Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						7 3 6 2 / 0 1	Signature	

Paper Reference(s)

7362/01

London Examinations GCE

Pure Mathematics

Alternative Ordinary Level

Paper 1

Monday 11 May 2009 – Morning

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
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11	
12	
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 12 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. $$f(x) = 2x^3 + px^2 - 5x + 6$$

Given that $(x - 3)$ is a factor of $f(x)$, find the value of p.

(3)

Q1

(Total 3 marks)

Leave blank

2. Solve the equation $\log_5 (3x + 19) = 4$.

(3)

Q2

(Total 3 marks)

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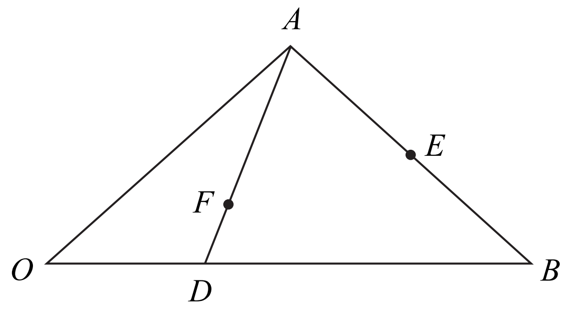
3. **Figure 1**



In Figure 1, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and D is a point on OB. The point E is the midpoint of AB and F is the point on AD which is such that $\overrightarrow{OF} = \frac{2}{5}(\mathbf{a} + \mathbf{b})$.

Prove that O, F and E are collinear.

(4)

Q3

(Total 4 marks)

Leave blank

4. Oil is dripping from a pipe onto horizontal ground, forming a circular pool.

Find an estimate for the percentage increase in the area of the pool when its radius increases by 1%.

(5)

Q4

(Total 5 marks)

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5. The point A has coordinates (3, 4) and the point B has coordinates (8, 14). The point C divides AB in the ratio 2 : 3.

(a) Find the coordinates of C.

(2)

The point D has coordinates (9, 6).

(b) Show that CD is perpendicular to AB.

(3)

The line l passes through the point A and is perpendicular to AB.

(c) Find an equation, with integer coefficients, for l.

(2)

Leave blank

Question 5 continued

Q5

(Total 7 marks)

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6. A particle is moving along a straight line. At time t seconds, the displacement, s metres, of the particle from a fixed point of the line is given by $s = 4t^3 - 22t^2 + 24t + 31$.

Find

(a) the values of t when the particle is instantaneously at rest,

(4)

(b) the acceleration of the particle when it is instantaneously at rest for the first time.

(3)

Leave blank

Question 6 continued

(Total 7 marks)

Q6

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7. In an arithmetic series, the sum of the sixth and seventh terms is equal to five times the sum of the first and second terms. The fourth term of the series is 15.

(a) Find, for the series,

(i) the first term,

(ii) the common difference.

(5)

(b) Find the sum of the 10th to 25th terms inclusive of the series.

(4)

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Question 7 continued

Q7

(Total 9 marks)

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8. **Figure 2**

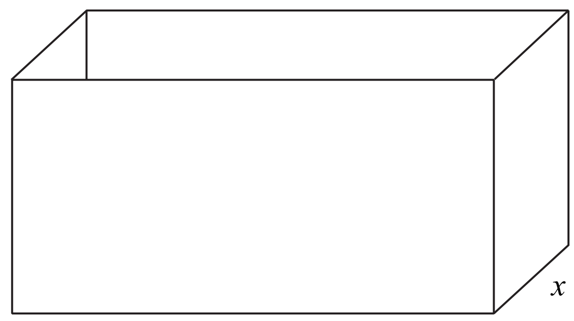

Figure 2 shows a box in the shape of a cuboid of height h cm.

The base of the box is a rectangle of length $3x$ cm and width x cm.

The top of the box is open.

The volume of the box is V cm^3 and the total external surface area of the box is 25 cm^2.

(a) Show that $V = \frac{3}{8}x(25 - 3x^2)$.

(4)

Given that x can vary,

(b) find the maximum value of V.

(5)

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Question 8 continued

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

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Question 8 continued

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Question 8 continued

Q8

(Total 9 marks)

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9.

Figure 3

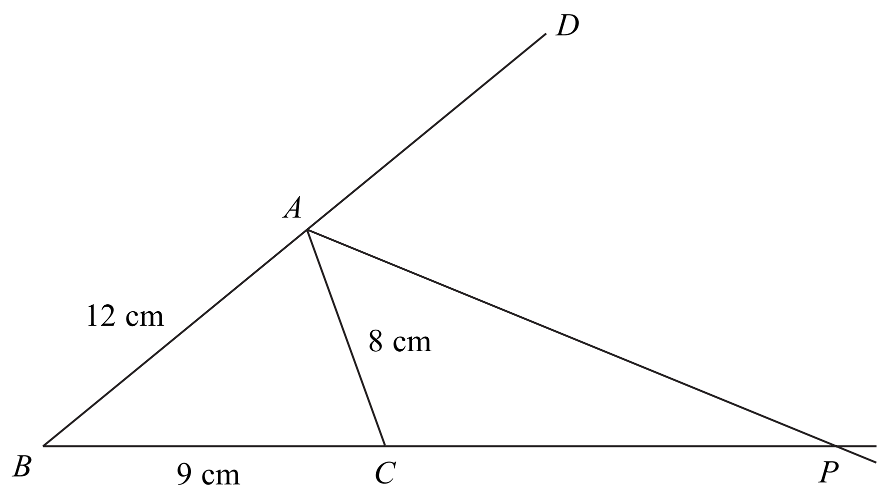

Figure 3 shows $\triangle ABC$ with $AB = 12$ cm, $AC = 8$ cm and $BC = 9$ cm.

