OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)

Wednesday **12 JANUARY 2005** Afternoon 1 hour 30 minutes

Additional materials:
Answer booklet
Graph paper
MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is 72.

WARNING

You are not allowed to use a calculator in this paper

This question paper consists of 4 printed pages.

Registered Charity 106696
[Turn over

Section A (36 marks)

1 Solve the inequality $2(x-3) < 6x+15$. [3]

2 Make r the subject of $V = \frac{4}{3}\pi r^3$. [3]

3 In each case, choose one of the statements

$$P \Rightarrow Q \qquad P \Leftarrow Q \qquad P \Leftrightarrow Q$$

to describe the complete relationship between P and Q.

(i) For n an integer:

P: n is an even number
Q: n is a multiple of 4 [1]

(ii) For triangle ABC:

P: B is a right-angle
Q: $AB^2 + BC^2 = AC^2$ [1]

4 Find the coefficient of x^3 in the expansion of $(2+3x)^5$. [4]

5 Find the value of the following.

(i) $\left(\frac{1}{3}\right)^{-2}$ [2]

(ii) $16^{\frac{3}{4}}$ [2]

6 The line L is parallel to $y = -2x+1$ and passes through the point $(5, 2)$.

Find the coordinates of the points of intersection of L with the axes. [5]

7 Express $x^2 - 6x$ in the form $(x-a)^2 - b$.

Sketch the graph of $y = x^2 - 6x$, giving the coordinates of its minimum point and the intersections with the axes. [5]

8 Find, in the form $y = mx + c$, the equation of the line passing through A $(3, 7)$ and B $(5, -1)$.

Show that the midpoint of AB lies on the line $x + 2y = 10$. [5]

9 Simplify $(3+\sqrt{2})(3-\sqrt{2})$.

Express $\dfrac{1+\sqrt{2}}{3-\sqrt{2}}$ in the form $a + b\sqrt{2}$, where a and b are rational. [5]

Section B (36 marks)

10

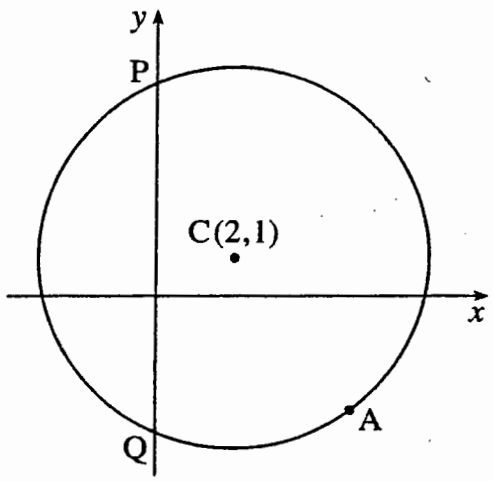

Fig. 10

Fig. 10 shows a circle with centre C (2, 1) and radius 5.

(i) Show that the equation of the circle may be written as

$$x^2 + y^2 - 4x - 2y - 20 = 0.$$ [3]

(ii) Find the coordinates of the points P and Q where the circle cuts the y-axis. Leave your answers in the form $a \pm \sqrt{b}$. [3]

(iii) Verify that the point A $(5, -3)$ lies on the circle.

Show that the tangent to the circle at A has equation $4y = 3x - 27$. [6]

11 A cubic polynomial is given by $f(x) = x^3 + x^2 - 10x + 8$.

(i) Show that $(x - 1)$ is a factor of $f(x)$.

Factorise $f(x)$ fully.

Sketch the graph of $y = f(x)$. [7]

(ii) The graph of $y = f(x)$ is translated by $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$.

Write down an equation for the resulting graph. You need not simplify your answer.

Find also the intercept on the y-axis of the resulting graph. [5]

[Turn over

12 (i) Show that the graph of $y = x^2 - 3x + 11$ is above the x-axis for all values of x. [3]

(ii) Find the set of values of x for which the graph of $y = 2x^2 + x - 10$ is above the x-axis. [4]

(iii) Find algebraically the coordinates of the points of intersection of the graphs of

$$y = x^2 - 3x + 11 \quad \text{and} \quad y = 2x^2 + x - 10.$$ [5]

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)

Monday **23 MAY 2005** Morning 1 hour 30 minutes

Additional materials:
Answer booklet
Graph paper
MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is 72.

