

1. Express

$$\frac{x+1}{3x^2-3} - \frac{1}{3x+1}$$

as a single fraction in its simplest form.

(4)



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Question 1 continued

Lined area for writing the answer to Question 1.

Q1

(Total 4 marks)



2.

$$f(x) = x^3 + 2x^2 - 3x - 11$$

(a) Show that $f(x) = 0$ can be rearranged as

$$x = \sqrt{\left(\frac{3x+11}{x+2}\right)}, \quad x \neq -2.$$

(2)

The equation $f(x) = 0$ has one positive root α .

The iterative formula $x_{n+1} = \sqrt{\left(\frac{3x_n+11}{x_n+2}\right)}$ is used to find an approximation to α .

(b) Taking $x_1 = 0$, find, to 3 decimal places, the values of x_2 , x_3 and x_4 .

(3)

(c) Show that $\alpha = 2.057$ correct to 3 decimal places.

(3)



Question 2 continued

Blank lined area for writing the answer to Question 2.

Q2

(Total 8 marks)



5. Sketch the graph of $y = \ln|x|$, stating the coordinates of any points of intersection with the axes.

(3)



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Question 5 continued

Q5

(Total 3 marks)



6.

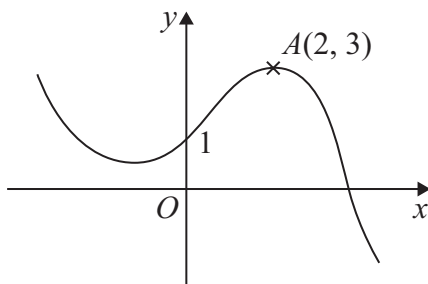
**Figure 1**

Figure 1 shows a sketch of the graph of $y = f(x)$.

The graph intersects the y -axis at the point $(0, 1)$ and the point $A(2, 3)$ is the maximum turning point.

Sketch, on separate axes, the graphs of

- (i) $y = f(-x) + 1$,
- (ii) $y = f(x + 2) + 3$,
- (iii) $y = 2f(2x)$.

On each sketch, show the coordinates of the point at which your graph intersects the y -axis and the coordinates of the point to which A is transformed.

(9)

Question 6 continued



Question 6 continued



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Question 6 continued

Q6

(Total 9 marks)



7. (a) By writing $\sec x$ as $\frac{1}{\cos x}$, show that $\frac{d(\sec x)}{dx} = \sec x \tan x$. (3)

Given that $y = e^{2x} \sec 3x$,

(b) find $\frac{dy}{dx}$. (4)

The curve with equation $y = e^{2x} \sec 3x$, $-\frac{\pi}{6} < x < \frac{\pi}{6}$, has a minimum turning point at (a, b) .

(c) Find the values of the constants a and b , giving your answers to 3 significant figures. (4)



Question 7 continued

Handwriting practice lines for Question 7.

(Total 11 marks)

Q7



8. Solve

$$\operatorname{cosec}^2 2x - \cot 2x = 1$$

for $0 \leq x \leq 180^\circ$.

(7)



9. (i) Find the exact solutions to the equations

(a) $\ln(3x - 7) = 5$ **(3)**

(b) $3^x e^{7x+2} = 15$ **(5)**

(ii) The functions f and g are defined by

$$f(x) = e^{2x} + 3, \quad x \in \mathbb{R}$$

$$g(x) = \ln(x - 1), \quad x \in \mathbb{R}, \quad x > 1$$

(a) Find f^{-1} and state its domain. **(4)**

(b) Find fg and state its range. **(3)**



Question 9 continued

Handwriting lines for the question response.

(Total 15 marks)

Q9

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TOTAL FOR PAPER: 75 MARKS

END

