OCR
Oxford Cambridge and RSA

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 $\left(\frac{1}{2},-4\right)$ 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 $\left|\overrightarrow{AD}\right|=\sqrt{13}$. **[3]**

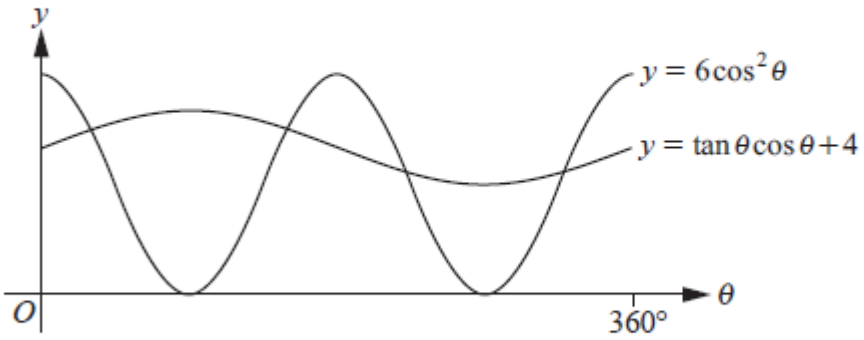
(c) Find one value of k for which the four points form a trapezium. **[2]**

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 $0° < \theta < 360°$. **[5]**

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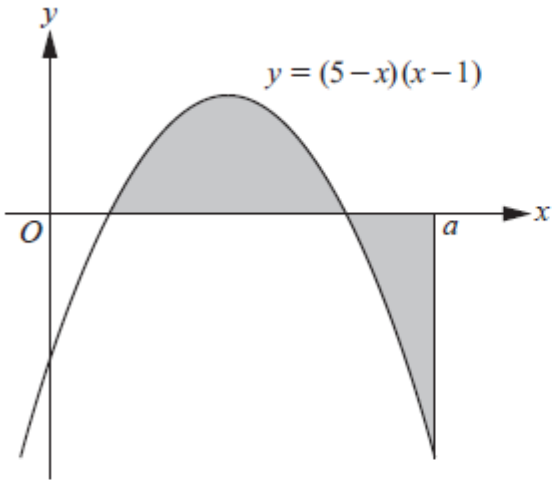

The diagram shows part of the curve $y = (5-x)(x-1)$ and the line $x = a$.

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