

2.

$$f(x) = 5 \cos x + 12 \sin x$$

Given that $f(x) = R \cos(x - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$,

(a) find the value of R and the value of α to 3 decimal places. (4)

(b) Hence solve the equation

$$5 \cos x + 12 \sin x = 6$$

for $0 \leq x < 2\pi$. (5)

(c) (i) Write down the maximum value of $5 \cos x + 12 \sin x$. (1)

(ii) Find the smallest positive value of x for which this maximum value occurs. (2)





Question 2 continued

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3.

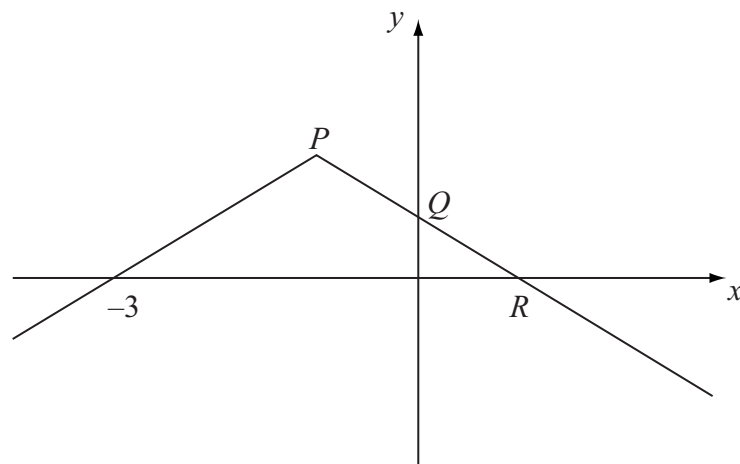


Figure 1

Figure 1 shows the graph of $y = f(x)$, $x \in \mathbb{R}$.
 The graph consists of two line segments that meet at the point P .
 The graph cuts the y -axis at the point Q and the x -axis at the points $(-3, 0)$ and R .
 Sketch, on separate diagrams, the graphs of

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

(b) $y = f(-x)$. (2)

Given that $f(x) = 2 - |x + 1|$,

(c) find the coordinates of the points P , Q and R , (3)

(d) solve $f(x) = \frac{1}{2}x$. (5)



Question 3 continued

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Question 3 continued

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(Total 12 marks)

Q3

11

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Question 4 continued

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(Total 12 marks)

Q4

15

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Question 5 continued

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(Total 8 marks)

Q5

17

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6. (a) Differentiate with respect to x ,

(i) $e^{3x}(\sin x + 2\cos x)$,

(3)

(ii) $x^3 \ln(5x + 2)$.

(3)

Given that $y = \frac{3x^2 + 6x - 7}{(x+1)^2}$, $x \neq -1$,

(b) show that $\frac{dy}{dx} = \frac{20}{(x+1)^3}$.

(5)

(c) Hence find $\frac{d^2y}{dx^2}$ and the real values of x for which $\frac{d^2y}{dx^2} = -\frac{15}{4}$.

(3)





Question 6 continued

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Question 6 continued	Leave blank
(Total 14 marks)	Q6

21

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7.

$$f(x) = 3x^3 - 2x - 6$$

- (a) Show that $f(x) = 0$ has a root, α , between $x = 1.4$ and $x = 1.45$

(2)

- (b) Show that the equation $f(x) = 0$ can be written as

$$x = \sqrt{\left(\frac{2}{x} + \frac{2}{3}\right)}, \quad x \neq 0.$$

(3)

- (c) Starting with $x_0 = 1.43$, use the iteration

$$x_{n+1} = \sqrt{\left(\frac{2}{x_n} + \frac{2}{3}\right)}$$

to calculate the values of x_1 , x_2 and x_3 , giving your answers to 4 decimal places.

(3)

- (d) By choosing a suitable interval, show that $\alpha = 1.435$ is correct to 3 decimal places.

(3)



Question 7 continued

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(Total 11 marks)

Q7

TOTAL FOR PAPER: 75 MARKS

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