Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						7	3	6	2	/	0	2	Signature	

Paper Reference(s)

7362/02

London Examinations GCE

Pure Mathematics

Alternative Ordinary Level

Paper 2

Thursday 14 May 2009 – Afternoon

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Materials required for examination	Items included with question papers
Nil	Nil

Candidates are expected to have an electronic calculator when answering this paper.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
You must write your answer for each question in the space following the question.
If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates

Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 10 questions in this question paper. The total mark for this paper is 100.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and legibly.

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1. Find the set of values of the constant p for which the equation
$4x^2 + 4(2 - p)x + (3p - 8) = 0$ has no real roots.

(4)

Q1

(Total 4 marks)

Leave blank

2. Find the coordinates of the points where the line with equation $y = 2x - 5$ meets the curve with equation $xy = 12$.

(5)

Q2

(Total 5 marks)

Leave blank

3. The diagram on page 5 shows a sketch of the line with equation $y = 16 - 4x$.

The line crosses the x-axis at the point A and the y-axis at the point B.

(a) Write down the coordinates of

(i) the point A,

(ii) the point B.

(2)

On the diagram

(b) sketch the line with equation $x = 3$ and the line with equation $y = 3x + 8$

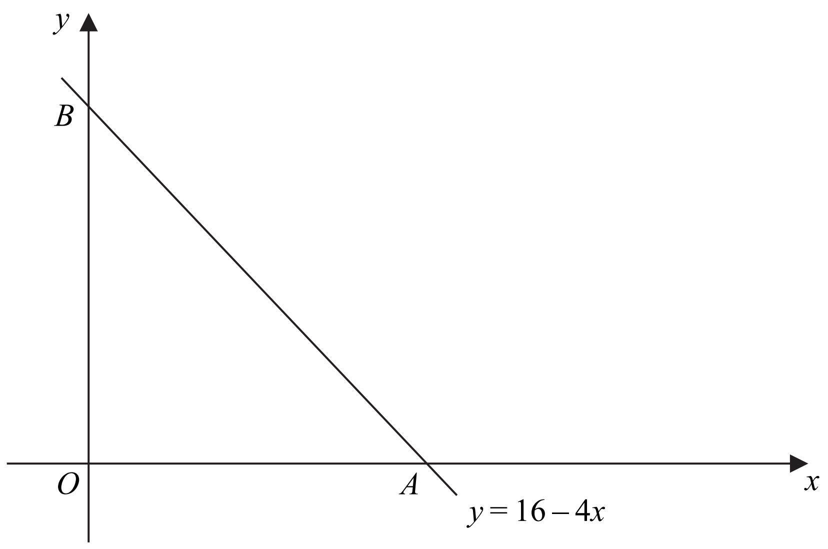
(2)

(c) show, by shading, the region for which $y \geqslant 16 - 4x$, $x \leqslant 3$ and $y \leqslant 3x + 8$

(1)

Leave blank

Question 3 continued



Q3

(Total 5 marks)

N 3 3 4 2 1 A 0 5 2 8

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4. A curve has equation $y = \dfrac{x-2}{x+3}, \quad x \neq -3$

(a) Write down an equation of the asymptote to the curve which is parallel to

(i) the x-axis,

(ii) the y-axis.

(2)

(b) Calculate the coordinates of the point where the curve crosses

(i) the x-axis,

(ii) the y-axis.

(2)

Leave blank

Question 4 continued

(c) Sketch the curve, showing clearly the asymptotes and the coordinates of the points where the curve crosses the coordinate axes.

(3)

Q4

(Total 7 marks)

Leave blank

5. (a) Complete the table for $y = 2x - 3 + \frac{1}{x^2}$, giving your values of y to 2 decimal places.

x	0.3	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y		2	0		1.25		3.11		5.06

(2)

The grid on the facing page shows the graph of $y = 2 + \frac{1}{x}$, $0.3 \leqslant x \leqslant 4.0$

(b) On the same grid, draw the graph of $y = 2x - 3 + \frac{1}{x^2}$ for $0.3 \leqslant x \leqslant 4.0$

(2)

