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

A curve has equation $y = f(x), x > 0$

Given that

- $f'(x) = 2x + \frac{8}{x^2} + k$, where k is a constant
- the equation of the tangent to the curve at $x = \sqrt{2}$ is $y = 5x - 3\sqrt{2}$

(a) find the exact value of k.

(2)

(b) Find an equation of the normal to the curve at $x = \sqrt{2}$

(2)

(c) Find $f(x)$, writing your answer in simplest form.

(4)

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 8 marks)

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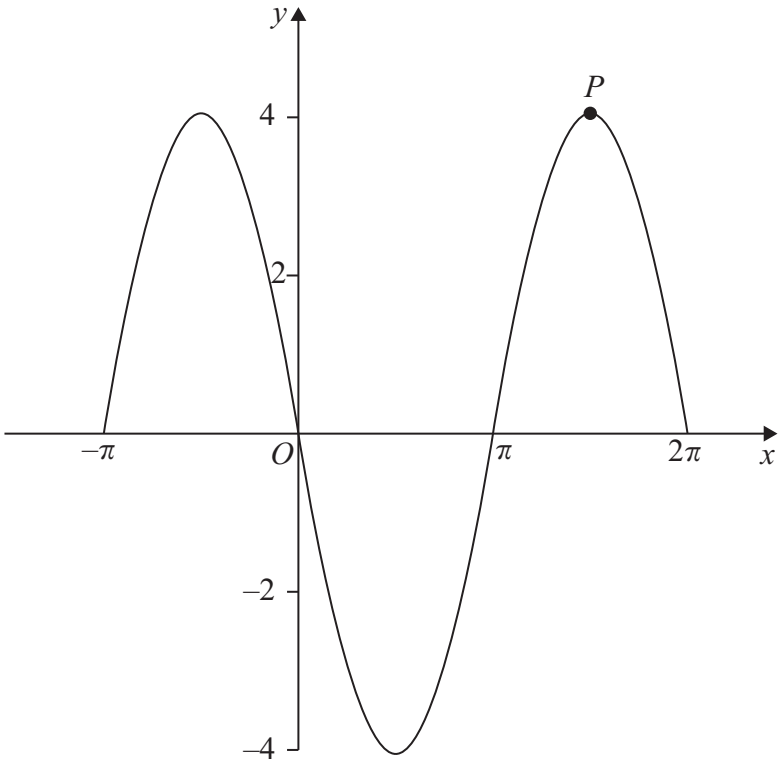

Figure 3

Figure 3 shows a sketch of part of the graph of the trigonometric function with equation $y = \mathrm{f}(x)$

(a) Write down an expression for $\mathrm{f}(x)$

(2)

The point P lies on $y = \mathrm{f}(x)$ and is shown in Figure 3.

(b) State the coordinates of the point to which P is transformed when the graph of $y = \mathrm{f}(x)$ is transformed to the graph with equation

(i) $y = \mathrm{f}\left(x - \frac{\pi}{6}\right)$

(2)

(ii) $y = -\frac{1}{2}\mathrm{f}(x)$

(2)

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