WARNING

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This question paper consists of 4 printed pages.

Registered Charity 106696
[Turn over

Section A (36 marks)

1 Find the remainder when $x^3 + 2x^2 - 5$ is divided by $x - 3$. [2]

2 Make x the subject of

$$3x - 5y = y - mx.$$ [3]

3 The smallest of three consecutive integers is n.

Write down the other two integers.

Prove that the sum of any three consecutive integers is divisible by 3. [3]

4 A line has equation $3x + 5y = 12$. Find its gradient and the coordinates of the points where it crosses the axes. [4]

5 Find the binomial expansion of $(2 - x)^3$. [4]

6 Simplify the following.

(i) a^0 [1]

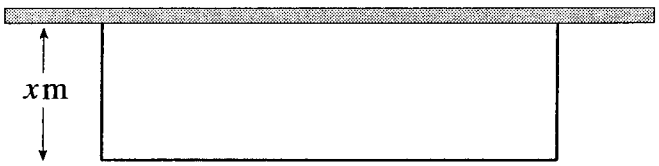
(ii) $a^6 \div a^{-2}$ [1]

(iii) $(9a^6b^2)^{-\frac{1}{2}}$ [3]

7 **(i)** Simplify $\sqrt{24} + \sqrt{6}$. [2]

(ii) Express $\dfrac{36}{5 - \sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers. [3]

8 Fig. 8 is a plan view of a rectangular enclosure. A wall forms one side of the enclosure. The other three sides are formed by fencing of total length 30 m. The width of the rectangle is x m and the area enclosed is 112 m^2.



Not to scale

Fig. 8

Show that $x^2 - 15x + 56 = 0$.

By factorising, solve this equation and find the possible dimensions of the rectangle. [5]

9 Find the x-coordinates of the points of intersection of the line $y = 3x + 2$ and the curve $y = 3x^2 - 7x + 1$. Leave your answers in surd form. [5]

Section B (36 marks)

10 **(i)** Write $x^2 - 8x + 25$ in the form $(x - a)^2 + b$. [3]

(ii) State the coordinates of the minimum point on the graph of $y = x^2 - 8x + 25$ and sketch this graph. [4]

(iii) Solve the inequality $x^2 - 8x + 25 > 18$. [3]

(iv) The graph of $y = x^2 - 8x + 25$ is translated by $\begin{pmatrix} 0 \\ -20 \end{pmatrix}$. State an equation for the resulting graph. [1]

11 The points A(0, 2), B(7, 9) and C(6, 10) lie on the circumference of a circle, as shown in Fig.11.

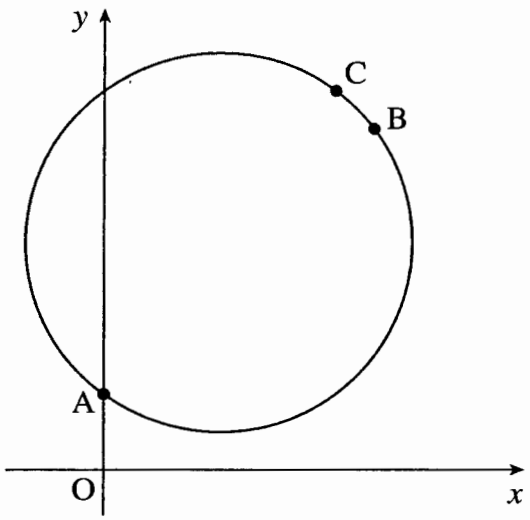


Fig. 11

(i) Find the length of AC.

Prove that triangle ABC is right-angled at B. [4]

(ii) Hence show that the centre of the circle is (3, 6) and its radius is 5.