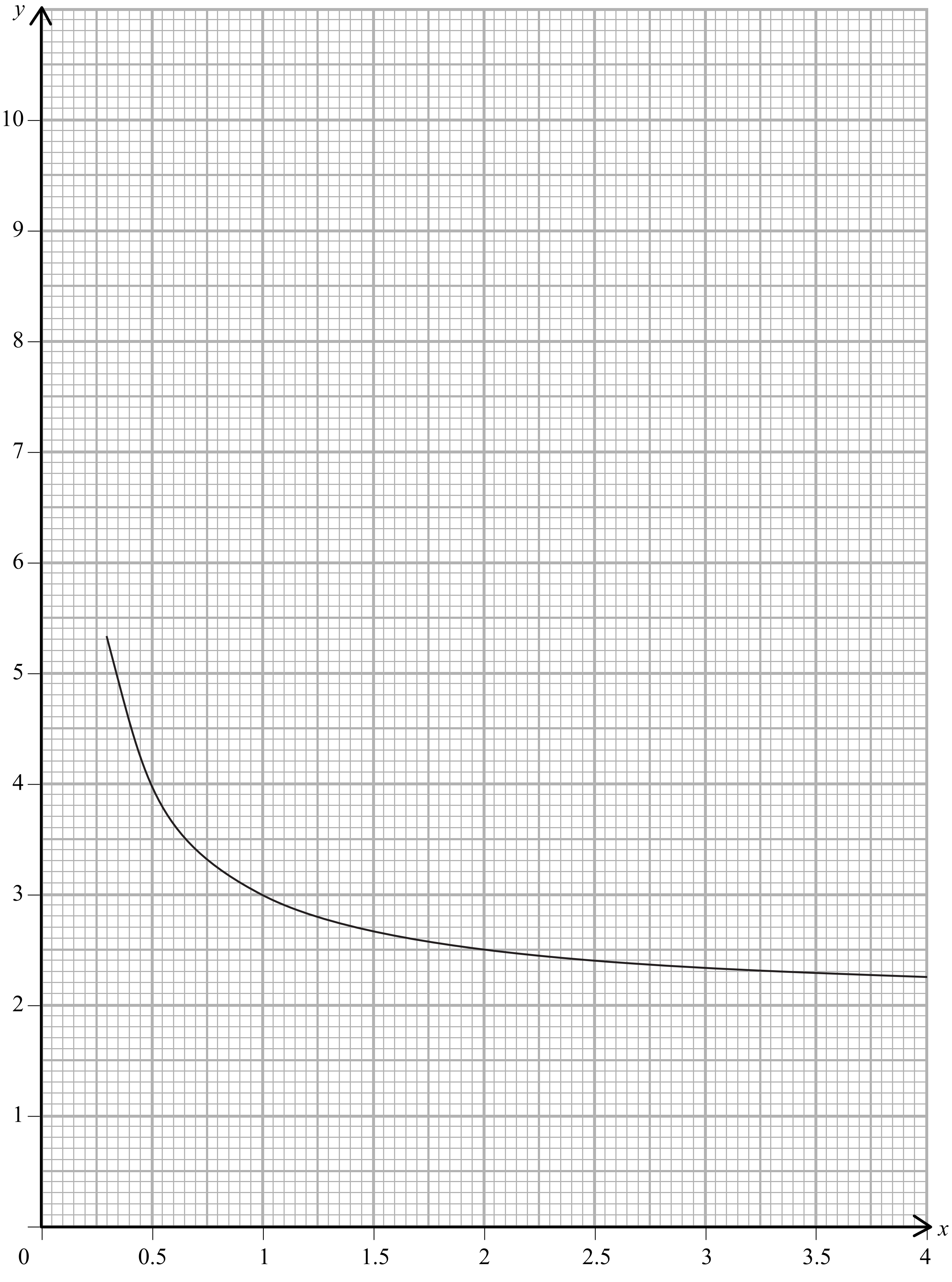
(c) Use algebra to show that the x-coordinates of the points of intersection of the curve with equation $y = 2x - 3 + \frac{1}{x^2}$ and the curve with equation $y = 2 + \frac{1}{x}$ are the roots of the equation $2x^3 - 5x^2 - x + 1 = 0$.

(2)

(d) Hence use your graph to obtain estimates, in the interval $0.3 \leqslant x \leqslant 4.0$, to one decimal place, of the roots of the equation $2x^3 - 5x^2 - x + 1 = 0$.

(2)

Question 5 continued



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Question 5 continued

Leave blank

Question 5 continued

(Total 8 marks)

Q5

N 3 3 4 2 1 A 0 1 1 2 8

Leave blank

6. A geometric series is such that the difference between the third and second terms is 12.

Also, the difference between the fifth and fourth terms is 27.

The common ratio of the series is r, where $r > 1$.

Find

(a) the value of r,

(4)

(b) the first term of the series.

