

1. Express

$$\frac{3}{2x+3} - \frac{1}{2x-3} + \frac{6}{4x^2-9}$$

as a single fraction in its simplest form.

(4)



A blank Cartesian coordinate system is shown. It consists of a horizontal x-axis and a vertical y-axis that intersect at a point labeled 'O', representing the origin. The x-axis is labeled 'x' at its right end, and the y-axis is labeled 'y' at its top end. There are no tick marks or grid lines on the axes.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



$$x = \sec^2 2y, \quad 0 < y < \frac{\pi}{4}$$
$$\frac{dy}{dx} = \frac{1}{4x\sqrt{(x-1)}}$$

(ii) Given that

$$y = (x^2 + x^3) \ln 2x$$

find the exact value of $\frac{dy}{dx}$ at $x = \frac{e}{2}$, giving your answer in its simplest form.

(iii) Given that

$$f(x) = \frac{3 \cos x}{(x+1)^{\frac{1}{3}}}, \quad x \neq -1$$

show that

$$f'(x) = \frac{g(x)}{(x+1)^{\frac{4}{3}}}, \quad x \neq -1$$

where $g(x)$ is an expression to be found.

(3)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



5. (a) Sketch the graph with equation

$$y = |4x - 3|$$

stating the coordinates of any points where the graph cuts or meets the axes.

(2)

Find the complete set of values of x for which

- (b)

$$|4x - 3| > 2 - 2x$$

(4)

- (c)

$$|4x - 3| > \frac{3}{2} - 2x$$

(2)



Question 5 continued



[illegible]

7.

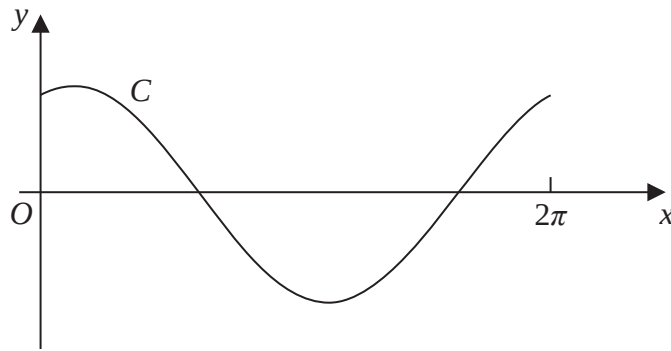
**Figure 1**

Figure 1 shows the curve C , with equation $y = 6 \cos x + 2.5 \sin x$ for $0 \leq x \leq 2\pi$

- (a) Express $6 \cos x + 2.5 \sin x$ in the form $R \cos(x - \alpha)$, where R and α are constants

with $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. Give your value of α to 3 decimal places.

(3)

- (b) Find the coordinates of the points on the graph where the curve C crosses the coordinate axes.

(3)

A student records the number of hours of daylight each Sunday throughout the year. She starts on the last Sunday in May with a recording of 18 hours, and continues until her final recording 52 weeks later.

She models her results with the continuous function given by

$$H = 12 + 6 \cos\left(\frac{2\pi t}{52}\right) + 2.5 \sin\left(\frac{2\pi t}{52}\right), \quad 0 \leq t \leq 52$$

where H is the number of hours of daylight and t is the number of weeks since her first recording.

Use this function to find

- (c) the maximum and minimum values of H predicted by the model,

(3)

- (d) the values for t when $H = 16$, giving your answers to the nearest whole number.

[You must show your working. Answers based entirely on graphical or numerical methods are not acceptable.]

(6)



(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

END