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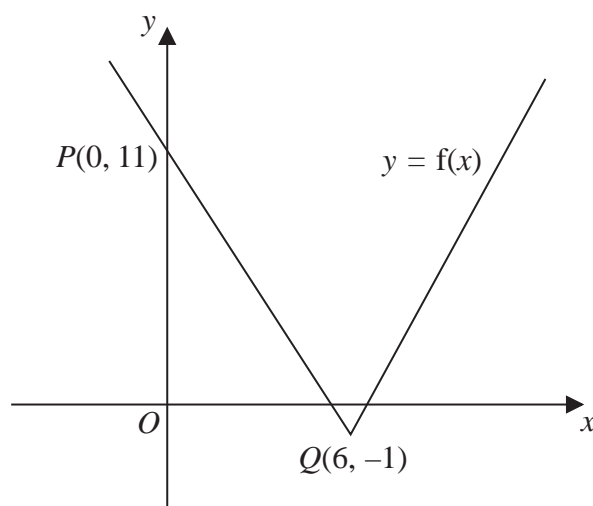
**Figure 1**

Figure 1 shows part of the graph with equation  $y = f(x)$ ,  $x \in \mathbb{R}$ .

The graph consists of two line segments that meet at the point  $Q(6, -1)$ .

The graph crosses the  $y$ -axis at the point  $P(0, 11)$ .

Sketch, on separate diagrams, the graphs of

(a)  $y = |f(x)|$  (2)

(b)  $y = 2f(-x) + 3$  (3)

On each diagram, show the coordinates of the points corresponding to  $P$  and  $Q$ .

Given that  $f(x) = a|x - b| - 1$ , where  $a$  and  $b$  are constants,

(c) state the value of  $a$  and the value of  $b$ . (2)

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**Question 4 continued**

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6.

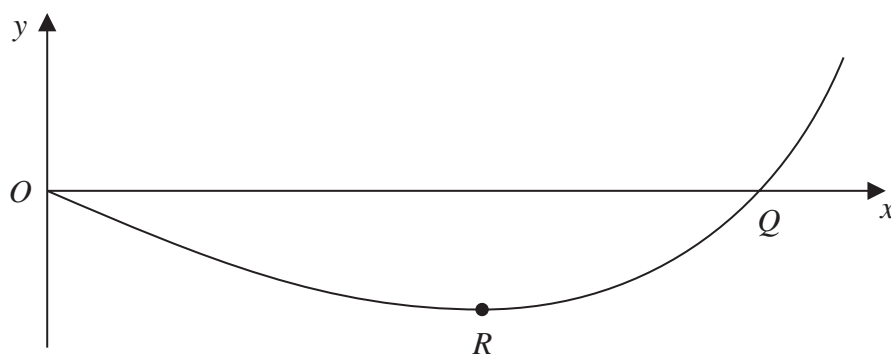
**Figure 2**

Figure 2 shows a sketch of part of the curve with equation

$$y = 2 \cos\left(\frac{1}{2}x^2\right) + x^3 - 3x - 2$$

The curve crosses the  $x$ -axis at the point  $Q$  and has a minimum turning point at  $R$ .

(a) Show that the  $x$  coordinate of  $Q$  lies between 2.1 and 2.2 (2)

(b) Show that the  $x$  coordinate of  $R$  is a solution of the equation

$$x = \sqrt{1 + \frac{2}{3}x \sin\left(\frac{1}{2}x^2\right)} \quad (4)$$

Using the iterative formula

$$x_{n+1} = \sqrt{1 + \frac{2}{3}x_n \sin\left(\frac{1}{2}x_n^2\right)}, \quad x_0 = 1.3$$

(c) find the values of  $x_1$  and  $x_2$  to 3 decimal places. (2)

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9. (a) Express  $2 \sin \theta - 4 \cos \theta$  in the form  $R \sin(\theta - \alpha)$ , where  $R$  and  $\alpha$  are constants,  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$

Give the value of  $\alpha$  to 3 decimal places.

(3)

$$H(\theta) = 4 + 5(2 \sin 3\theta - 4 \cos 3\theta)^2$$

Find

- (b) (i) the maximum value of  $H(\theta)$ ,  
 (ii) the smallest value of  $\theta$ , for  $0 \leq \theta < \pi$ , at which this maximum value occurs.

(3)

Find

- (c) (i) the minimum value of  $H(\theta)$ ,  
 (ii) the largest value of  $\theta$ , for  $0 \leq \theta < \pi$ , at which this minimum value occurs.

(3)

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