Find the equation of the circle. [4]

(iii) Find an equation for the tangent to the circle at C.

Find the coordinates of the points where this tangent crosses the axes. [5]

12 In the cubic polynomial f(x), the coefficient of x^3 is 1. The roots of f(x) = 0 are –1, 2 and 5.

(i) Write f(x) in factorised form.

Show that f(x) may be written as

$$f(x) = x^3 - 6x^2 + 3x + 10.$$ [3]

(ii) Sketch the graph of y = f(x). [3]

(iii) Show that $x = 4$ is one root of the equation f(x) + 10 = 0.

Hence find a quadratic equation which is satisfied by the other two roots of the equation f(x) + 10 = 0. [6]

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)

Monday **16 JANUARY 2006** Morning 1 hour 30 minutes

Additional materials:
8 page answer booklet
Graph paper
MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
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- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

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This question paper consists of 4 printed pages.

Registered Charity 106696
[Turn over

Section A (36 marks)

1 n is a positive integer. Show that $n^2 + n$ is always even. [2]

2

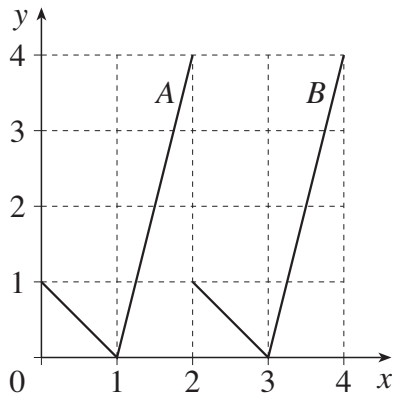


Fig. 2

Fig. 2 shows graphs A and B.

(i) State the transformation which maps graph A onto graph B. [2]

(ii) The equation of graph A is $y = \mathrm{f}(x)$.

Which one of the following is the equation of graph B?

$y = \mathrm{f}(x) + 2$ $\quad$ $y = \mathrm{f}(x) - 2$ $\quad$ $y = \mathrm{f}(x + 2)$ $\quad$ $y = \mathrm{f}(x - 2)$

$y = 2\mathrm{f}(x)$ $\quad$ $y = \mathrm{f}(x + 3)$ $\quad$ $y = \mathrm{f}(x - 3)$ $\quad$ $y = 3\mathrm{f}(x)$ [2]

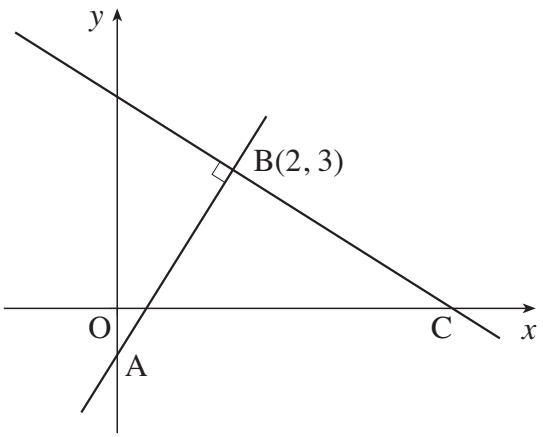
3 Find the binomial expansion of $(2 + x)^4$, writing each term as simply as possible. [4]

4 Solve the inequality $\dfrac{3(2x + 1)}{4} > -6$. [4]

5 Make C the subject of the formula $P = \dfrac{C}{C + 4}$. [4]

6 When $x^3 + 3x + k$ is divided by $x - 1$, the remainder is 6. Find the value of k. [3]

7



Not to scale

Fig. 7

The line AB has equation $y = 4x - 5$ and passes through the point $B(2, 3)$, as shown in Fig. 7. The line BC is perpendicular to AB and cuts the x-axis at C. Find the equation of the line BC and the x-coordinate of C. [5]

8 **(i)** Simplify $5\sqrt{8} + 4\sqrt{50}$. Express your answer in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. [2]

(ii) Express $\dfrac{\sqrt{3}}{6-\sqrt{3}}$ in the form $p + q\sqrt{3}$, where p and q are rational. [3]

9 **(i)** Find the range of values of k for which the equation $x^2 + 5x + k = 0$ has one or more real roots. [3]

(ii) Solve the equation $4x^2 + 20x + 25 = 0$. [2]

Section B (36 marks)

10 A circle has equation $x^2 + y^2 = 45$.

(i) State the centre and radius of this circle. [2]

(ii) The circle intersects the line with equation $x + y = 3$ at two points, A and B. Find algebraically the coordinates of A and B.

