

AS Level Mathematics B (MEI)

H630/01 Pure Mathematics and Mechanics

Question Set 3

1. In this question you must show detailed reasoning.

Show that the equation $x = 7 + 2x^2$ has no real roots.

[3]

2. In this question you must show detailed reasoning.

Fig. 2 shows the graphs of $y = 4 \sin x^\circ$ and $y = 3 \cos x^\circ$ for $0 \leq x \leq 360$.

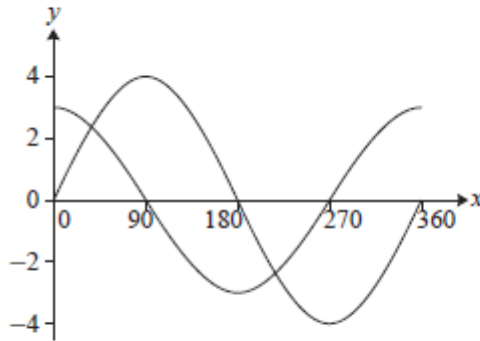


Fig. 2

Find the x -coordinates of the two points of intersection, giving your answers correct to 1 decimal place.

[3]

3. Given that k is an integer, express $\frac{3\sqrt{2}-k}{\sqrt{8+1}}$ in the form $a+b\sqrt{2}$ where a and b are rational expressions in terms of k .

[4]

4. A triangle ABC has sides $AB = 5$ cm, $AC = 9$ cm and $BC = 10$ cm.

(a) Find the cosine of angle BAC, giving your answer as a fraction in its lowest terms.

[2]

(b) Find the exact area of the triangle.

[3]

5. In this question you must show detailed reasoning.

(a) Nigel is asked to determine whether $(x+7)$ is a factor of $x^3 - 37x + 84$. He substitutes $x = 7$ and calculates $7^3 - 37 \times 7 + 84$. This comes to 168, so Nigel concludes that $(x+7)$ is not a factor.

Nigel's conclusion is wrong.

- Explain why Nigel's argument is not valid.
- Show that $(x+7)$ is a factor of $x^3 - 37x + 84$.

[2]

(b) Sketch the graph of $y = x^3 - 37x + 84$, indicating the coordinates of the points at which the curve crosses the coordinate axes.

[5]

(c) The graph in part (b) is translated by $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$. Find the equation of the translated graph, giving your answer in the form $y = x^3 + ax^2 + bx + c$ where a , b and c are integers.

[4]

6

In this question you must show detailed reasoning.

Show that the only stationary point on the graph of $y = x^2 - 4\sqrt{x}$ is a minimum point at $(1, -3)$.
[7]

7

In this question you must show detailed reasoning.

(a) Sketch the gradient function for the curve $y = 24x - 3x^2 - x^3$. [5]

(b) Determine the set of values of x for which $24x - 3x^2 - x^3$ is decreasing. [2]

8

David puts a block of ice into a cool-box. He wishes to model the mass m kg of the remaining block of ice at time t hours later. He finds that when $t = 5$, $m = 2.1$, and when $t = 50$, $m = 0.21$.

(a) David at first guesses that the mass may be inversely proportional to time. Show that this model fits his measurements. [3]

(b) Explain why this model

(i) is not suitable for small values of t , [1]

(ii) cannot be used to find the time for the block to melt completely. [1]

David instead proposes a linear model $m = at + b$, where a and b are constants.

(c) Find the values of the constants for which the model fits the mass of the block when $t = 5$ and $t = 50$. [3]

(d) Interpret these values of a and b . [2]

(e) Find the time according to this model for the block of ice to melt completely. [1]

Total Marks for Question Set 3: 51 marks

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