

2.

$$f(x) = 1 - \frac{3}{x+2} + \frac{3}{(x+2)^2}, \quad x \neq -2.$$

(a) Show that $f(x) = \frac{x^2 + x + 1}{(x+2)^2}$, $x \neq -2$. (4)

(b) Show that $x^2 + x + 1 > 0$ for all values of x . (3)

(c) Show that $f(x) > 0$ for all values of x , $x \neq -2$. (1)



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5.

Figure 1

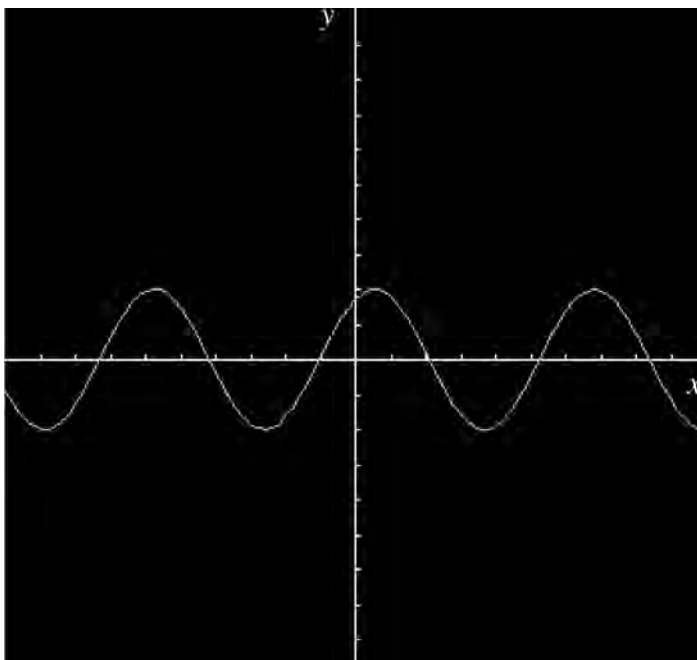


Figure 1 shows an oscilloscope screen.

The curve shown on the screen satisfies the equation

$$y = \sqrt{3} \cos x + \sin x.$$

- (a) Express the equation of the curve in the form $y = R \sin(x + \alpha)$, where R and α are constants, $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. (4)

- (b) Find the values of x , $0 \leq x < 2\pi$, for which $y = 1$. (4)



6. The function f is defined by

$$f : x \mapsto \ln(4 - 2x), \quad x < 2 \quad \text{and} \quad x \in \mathbb{R}.$$

(a) Show that the inverse function of f is defined by

$$f^{-1} : x \mapsto 2 - \frac{1}{2}e^x$$

and write down the domain of f^{-1} .

(4)

(b) Write down the range of f^{-1} .

(1)

(c) In the space provided on page 16, sketch the graph of $y = f^{-1}(x)$. State the coordinates of the points of intersection with the x and y axes.

(4)

The graph of $y = x + 2$ crosses the graph of $y = f^{-1}(x)$ at $x = k$.

The iterative formula

$$x_{n+1} = -\frac{1}{2}e^{x_n}, \quad x_0 = -0.3$$

is used to find an approximate value for k .

(d) Calculate the values of x_1 and x_2 , giving your answers to 4 decimal places.

(2)

(e) Find the value of k to 3 decimal places.

(2)



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Question 6 continued



7.

$$f(x) = x^4 - 4x - 8.$$

(a) Show that there is a root of $f(x) = 0$ in the interval $[-2, -1]$. (3)

(b) Find the coordinates of the turning point on the graph of $y = f(x)$. (3)

(c) Given that $f(x) = (x - 2)(x^3 + ax^2 + bx + c)$, find the values of the constants, a , b and c . (3)

(d) In the space provided on page 21, sketch the graph of $y = f(x)$. (3)

(e) Hence sketch the graph of $y = |f(x)|$. (1)



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Question 7 continued

Q7

(Total 13 marks)