The point D is on BA produced and the bisector of $\angle DAC$ meets BC produced at P.

(a) Find, to the nearest 0.1°, the size of each of the three angles of $\triangle ABC$.

(6)

(b) Find, to the nearest cm, the length of BP.

(5)

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Question 9 continued

(Total 11 marks)

Q9

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

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10. (a) Solve $\sin x + \sin x \cos x = 0, \quad 0 \leqslant x \leqslant \pi$.

(3)

A curve has equation $y = \sin x + \sin x \cos x$.

(b) Show that the curve has a maximum point at $\left(\frac{\pi}{3}, \frac{3\sqrt{3}}{4}\right)$.

(8)

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Question 10 continued

Q10

(Total 11 marks)

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11. (a) By writing $\tan x \equiv \dfrac{\sin x}{\cos x}$, show that $\dfrac{\mathrm{d}}{\mathrm{d}x}(\tan x) \equiv \dfrac{1}{\cos^2 x}$.

(3)

Figure 4

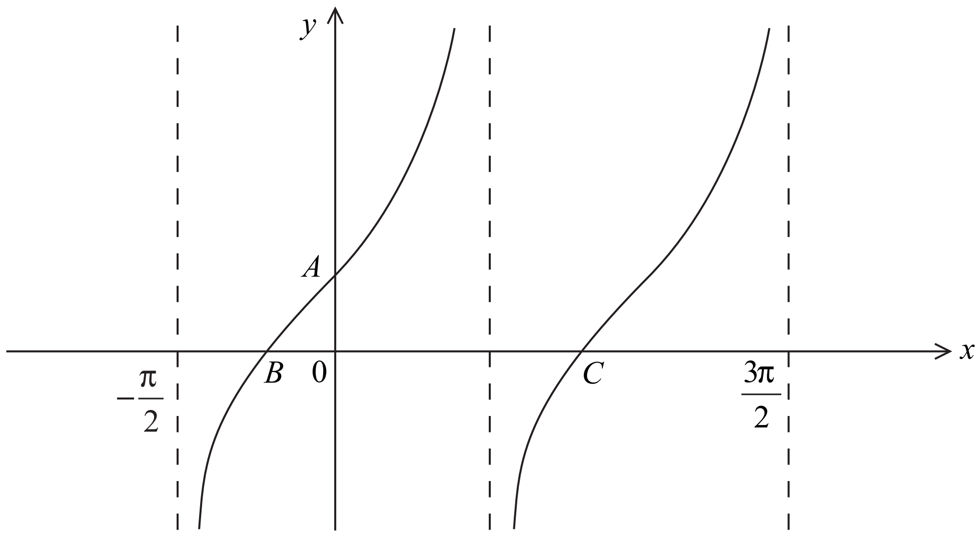

Figure 4 shows the curve with equation $y = 1 + \tan x$, $-\dfrac{\pi}{2} < x < \dfrac{3\pi}{2}$.

The curve crosses the y-axis at the point A and the x-axis at the points B and C.

(b) Write down the coordinates of A.

(1)

(c) Find the x-coordinate of

(i) B,

(ii) C.

(2)

The point D on the curve has x-coordinate $\dfrac{\pi}{6}$.

The normal to the curve at D meets the curve again at the point E and crosses the x-axis at G.

(d) Find the exact value of the x-coordinate of G.

(6)

Given that the coordinates of E are (e, f), $\dfrac{\pi}{2} < e < \dfrac{3\pi}{2}$,

(e) hence or otherwise show that $f > 0$.

(2)

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Question 11 continued

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Question 11 continued

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Question 11 continued

(Total 14 marks)

Q11

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12. (a) Expand $\left(1-\frac{x}{2}\right)^{\frac{1}{5}}$ in ascending powers of x, up to and including the term in x^3, simplifying your terms as far as possible.

(3)

(b) Expand $\left(1+\frac{x}{2}\right)^{-\frac{1}{5}}$ in ascending powers of x, up to and including the term in x^3, simplifying your terms as far as possible.

(3)

(c) State the range of values of x for which your expansions are valid.

(1)

(d) Using your answers to parts (a) and (b) or otherwise, expand $\left(\frac{2-3y}{2+3y}\right)^{\frac{1}{5}}$ in ascending powers of y, up to and including the term in y^2, simplifying your terms as far as possible.

(5)

(e) Find the range of values of y for which your expansion is valid.

(1)

(f) Use your expansion from part (d) to find an estimate, to 3 significant figures, of

$$\int_0^{0.5}\left(\frac{2-3y}{2+3y}\right)^{\frac{1}{5}}\,\mathrm{d}y.$$

(4)

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Question 12 continued

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Question 12 continued

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Question 12 continued

Q12

(Total 17 marks)

TOTAL FOR PAPER: 100 MARKS

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