Show that the distance AB is $\sqrt{162}$. [8]

11 **(i)** Write $x^2 - 7x + 6$ in the form $(x - a)^2 + b$. [3]

(ii) State the coordinates of the minimum point on the graph of $y = x^2 - 7x + 6$. [2]

(iii) Find the coordinates of the points where the graph of $y = x^2 - 7x + 6$ crosses the axes and sketch the graph. [5]

(iv) Show that the graphs of $y = x^2 - 7x + 6$ and $y = x^2 - 3x + 4$ intersect only once. Find the x-coordinate of the point of intersection. [3]

12 **(i)** Sketch the graph of $y = x(x - 3)^2$. [3]

(ii) Show that the equation $x(x - 3)^2 = 2$ can be expressed as $x^3 - 6x^2 + 9x - 2 = 0$. [2]

(iii) Show that $x = 2$ is one root of this equation and find the other two roots, expressing your answers in surd form.

Show the location of these roots on your sketch graph in part **(i)**. [8]

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)

Tuesday **6 JUNE 2006** Afternoon 1 hour 30 minutes

Additional materials:
8 page answer booklet
Graph paper
MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- There is an **insert** for use in Question **13**.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
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WARNING

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This question paper consists of 4 printed pages and an insert.

Registered Charity 106696
[Turn over

Section A (36 marks)

1 The volume of a cone is given by the formula $V = \frac{1}{3}\pi r^2 h$. Make r the subject of this formula. [3]

2 One root of the equation $x^3 + ax^2 + 7 = 0$ is $x = -2$. Find the value of a. [2]

3 A line has equation $3x + 2y = 6$. Find the equation of the line parallel to this which passes through the point $(2, 10)$. [3]

4 In each of the following cases choose one of the statements

$$\text{P} \Rightarrow \text{Q} \qquad \text{P} \Leftrightarrow \text{Q} \qquad \text{P} \Leftarrow \text{Q}$$

to describe the complete relationship between P and Q.

(i) P: $x^2 + x - 2 = 0$
Q: $x = 1$ [1]

(ii) P: $y^3 > 1$
Q: $y > 1$ [1]

5 Find the coordinates of the point of intersection of the lines $y = 3x + 1$ and $x + 3y = 6$. [3]

6 Solve the inequality $x^2 + 2x < 3$. [4]

7 **(i)** Simplify $6\sqrt{2} \times 5\sqrt{3} - \sqrt{24}$. [2]

(ii) Express $(2 - 3\sqrt{5})^2$ in the form $a + b\sqrt{5}$, where a and b are integers. [3]

8 Calculate ${}^6\text{C}_3$.

Find the coefficient of x^3 in the expansion of $(1 - 2x)^6$. [4]

9 Simplify the following.

(i) $\dfrac{16^{\frac{1}{2}}}{81^{\frac{3}{4}}}$ [2]

(ii) $\dfrac{12(a^3b^2c)^4}{4a^2c^6}$ [3]

10 Find the coordinates of the points of intersection of the circle $x^2 + y^2 = 25$ and the line $y = 3x$. Give your answers in surd form. [5]

Section B (36 marks)

11 A$(9, 8)$, B$(5, 0)$ and C$(3, 1)$ are three points.

(i) Show that AB and BC are perpendicular. [3]

(ii) Find the equation of the circle with AC as diameter. You need not simplify your answer.

