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 17 May 2010 – Morning

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	
11	
Total	

Materials required for examination
Nil

Items included with question papers
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 to 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 11 questions in this question paper. The total mark for this paper is 100.
There are 32 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and legibly.

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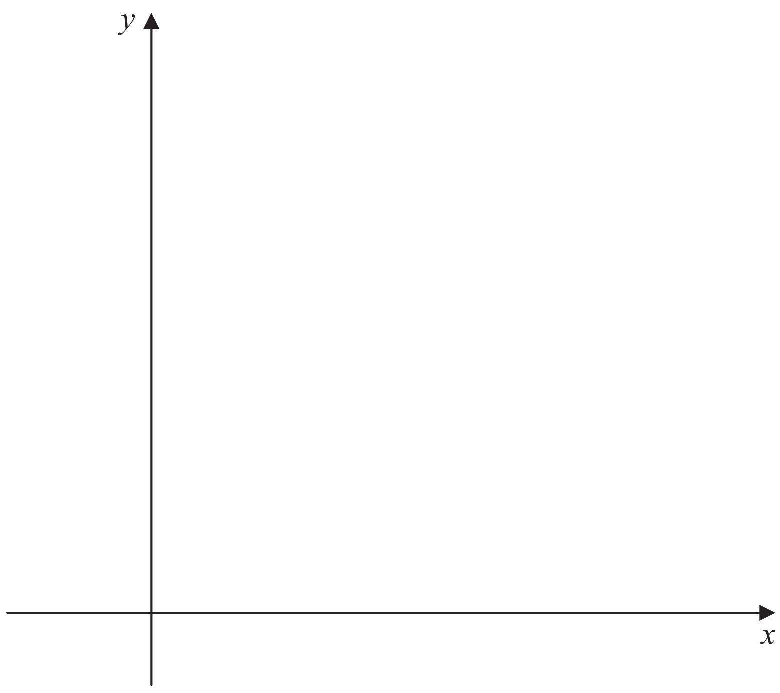
1. (a) On the axes below sketch the lines with equations $y = 2x + 1$ and $y + 3x = 9$

(2)

(b) Show, by shading, the region R defined by the inequalities

$$y \leqslant 2x + 1,\ y + 3x \leqslant 9,\ x \geqslant 0 \text{ and } y \geqslant 0$$

(1)



Q1

(Total 3 marks)

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2. $$f(x) = x^3 + 2x^2 - 5x - 6$$

(a) Factorise $x^2 - x - 2$

(1)

(b) Hence, or otherwise, show that $(x^2 - x - 2)$ is a factor of $f(x)$.

(3)

Q2

(Total 4 marks)

Leave blank

3. Show that $\sum_{r=5}^{n}(2r-1) = n^2 - 16$

(4)

Q3

(Total 4 marks)

Leave blank

4. Referred to a fixed origin O, the position vectors of the points A and B are $a\mathbf{i} + 8\mathbf{j}$ and $14\mathbf{i} + b\mathbf{j}$ respectively and the mid-point, M, of AB has position vector $9\mathbf{i} + 40\mathbf{j}$.

(a) Find the value of a and the value of b.

(2)

(b) Find the unit vector in the direction of $\overrightarrow{OM}$.

(2)

Q4

(Total 4 marks)

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5. Oil is leaking from a hole in a pipe. The oil forms a circular pool of radius r cm.
The area, A cm^2, of the surface of the pool is increasing at a constant rate of 0.3 cm^2/s.
Find, to 3 significant figures, the rate of increase of the radius of the pool when the area is 40 cm^2.

(5)

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Question 5 continued

Q5

(Total 5 marks)

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6. $y = \tan x \qquad \text{where} \quad \tan x = \dfrac{\sin x}{\cos x}$

(a) Show, by differentiation, that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1}{\cos^2 x}$ **(3)**

(b) Hence differentiate $\mathrm{e}^{3x} \tan x$ **(3)**

(c) Solve, to 3 significant figures, the equation $3\sin\theta = 6\cos\theta,\ \ 0 \leqslant \theta \leqslant \frac{\pi}{2}$ **(2)**

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Question 6 continued

Q6

(Total 8 marks)

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7.

