

AS Level Mathematics A

H230/02 Pure Mathematics and Mechanics

Question Set 3

1 In this question you must show detailed reasoning.

Solve the equation $x(3 - \sqrt{5}) = 24$, giving your answer in the form $a + b\sqrt{5}$, where a and b are positive integers. [3]

2 (a) Express $5x^2 - 20x + 3$ in the form $p(x + q)^2 + r$, where p , q and r are integers. [3]

(b) State the coordinates of the minimum point of the curve $y = 5x^2 - 20x + 3$. [2]

(c) State the equation of the normal to the curve $y = 5x^2 - 20x + 3$ at its minimum point. [1]

3 (a) Sketch the curve $y = -\frac{1}{x^2}$. [1]

(b) The curve $y = -\frac{1}{x^2}$ is translated by 2 units in the positive x -direction.

State the equation of the curve after it has been translated. [2]

(c) The curve $y = -\frac{1}{x^2}$ is stretched parallel to the y -axis with scale factor $\frac{1}{2}$ and, as a result, the point $(\frac{1}{2}, -4)$ on the curve is transformed to the point P .

State the coordinates of P . [2]

4 (a) Find and simplify the first three terms in the expansion of $(2 - 5x)^5$ in ascending powers of x . [3]

(b) In the expansion of $(1 + ax)^2(2 - 5x)^5$, the coefficient of x is 48.

Find the value of a . [3]

5 Points A , B , C and D have position vectors $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$ and $\mathbf{d} = \begin{pmatrix} 4 \\ k \end{pmatrix}$.

(a) Find the value of k for which D is the midpoint of AC . [1]

(b) Find the two values of k for which $|\overrightarrow{AD}| = \sqrt{13}$. [3]

(c) Find one value of k for which the four points form a trapezium. [2]

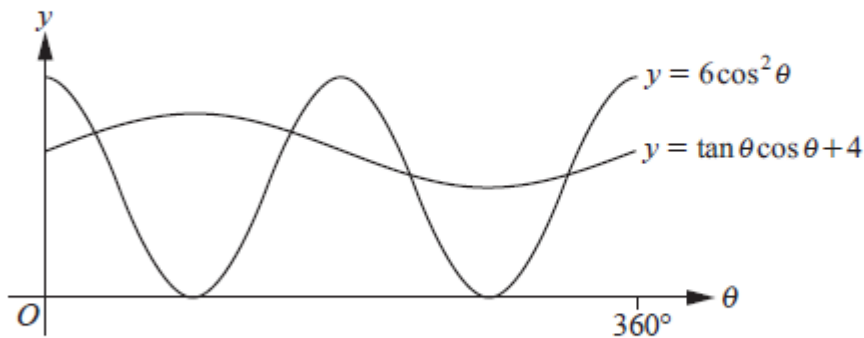
6 In this question you must show detailed reasoning.

(a) Show that the equation $6 \cos^2 \theta = \tan \theta \cos \theta + 4$

can be expressed in the form $6 \sin^2 \theta + \sin \theta - 2 = 0$.

[2]

(b)

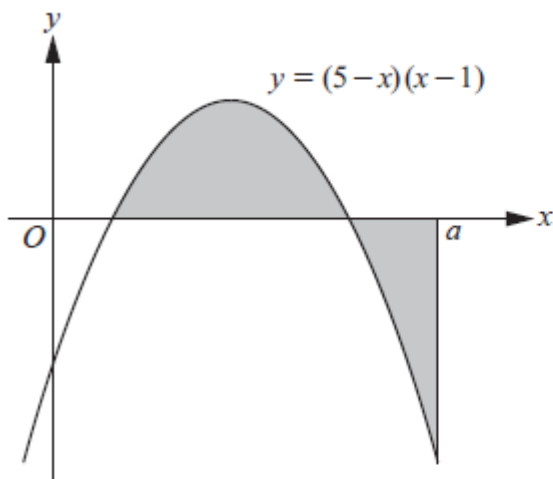


The diagram shows parts of the curves $y = 6 \cos^2 \theta$ and $y = \tan \theta \cos \theta + 4$, where θ is in degrees.

Solve the inequality $6 \cos^2 \theta > \tan \theta \cos \theta + 4$ for $0^\circ < \theta < 360^\circ$.

[5]

7



The diagram shows part of the curve $y = (5-x)(x-1)$ and the line $x = a$.

Given that the total area of the regions shaded in the diagram is 19 units^2 , determine the exact value of a .

[8]

8

(a) Show that the equation $2 \log_2 x = \log_2(kx-1) + 3$, where k is a constant, can be expressed in the form $x^2 - 8kx + 8 = 0$.

[4]

(b) Given that the equation $2 \log_2 x = \log_2(kx-1) + 3$ has only one real root, find the value of this root.

[4]

Total Marks for Question Set 3: 49

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