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

Paper Reference(s)

7361/02

Examiner's use only

Team Leader's use only

London Examinations GCE

Mathematics Syllabus B

Ordinary Level

Paper 2

Thursday 14 January 2010 – Morning

Time: 2 hours 30 minutes

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.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
Full marks may be obtained for answers to ALL questions.
There are 11 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.

$$A = \{1, 2, 3\}.$$

(a) List all the subsets of A.

(3)

$$B = \{1, 3, 4, 5, 7, 8, 10\},$$
$$C = \{1, 4, 6, 8\},$$
$$D = \{4, 8\}.$$

(b) Write down which of the following statements is correct

$$B \subset C, \quad C \subset B, \quad C \subset D, \quad D \subset C.$$

(1)

Q1

(Total 4 marks)

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2.

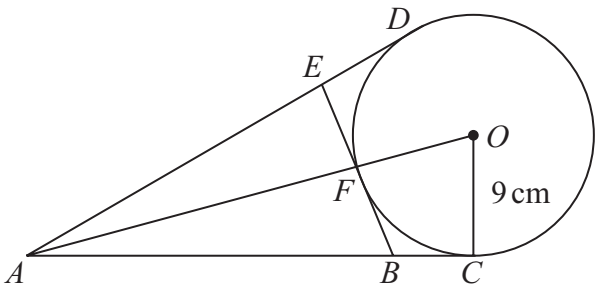

Diagram **NOT** accurately drawn

Figure 1

C, *F* and *D* are three points on a circle with centre *O* as shown in Figure 1. The radius of the circle is 9 cm. The straight lines *ABC*, *AED* and *BFE* are tangents to the circle and *AFO* is also a straight line.
AB = 7.5 cm and *BE* = 9 cm.

Calculate, in cm^2,

(a) the area of ΔOBA,

(2)

(b) the area of ΔABE.

(3)

(Total 5 marks)

Q2

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3.

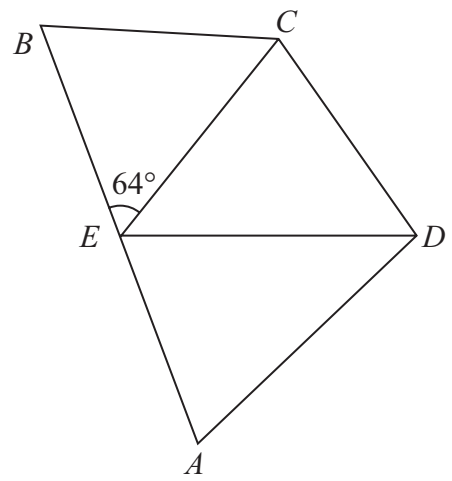

Diagram **NOT** accurately drawn

Figure 2

In Figure 2, $ABCD$ is a quadrilateral and ΔCDE is an equilateral triangle.
$AE = EC = BC$ and $\angle BEC = 64°$.

Find, giving reasons, the size, in degrees, of

(a) $\angle BCD$,

(3)

(b) $\angle BAC$.

(2)

(Total 5 marks)

Q3

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4. A solid metal sphere has a radius of 9 cm.

(a) Calculate the volume, in cm^3 to 4 significant figures, of the sphere.

(2)

The sphere is melted down and the resulting metal is used to make 20 identical right circular cylinders, each with height 15 cm.

(b) Calculate the radius, in cm, of each cylinder.

(4)

(c) Write down in standard form, the radius, in metres, of each cylinder.

(1)

[Area of circle = πr^2 , Volume of sphere = $\frac{4}{3}\pi r^3$]

Q4

(Total 7 marks)

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5. A particle P moves along a straight line so that at time t seconds its displacement, s metres, from a point O on the straight line is given by

$$s = t^3 - 2t^2 + t + 2, \quad t \geqslant 0.$$

Find an expression in terms of t for

(a) the velocity of P,

(2)

(b) the acceleration of P.

(2)

(c) Calculate the two values of the time when the numerical value of the velocity of P is the same as the numerical value of the acceleration of P.

