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

Monday 18 January 2010 – Afternoon

Time: 2 hours

Materials required for examination
Nil

Items included with question papers
Nil

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

Examiner's use only

Team Leader's use only

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

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 24 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and legibly.

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1. Differentiate with respect to x, $e^{2x} \sin 3x$.

(3)

Q1

(Total 3 marks)

N 3 5 3 7 6 A 0 2 2 4

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2. In ΔABC, $AB = 5$ cm, $BC = 8.3$ cm and $AC = 6.9$ cm.

(a) Find, in degrees, to the nearest 0.1°, the size of $\angle ACB$.

(3)

(b) Find, in cm^2, to 3 significant figures, the area of ΔABC.

(3)

Q2

(Total 6 marks)

N 3 5 3 7 6 A 0 3 2 4

Turn over

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

(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)

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

(3)

N 3 5 3 7 6 A 0 4 2 4

Leave blank

Question 3 continued

Q3

(Total 7 marks)

N 3 5 3 7 6 A 0 5 2 4

Turn over

Leave blank

4. (a) Complete the table for $y = e^x - 4x^2$, giving your values of y to 3 significant figures.

x	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1	0.649		–4.52		–12.8		–15.9	

(2)

(b) On the grid on the facing page, draw the graph of $y = e^x - 4x^2$ for $0 \leqslant x \leqslant 4.0$

(2)

(c) For each of the following equations, use your graph to obtain an estimate, to one decimal place, for the root between $x = 0$ and $x = 4$

(i) $x^2 = \frac{1}{4}e^x + 2$

(ii) $x = \ln(4x^2 - 3)$

(5)

N 3 5 3 7 6 A 0 6 2 4

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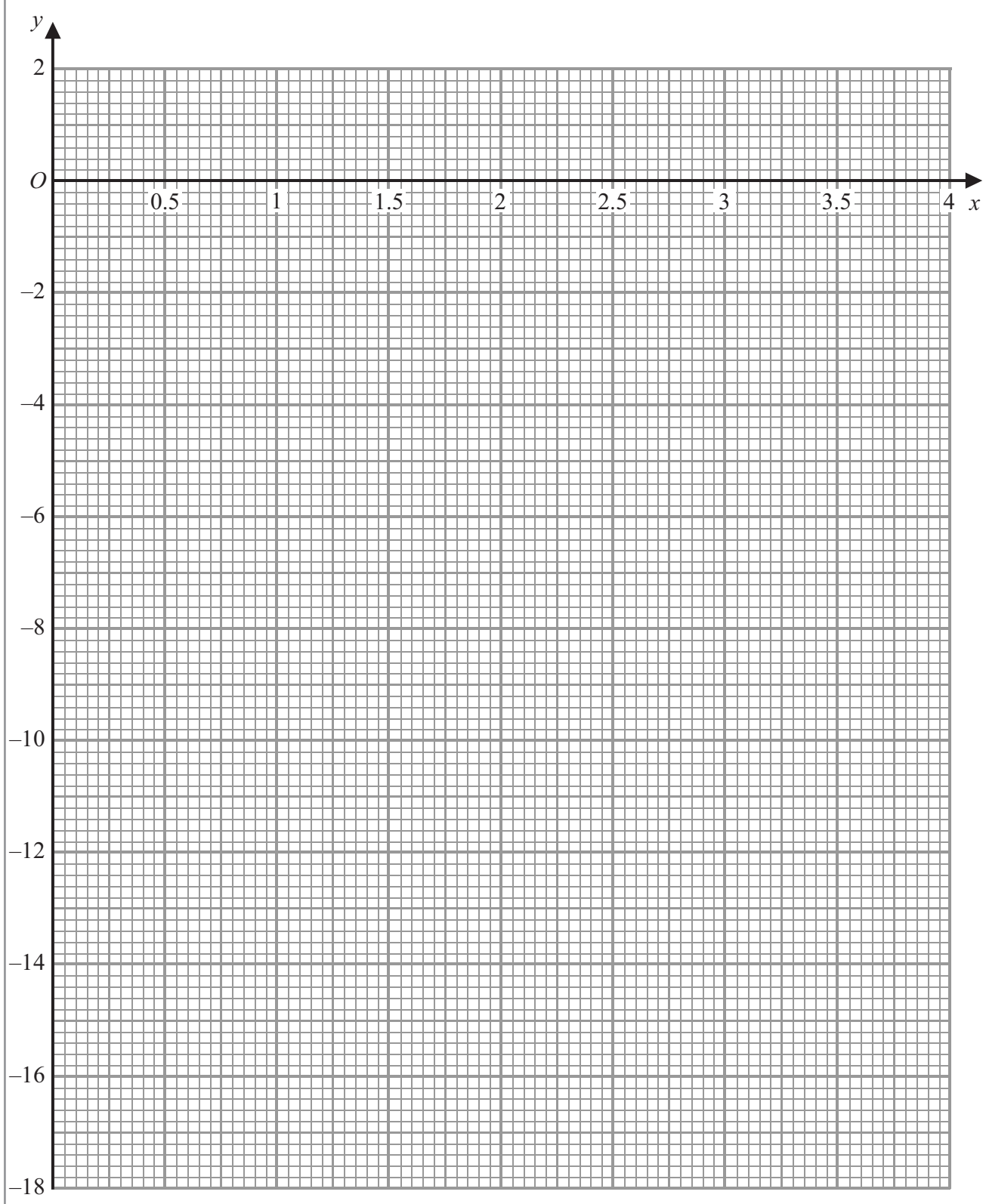
Question 4 continued



Q4

(Total 9 marks)

N 3 5 3 7 6 A 0 7 2 4

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5. A particle moves along a straight line.