(2)

A new geometric series starts with the second term of the original series.

The common ratio of this series is r^2.

(c) Find, to the nearest whole number, the sum of the first 10 terms of this new series.

(4)

Leave blank

Question 6 continued

Q6

(Total 10 marks)

N 3 3 4 2 1 A 0 1 3 2 8

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7. A curve has equation $a^{\frac{3}{2}}y = x^{\frac{5}{2}}$, where $x \geqslant 0$ and a is a positive constant.

(a) Show that an equation of the normal to the curve at the point with coordinates (a, a) is $5y + 2x = 7a$.

(6)

(b) Find the coordinates of the point where this normal meets the x-axis.

(1)

The finite region bounded by the curve, the normal to the curve at the point (a, a) and the x-axis is rotated through 360° about the x-axis.

(c) Find, in terms of π, the volume of the solid generated.

(6)

Leave blank

Question 7 continued

(Total 13 marks)

Q7

Turn over

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8. $$f(x) \equiv 3 - 5x - 7x^2$$

(a) Show that $f(x)$ can be written in the form $A - B(x + C)^2$, stating the values of A, B and C.

(4)

(b) Write down the maximum value of $f(x)$ and the value of x for which this maximum occurs.

(2)

The equation $f(x) = 0$ has roots α and β.

Without solving the equation find, as exact fractions,

(c) $\alpha^2 + \beta^2$,

(3)

(d) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

(3)

(e) Form a quadratic equation, with integer coefficients, which has roots $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$.

(2)

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 14 marks)

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9. **Figure 1**

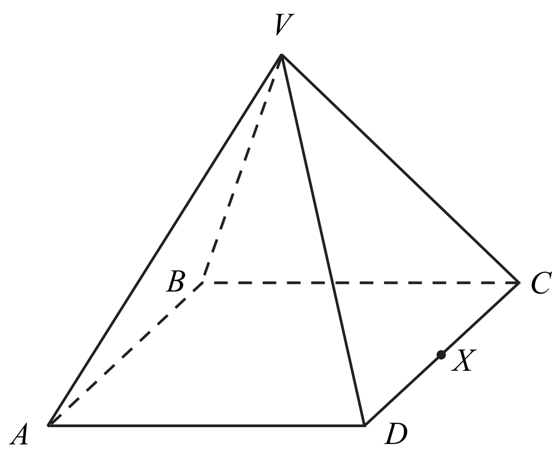

Figure 1 shows a hollow right pyramid *VABCD* with a square base of side 4 cm.

The point *X* is the mid-point of *CD*.

The sloping edge *VA* makes an angle of 60° with the base *ABCD*.

Find, in cm to 3 significant figures,

(a) the height of the pyramid,
(4)

(b) the length of *VA*,
(3)

(c) the length of *VX*.
(3)

(d) Find, in degrees, to one decimal place, the angle between the plane *VCD* and the base *ABCD*.
(3)

A sphere is inside the pyramid and is touching all five plane faces of the pyramid.

(e) Find, in cm to 3 significant figures, the radius of the sphere.
(3)

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Question 9 continued

N 3 3 4 2 1 A 0 2 1 2 8

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Question 9 continued

Leave blank

Question 9 continued

(Total 16 marks)

Q9

N 3 3 4 2 1 A 0 2 3 2 8

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10.
$$\cos(A+B) \equiv \cos A \cos B - \sin A \sin B,$$
$$\cos(A-B) \equiv \cos A \cos B + \sin A \sin B.$$

(a) Prove that $\cos 2A \equiv 2\cos^2 A - 1$

(2)

$$f(\theta) = \cos 5\theta + \cos 3\theta + 2\cos\theta$$

(b) Show that

(i) $\cos 5\theta + \cos 3\theta \equiv 2\cos 4\theta \cos\theta$,

(ii) $f(\theta) = 16\cos^5\theta - 16\cos^3\theta + 4\cos\theta$.

(6)

(c) Hence or otherwise solve, for $-\pi \leqslant \theta \leqslant \pi$, giving the values of θ in terms of π, the equation $\cos 5\theta + \cos 3\theta - 2\cos\theta = 0$

(5)

(d) Find, to 3 significant figures, the value of $\int_0^{\frac{\pi}{3}} (\cos^5\theta - \cos^3\theta)\,d\theta$.

(5)

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Question 10 continued

Leave blank

Question 10 continued

Leave blank

Question 10 continued

(Total 18 marks)

Q10

TOTAL FOR PAPER: 100 MARKS

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