AS Level Mathematics B (MEI)

H630/01 Pure Mathematics and Mechanics

Question Set 1

1

Write $\frac{8}{3-\sqrt{5}}$ in the form $a+b\sqrt{5}$, where a and b are integers to be found. **[2]**

2

Find the binomial expansion of $(3-2x)^3$. **[4]**

3 **(i)**

Sketch the graphs of $y = 4\cos x$ and $y = 2\sin x$ for $0° \leqslant x \leqslant 180°$ on the same axes. **[2]**

(ii)

Find the exact coordinates of the point of intersection of these graphs, giving your answer in the form $(\arctan a, k\sqrt{b})$, where a and b are integers and k is rational. **[4]**

(iii)

A student argues that without the condition $0° \leqslant x \leqslant 180°$ all the points of intersection of the graphs would occur at intervals of 360° because both $\sin x$ and $\cos x$ are periodic functions with this period. Comment on the validity of the student's argument. **[1]**

4

In this question you must show detailed reasoning.

You are given that $f(x) = 4x^3 - 3x + 1$.

(i)

Use the factor theorem to show that $(x+1)$ is a factor of $f(x)$. **[2]**

(ii)

Solve the equation $f(x) = 0$. **[3]**

5

In this question you must show detailed reasoning.

Fig. 5 shows the graph of a quadratic function. The graph crosses the axes at the points (−1, 0), (0, −4) and (2, 0).

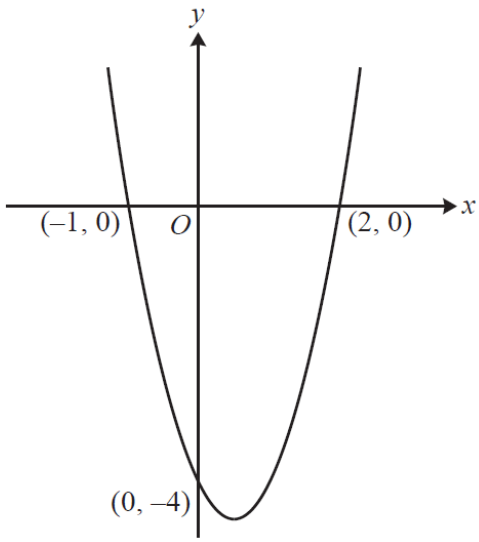

Fig. 5

Find the area of the finite region bounded by the curve and the x-axis. **[8]**

6 The curve $y=(x-1)^2$ maps onto the curve C_1 following a stretch scale factor $\frac{1}{2}$ in the x-direction.

(i) Show that the equation of C_1 can be written as $y=4x^2-4x+1$. **[2]**

The curve C_2 is a translation of $y=4.25x-x^2$ by $\begin{pmatrix}0\\-3\end{pmatrix}$.

(ii) Show that the normal to the curve C_1 at the point (0, 1) is a tangent to the curve C_2. **[7]**

7 The intensity of the sun's radiation, y watts per square metre, and the average distance from the sun, x astronomical units, are shown in Fig. 7 for the planets Mercury and Jupiter.

	x	y
Mercury	0.3075	14 400
Jupiter	4.950	55.8

Fig. 7

The intensity y is proportional to a power of the distance x.

(i) Write down an equation for y in terms of x and two constants. **[1]**

(ii) Show that the equation can be written in the form $\ln y = a + b\ln x$. **[2]**

(iii) Complete the table below for $\ln x$ and $\ln y$ correct to 4 significant figures. **[2]**

	$\ln x$	$\ln y$
Mercury		
Jupiter		

(iv) Use the values from part (iii) to find a and b. **[3]**

(v) Hence rewrite your equation from part (i) for y in terms of x, using suitable numerical values for the constants. **[2]**

(vi) Sketch a graph of the equation found in part (v). **[2]**

(vii) Earth is 1 astronomical unit from the sun. Find the intensity of the sun's radiation for Earth. **[1]**

Total Marks for Question Set 1: 48

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