(5)

[Solutions of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$]

Question 5 continued

Leave blank

(Total 9 marks)

Q5

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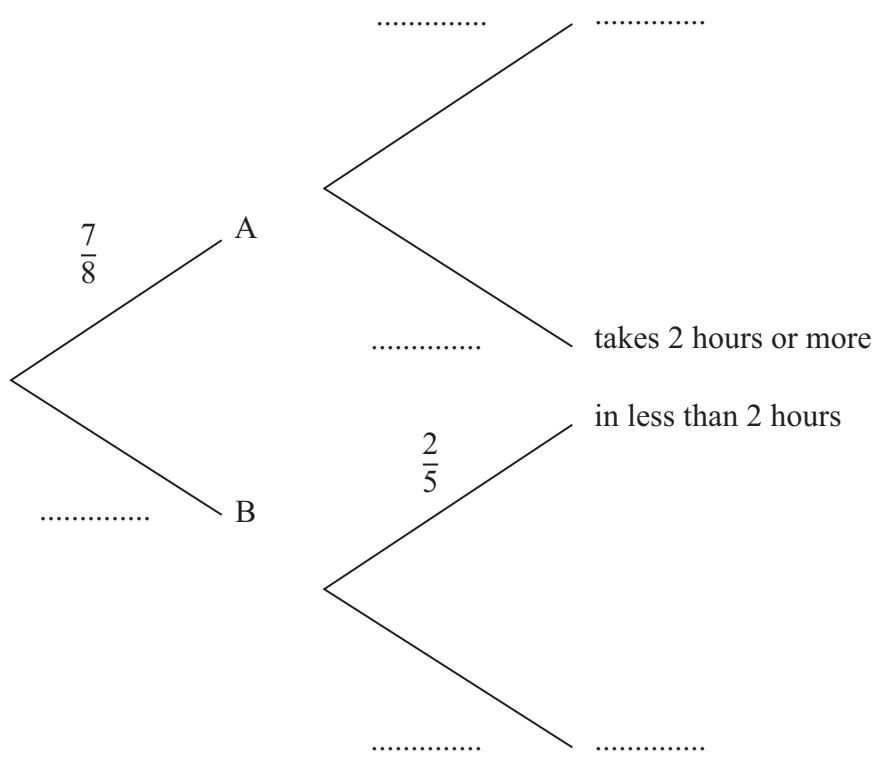
6. A man plans to travel to a town. He will take one of two different routes. The probability of him taking route A is $\frac{7}{8}$. When he takes route A, the probability of him arriving in town in less than 2 hours is $\frac{3}{4}$. When he takes route B, the probability of him arriving in town in less than 2 hours is $\frac{2}{5}$.



(a) Label and complete the probability tree.

(4)

(b) Calculate the probability that he takes route B to town and takes 2 hours or more.

(2)

(c) Calculate the probability that his journey to town is less than 2 hours.

(3)

Question 6 continued

Leave blank

(Total 9 marks)

Q6

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7.

$$f : x \mapsto x^2 + 2,$$

$$g : x \mapsto \frac{1}{2x-1}, \quad x \neq \frac{1}{2}.$$

(a) Find gf(2).

(1)

(b) Find the inverse function g^{-1}. Give your answer in the form $g^{-1} : x \mapsto$ .....

(2)

(c) Solve the equation $fg(x) = 3$

(6)

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Question 7 continued

(Total 9 marks)

Q7

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8.

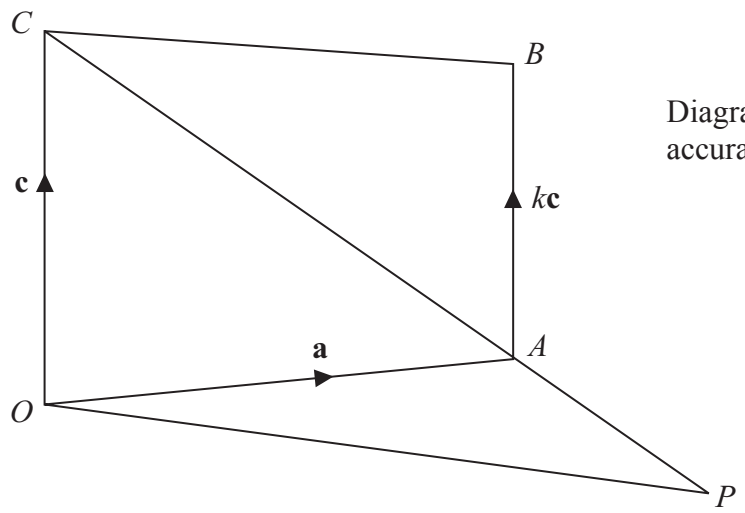

Diagram **NOT** accurately drawn

Figure 3

In Figure 3, $OABC$ is a trapezium, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{AB} = k\mathbf{c}$, where k is a positive constant. The point P lies on the straight line CAP such that $CA : AP = m : 1$, where m is a positive integer.

Express in terms of **a** and **c** and, where necessary, k or m, simplifying your answer where possible,

(a) $\overrightarrow{CA}$,

(1)

(b) $\overrightarrow{AP}$,

(2)

(c) $\overrightarrow{CB}$,

(2)

(d) $\overrightarrow{OP}$.