At time t seconds the velocity, v ms^{-1}, of the particle is given by $v = t^3 - 7t^2 + 12t,\ t \geqslant 0$

(a) Find the values of t for which the particle is instantaneously at rest.

(3)

(b) Sketch the graph of $v = t^3 - 7t^2 + 12t,\ t \geqslant 0$

(2)

(c) Find, to 3 significant figures, the total distance travelled by the particle in the interval $0 \leqslant t \leqslant 4$

(4)

N 3 5 3 7 6 A 0 8 2 4

Leave blank

Question 5 continued

Q5

(Total 9 marks)

Leave blank

6. The sum to infinity of a convergent geometric series is $80x$, $x > 0$, and the sum of the first four terms is $75x$.

(a) Find the possible values of the common ratio of the series.

(4)

Given that the first term of the series is greater than $100x$,

(b) find, in terms of x, the first term of the series.

(3)

Given also that the fifth term of the series is 30

(c) find the value of x.

(3)

N 3 5 3 7 6 A 0 1 0 2 4

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Question 6 continued

(Total 10 marks)

Q6

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7. The curve with equation $y = 4e^{2x}$ meets the curve with equation $y = \left(e^{2x} - 3\right)^2$ at the points A and B.

(a) Find the coordinates of A and the coordinates of B.

(6)

(b) Find, to 4 significant figures, the length of AB.

(2)

The point C has coordinates $(5, 0)$.

(c) Find, to 3 significant figures, the area of ΔABC.

(4)

N 3 5 3 7 6 A 0 1 2 2 4

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Question 7 continued

Q7

(Total 12 marks)

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8. A solid metal cube of side 5 cm is melted down and all the metal is used to make a right cylinder.
The radius of the cylinder is r cm and the height is h cm.
The total surface area of the cylinder is A cm^2.

(a) Show that $A = \frac{250}{r} + 2\pi r^2$ **(4)**

(b) Find, to 3 significant figures, the value of r for which $\frac{dA}{dr} = 0$ **(3)**

(c) Show that the value of r found in part (b) gives a minimum value of A. **(3)**

(d) Find, to 3 significant figures, the minimum value of A. **(2)**

N 3 5 3 7 6 A 0 1 4 2 4

Leave blank

Question 8 continued

Leave blank

Question 8 continued

N 3 5 3 7 6 A 0 1 6 2 4

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Question 8 continued

Q8

(Total 12 marks)

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9. (a) Show that

$$(\alpha + \beta)(\alpha^2 - \alpha\beta + \beta^2) = \alpha^3 + \beta^3$$

$$(\alpha - \beta)(\alpha^2 + \alpha\beta + \beta^2) = \alpha^3 - \beta^3$$

(3)

$$f(x) = x^2 + 7x + 3, \; x \in \mathbb{R}$$

The equation $f(x) = 0$ has roots α and β where $\alpha > \beta$.

Without solving the equation, calculate the value of

(b) $\alpha^3 + \beta^3$,

(3)

(c) $(\alpha - \beta)^2$.

(2)

Hence

(d) calculate the exact value of $\alpha^3 - \beta^3$,

(3)

(e) form a quadratic equation, with integer coefficients, with roots $\dfrac{\alpha}{\beta^2}$ and $\dfrac{\beta}{\alpha^2}$.

(4)

N 3 5 3 7 6 A 0 1 8 2 4

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Question 9 continued

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Question 9 continued

N 3 5 3 7 6 A 0 2 0 2 4

Leave blank

Question 9 continued

(Total 15 marks)

Q9

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10.

$$\sin(A+B) \equiv \sin A \cos B + \cos A \sin B,$$

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

(a) By writing $\tan(A+B) \equiv \dfrac{\sin(A+B)}{\cos(A+B)}$, prove that $\tan(A+B) \equiv \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$.

(3)

(b) Hence or otherwise, find the exact value of

(i) $\tan 75°$, (ii) $\tan 15°$,

simplifying your answers as far as possible.

(5)

(c) Use the result in (a) to write down an expression for $\tan 2\theta$ in terms of $\tan \theta$.

(1)

(d) Hence find the exact value of $\tan 22.5°$.

(4)

Given that $\tan \theta = \dfrac{2}{5}$ and θ is an acute angle,

(e) find the exact value of $\sin 2\theta$.

(4)

N 3 5 3 7 6 A 0 2 2 2 4

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Question 10 continued

Leave blank

Question 10 continued

Q10

(Total 17 marks)

TOTAL FOR PAPER: 100 MARKS

END

N 3 5 3 7 6 A 0 2 4 2 4