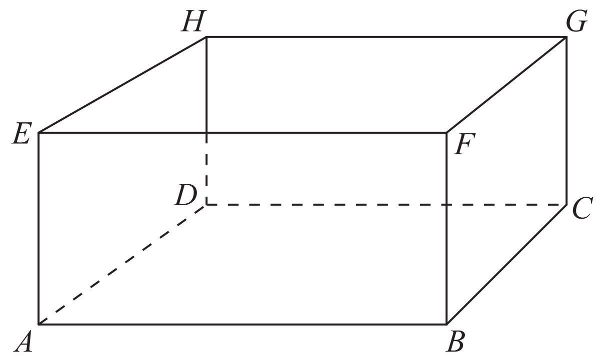

Figure 1

Figure 1 shows a rectangular box *ABCDEFGH* which is open at the top *EFGH*.

The volume of the box is 400 cm^3.

The length, x cm, of the base is twice the width of the base and the height of the box is h cm.

(a) Write down an expression, in terms of x and h, for the volume of the box.

(1)

The total surface area of the outside of the box is S cm^2.

(b) Show that

$$S = \frac{2400}{x} + \frac{1}{2}x^2$$

(3)

(c) Find, to 3 significant figures, the minimum value of S.

(5)

(d) Prove that the value of S found in (c) is the minimum value.

(2)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 11 marks)

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8. (a) Show that

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

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

(2)

$$\text{f}(x) = x^2 - 2x - 5$$

The roots of the equation $\text{f}(x) = 0$ are α and β, where $\alpha > \beta$.

Without solving the equation, calculate the value of

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

(3)

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

(2)

Hence

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

(2)

(e) calculate the exact value of $\alpha^3 - \beta^3$, giving your answer in the form $k\sqrt{6}$

(2)

(f) form an equation with roots $(\alpha - \beta)^2$ and $(\alpha + \beta)^2$.

(4)

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Question 8 continued

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Question 8 continued

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Question 8 continued

(Total 15 marks)

Q8

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

Show that

(a) $\cos(A+B) + \cos(A-B) \equiv 2\cos A \cos B$, **(1)**

(b) $\cos 2A \equiv 2\cos^2 A - 1$, **(2)**

(c) $\cos P + \cos Q \equiv 2\cos\left(\frac{P+Q}{2}\right)\cos\left(\frac{P-Q}{2}\right)$. **(2)**

(d) Hence show that $\cos 8x + 2\cos 6x + \cos 4x \equiv 4\cos 6x \cos^2 x$. **(4)**

(e) Find the exact value of $\int_0^{\frac{\pi}{4}} \cos 6x \cos^2 x \, dx$. **(6)**

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Question 9 continued

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Question 9 continued

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Question 9 continued

Q9

(Total 15 marks)

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10. A curve C has equation $y = 4x + \dfrac{1}{x-1}, \quad x \neq 1$

(a) Write down an equation of the asymptote to C which is parallel to the y-axis.

(1)

(b) Prove that C has a minimum point when $x = \frac{3}{2}$ and a maximum point when $x = \frac{1}{2}$.

(8)

(c) Find the y-coordinate of

(i) the minimum point,

(ii) the maximum point.

(2)

(d) Sketch C, showing clearly the asymptote found in (a), the coordinates of the turning points, and the coordinates of the point where the curve crosses the y-axis.

(4)

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Question 10 continued

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Question 10 continued

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Question 10 continued

Q10

(Total 15 marks)

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11. S and T are two geometric series.

The first, third and fifth terms of both series are $(x-4)$, $(2x-1)$ and $(16x+1)$ respectively.

(a) Find the two possible values of x.

(5)

The terms of S are all positive.

For S, find

(b) the first term,

(2)

(c) the common ratio.

(3)

The terms of T are all negative.

(d) Find the first term of T.

(2)

(e) Find the sum to infinity of T.

Give your answer to 3 significant figures.

(4)

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Question 11 continued

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Question 11 continued

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Question 11 continued

Q11

(Total 16 marks)

TOTAL FOR PAPER: 100 MARKS

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