(2)

Given that $3\overrightarrow{CB} = 2\overrightarrow{OP}$,

(e) calculate the value of m and the value of k.

(4)

Leave blank

Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 11 marks)

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9. The points $A(2, 4)$, $B(2, 6)$ and $C(6, 4)$ are the vertices of ΔABC.

(a) On the graph paper, using a scale of 1 cm to represent 1 unit on each axis and taking $-4 \leqslant x \leqslant 7$ and $-4 \leqslant y \leqslant 7$, draw and label ΔABC.

(1)

$$\mathbf{S} = \begin{pmatrix} -\frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}.$$

ΔABC is transformed to $\Delta A_1B_1C_1$, where A_1, B_1 and C_1 are respectively the images of A, B and C, under the transformation with matrix **S**.

(b) (i) Find the coordinates of A_1, B_1 and C_1.

(ii) Draw and label $\Delta A_1B_1C_1$.

(3)

The transformation with matrix **S** is the combined transformation of an enlargement and a reflection.

(c) Describe fully

(i) the enlargement,

(ii) the reflection.

(3)

$\Delta A_1B_1C_1$ is rotated 180° about the origin to form $\Delta A_2B_2C_2$ where A_2, B_2 and C_2 are the images of the points A_1, B_1 and C_1 respectively.

(d) Draw and label $\Delta A_2B_2C_2$.

(1)

(e) Write down the matrix representing a rotation of 180°.

(1)

(f) Hence find the matrix that represents the transformation that maps ΔABC to $\Delta A_2B_2C_2$.

(3)

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Question 9 continued

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Question 9 continued

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Question 9 continued

(Total 12 marks)

Q9

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10. (a) Complete the table for $y = \frac{x^2}{3} + \frac{6}{x^2} - 5$, giving your values of y to 2 decimal places.

x	1	1.5	2	3	3.5	4	5
y			–2.17	–1.33	–0.43		

(3)

(b) On the graph paper, using a scale of 2 cm to represent 1 unit on each axis and taking $0 \leqslant x \leqslant 5$ and $-5 \leqslant y \leqslant 4$, plot the points from your completed table and join them to form a smooth curve.

(3)

(c) By drawing and labelling a straight line on your graph, find estimates,

to 1 decimal place, of the 2 solutions of the equation $\frac{x^2}{3} + \frac{6}{x^2} - x - 3 = 0$ in the interval $1 \leqslant x \leqslant 5$.

(3)

(d) By drawing and labelling another straight line on your graph, explain why the equation $\frac{x^2}{3} + \frac{6}{x^2} - x = 0$ has no solution in the interval $1 \leqslant x \leqslant 5$.

(3)

(e) Determine, to 1 decimal place from your graph, the value of x in the interval $1 \leqslant x \leqslant 5$ for which $\frac{x^2}{3} + \frac{6}{x^2} - 5$ has a minimum value.

(1)

