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1. Differentiate with respect to x

(a) $\ln(x^2 + 3x + 5)$

(2)

(b) $\frac{\cos x}{x^2}$

(3)

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Question 1 continued

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Q1

(Total 5 marks)



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2. $f(x) = 2 \sin(x^2) + x - 2, \quad 0 \leq x < 2\pi$

(a) Show that $f(x) = 0$ has a root α between $x = 0.75$ and $x = 0.85$ (2)

The equation $f(x) = 0$ can be written as $x = [\arcsin(1 - 0.5x)]^{\frac{1}{2}}$.

(b) Use the iterative formula

$$x_{n+1} = [\arcsin(1 - 0.5x_n)]^{\frac{1}{2}}, \quad x_0 = 0.8$$

to find the values of x_1, x_2 and x_3 , giving your answers to 5 decimal places. (3)

(c) Show that $\alpha = 0.80157$ is correct to 5 decimal places. (3)

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Question 2 continued

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Q2

(Total 8 marks)

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3.

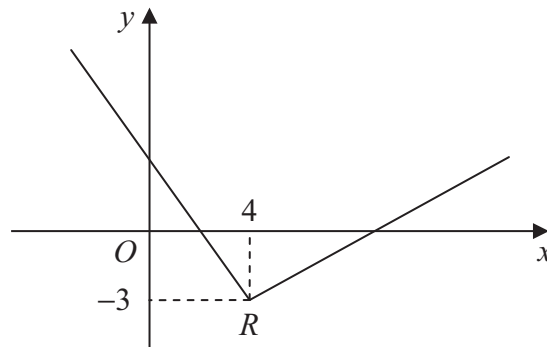


Figure 1

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

The graph consists of two line segments that meet at the point $R(4, -3)$, as shown in Figure 1.

Sketch, on separate diagrams, the graphs of

(a) $y = 2f(x+4)$, (3)

(b) $y = |f(-x)|$. (3)

On each diagram, show the coordinates of the point corresponding to R .



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Question 3 continued

Q3

(Total 6 marks)



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4. The function f is defined by

$$f : x \mapsto 4 - \ln(x + 2), \quad x \in \mathbb{R}, x \geq -1$$

(a) Find $f^{-1}(x)$.

(3)

(b) Find the domain of f^{-1} .

(1)

The function g is defined by

$$g : x \mapsto e^{-x^2} - 2, \quad x \in \mathbb{R}$$

(c) Find $fg(x)$, giving your answer in its simplest form.

(3)

(d) Find the range of fg.

(1)



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Question 4 continued

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(Total 8 marks)

Q4



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Question 6 continued

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Question 7 continued

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8. (a) Express $2\cos 3x - 3\sin 3x$ in the form $R \cos(3x + \alpha)$, where R and α are constants, $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. Give your answers to 3 significant figures. (4)

$$f(x) = e^{2x} \cos 3x$$

- (b) Show that $f'(x)$ can be written in the form

$$f'(x) = R e^{2x} \cos(3x + \alpha)$$

where R and α are the constants found in part (a).

- (c) Hence, or otherwise, find the smallest positive value of x for which the curve with equation $y = f(x)$ has a turning point. (3)



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