Show that B lies on this circle. [6]

(iii) BD is a diameter of the circle. Find the coordinates of D. [3]

12 You are given that $\mathrm{f}(x) = x^3 + 9x^2 + 20x + 12$.

(i) Show that $x = -2$ is a root of $\mathrm{f}(x) = 0$. [2]

(ii) Divide $\mathrm{f}(x)$ by $x + 6$. [2]

(iii) Express $\mathrm{f}(x)$ in fully factorised form. [2]

(iv) Sketch the graph of $y = \mathrm{f}(x)$. [3]

(v) Solve the equation $\mathrm{f}(x) = 12$. [3]

[Question 13 is printed overleaf.]

13 Answer the whole of this question on the insert provided.

The insert shows the graph of $y = \frac{1}{x}$, $x \neq 0$.

(i) Use the graph to find approximate roots of the equation $\frac{1}{x} = 2x + 3$, showing your method clearly. [3]

(ii) Rearrange the equation $\frac{1}{x} = 2x + 3$ to form a quadratic equation. Solve the resulting equation, leaving your answers in the form $\frac{p \pm \sqrt{q}}{r}$. [5]

(iii) Draw the graph of $y = \frac{1}{x} + 2$, $x \neq 0$, on the grid used for part (**i**). [2]

(iv) Write down the values of x which satisfy the equation $\frac{1}{x} + 2 = 2x + 3$. [2]

Candidate Name	Centre Number	Candidate Number

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)
INSERT

Tuesday **6 JUNE 2006** Afternoon 1 hours 30 minutes

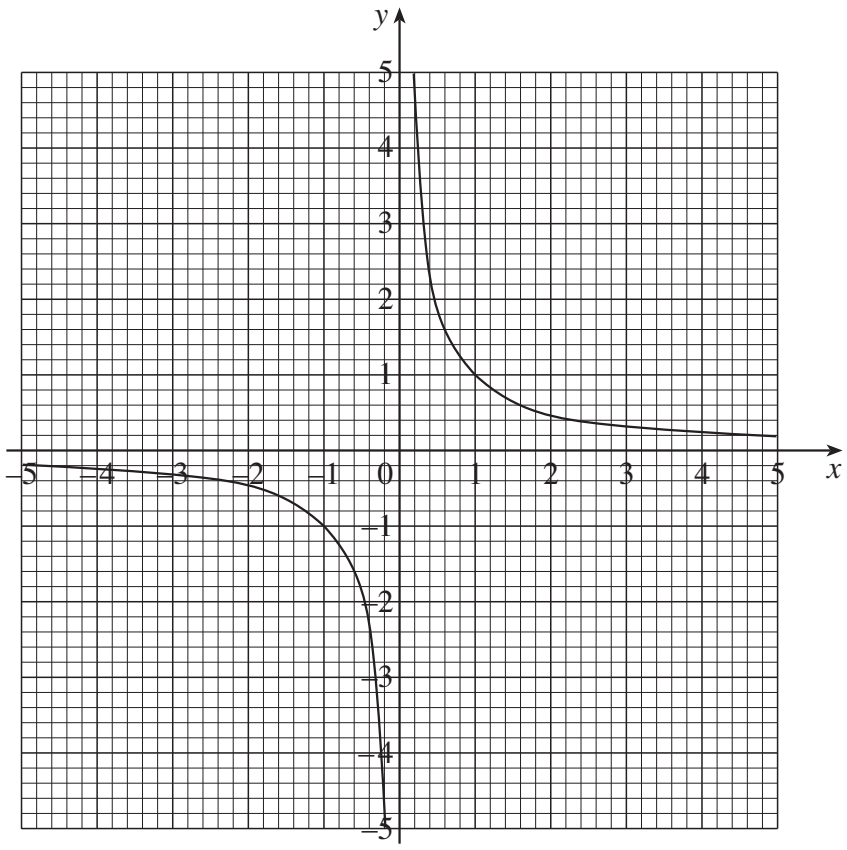
INSTRUCTIONS TO CANDIDATES

- This **insert** should be used in Question **13.**
- Write your name, centre number and candidate number in the spaces provided at the top of this page and attach it to your answer booklet.

