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1. The point P lies on the curve with equation

$$y = 4e^{2x+1}.$$

The y -coordinate of P is 8.

- (a) Find, in terms of $\ln 2$, the x -coordinate of P . (2)
- (b) Find the equation of the tangent to the curve at the point P in the form $y = ax + b$,
where a and b are exact constants to be found. (4)



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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)



3.

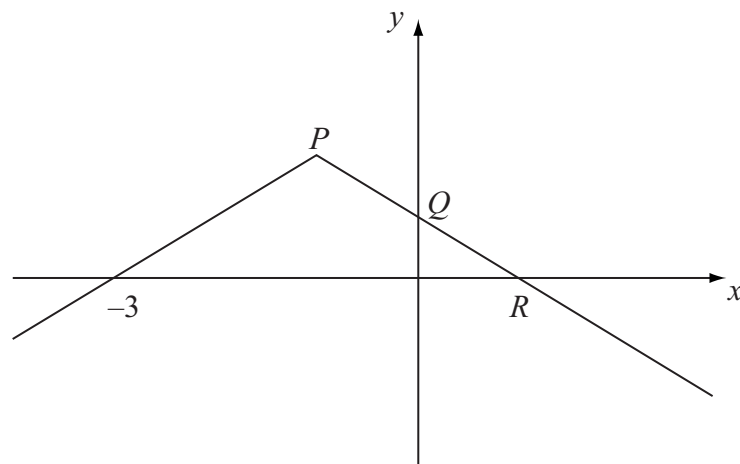


Figure 1

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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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)**





Question 4 continued

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Question 4 continued

Lined writing area for the answer to Question 4.

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Q4

(Total 12 marks)



