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**Question 1 continued**

Lined area for writing the answer to Question 1.

**(Total 6 marks)**

Q1









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Question 2 continued

Area containing horizontal lines for writing the answer to Question 2.

Q2

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(Total 12 marks)



3.

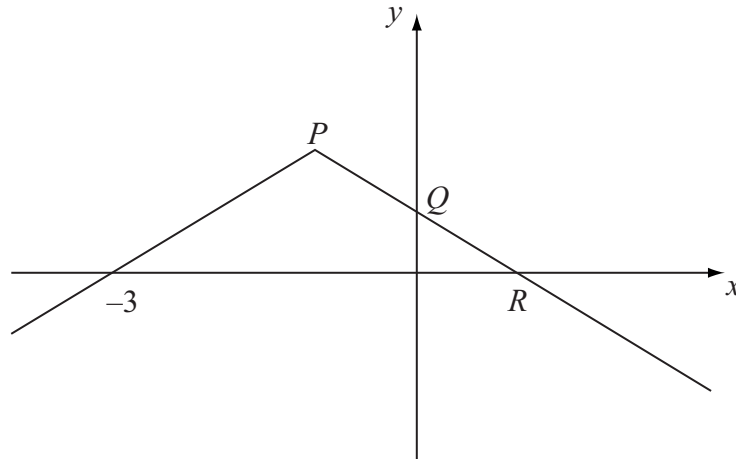


Figure 1

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)

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Question 3 continued

Lined area for writing the answer to Question 3 continued.





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**Question 3 continued**

Area with horizontal lines for writing answers.

**(Total 12 marks)**

Q3

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4. The function  $f$  is defined by

$$f : x \mapsto \frac{2(x-1)}{x^2 - 2x - 3} - \frac{1}{x-3}, \quad x > 3.$$

(a) Show that  $f(x) = \frac{1}{x+1}$ ,  $x > 3$ .

(4)

(b) Find the range of  $f$ .

(2)

(c) Find  $f^{-1}(x)$ . State the domain of this inverse function.

(3)

The function  $g$  is defined by

$$g : x \mapsto 2x^2 - 3, \quad x \in \mathbb{R}.$$

(d) Solve  $fg(x) = \frac{1}{8}$ .

(3)

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**Question 4 continued**

[Lined area for question response]













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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)

Lined area for student answers.



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**Question 6 continued**

A series of horizontal lines for writing.





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**Question 6 continued**

A series of horizontal lines for writing the answer to Question 6.

**Q6**

**(Total 14 marks)**



7.

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

(a) Show that  $f(x) = 0$  has a root,  $\alpha$ , 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)**

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**Question 7 continued**

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Q7

(Total 11 marks)

**TOTAL FOR PAPER: 75 MARKS**

**END**