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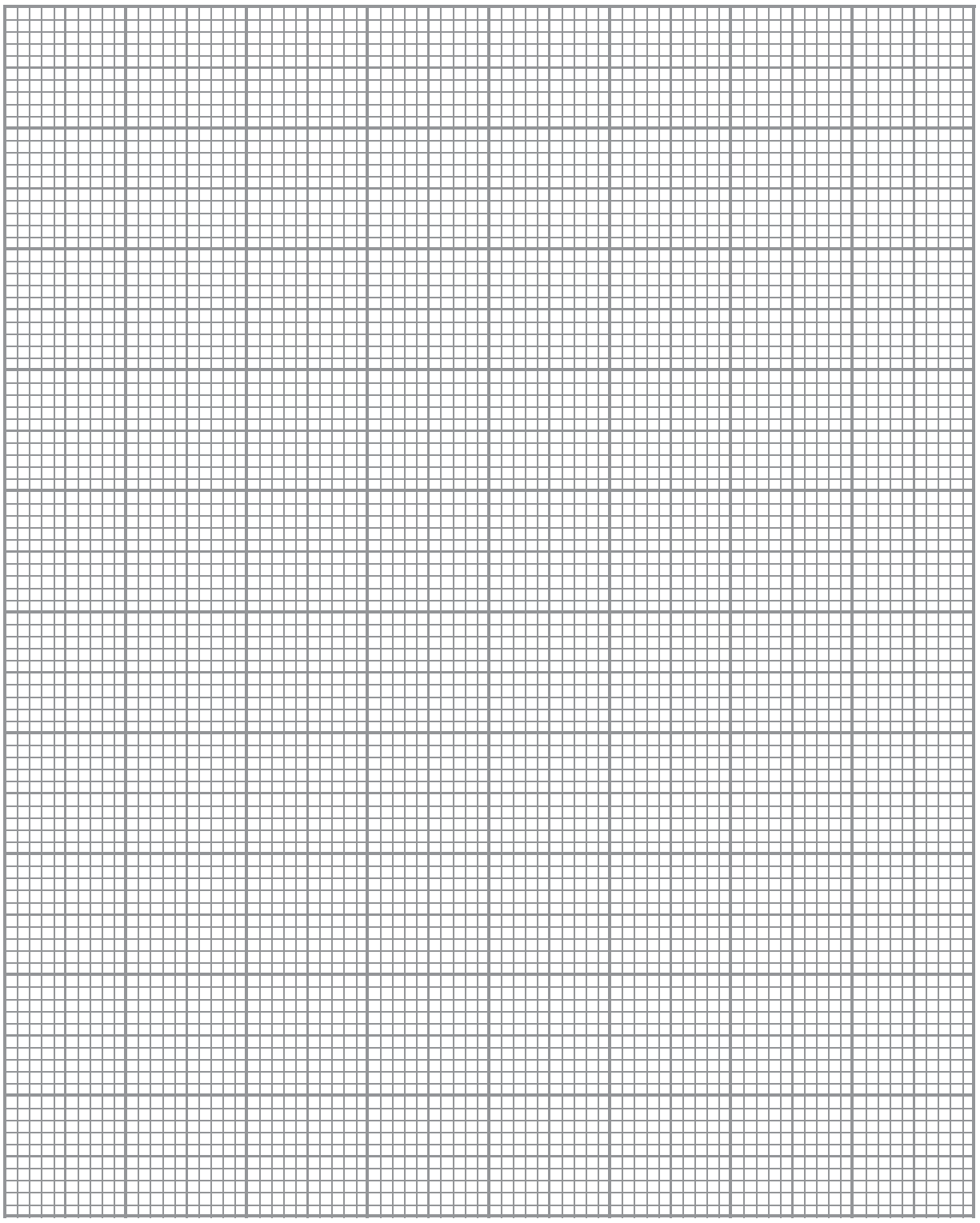
Question 10 continued



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Question 10 continued

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Question 10 continued

(Total 13 marks)

Q10

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11.

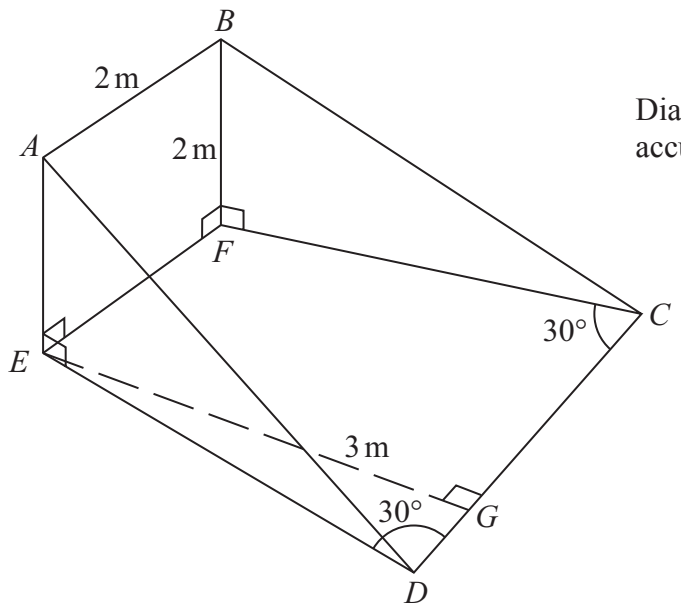

Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows a solid *ABCDEF*.
CDEF is a trapezium on a horizontal plane.
ADE and *BCF* are two vertical right-angled triangles.
ABFE is a vertical square of side 2 m.
The point *G* on *DC* is such that *EG* is perpendicular to *DC*.
ABCD is a trapezium and *AG* is perpendicular to *DC*.

Given that $EG = 3$ m, $\angle CDE = \angle DCF = 30°$, calculate,

(a) the length, in m, of *ED*,

(2)

(b) the length, in m to 3 significant figures, of *AD*,

(2)

(c) the size, in degrees to 3 significant figures, of $\angle ADG$,

(3)

(d) the area, in m^2 to 3 significant figures, of *ABCD*,

(5)

(e) the total surface area, in m^2 to 3 significant figures, of *ABCDEF*.

(4)

[Area of triangle $= \frac{1}{2}ab \sin C$, Area of trapezium $= \frac{1}{2}(a + b)h$]

Question 11 continued

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Question 11 continued

Question 11 continued

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Q11

(Total 16 marks)

TOTAL FOR PAPER: 100 MARKS

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