the number of roots of the equation

$$\sin\left(x + \frac{\pi}{8}\right) = \sin\left(\frac{\pi}{8}\right)$$

in the interval $0 \leqslant x < 101\pi$, giving a reason for your answer.

(2)

The curve C_2 has equation $y = -5\sin\left(x + \frac{\pi}{8}\right)$

The point Q is the minimum turning point on C_2 in the interval $0 \leqslant x < 2\pi$

(c) State the coordinates of Q.

(2)

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