This insert consists of 2 printed pages.

Registered Charity 1066969
[Turn over

13 (i) and (iii)



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(ii) .....

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ADVANCED SUBSIDIARY GCE UNIT **4751/01**

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

TUESDAY 16 JANUARY 2007

Morning
Time: 1 hour 30 minutes

Additional materials:
Answer booklet (8 pages)
MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
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INFORMATION FOR CANDIDATES

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- The total number of marks for this paper is 72.
- There is an **insert** for use in Question **11**.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

WARNING

You are not allowed to use a calculator in this paper

This document consists of **4** printed pages and an insert.

Section A (36 marks)

1 Find, in the form $y = ax + b$, the equation of the line through $(3, 10)$ which is parallel to $y = 2x + 7$. [3]

2 Sketch the graph of $y = 9 - x^2$. [3]

3 Make a the subject of the equation

$$2a + 5c = af + 7c.$$ [3]

4 When $x^3 + kx + 5$ is divided by $x - 2$, the remainder is 3. Use the remainder theorem to find the value of k. [3]

5 Calculate the coefficient of x^4 in the expansion of $(x + 5)^6$. [3]

6 Find the value of each of the following, giving each answer as an integer or fraction as appropriate.

(i) $25^{\frac{3}{2}}$ [2]

(ii) $\left(\frac{7}{3}\right)^{-2}$ [2]

7 You are given that $a = \frac{3}{2}$, $b = \frac{9-\sqrt{17}}{4}$ and $c = \frac{9+\sqrt{17}}{4}$. Show that $a + b + c = abc$. [4]

8 Find the set of values of k for which the equation $2x^2 + kx + 2 = 0$ has no real roots. [4]

9 **(i)** Simplify $3a^3b \times 4(ab)^2$. [2]

(ii) Factorise $x^2 - 4$ and $x^2 - 5x + 6$.

Hence express $\frac{x^2 - 4}{x^2 - 5x + 6}$ as a fraction in its simplest form. [3]

10 Simplify $(m^2 + 1)^2 - (m^2 - 1)^2$, showing your method.

Hence, given the right-angled triangle in Fig. 10, express p in terms of m, simplifying your answer. [4]

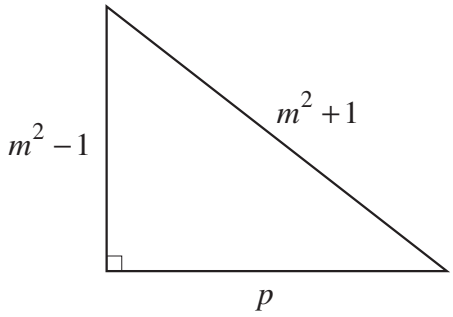


Fig. 10

Section B (36 marks)

11 There is an insert for use in this question.

The graph of $y = x + \frac{1}{x}$ is shown on the insert. The lowest point on one branch is $(1, 2)$. The highest point on the other branch is $(-1, -2)$.

(i) Use the graph to solve the following equations, showing your method clearly.

(*A*) $x + \frac{1}{x} = 4$ [2]

(*B*) $2x + \frac{1}{x} = 4$ [4]

(ii) The equation $(x - 1)^2 + y^2 = 4$ represents a circle. Find in exact form the coordinates of the points of intersection of this circle with the y-axis. [2]

(iii) State the radius and the coordinates of the centre of this circle.

Explain how these can be used to deduce from the graph that this circle touches one branch of the curve $y = x + \frac{1}{x}$ but does not intersect with the other. [4]

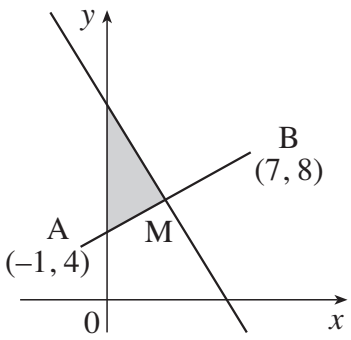
12 Use coordinate geometry to answer this question. Answers obtained from accurate drawing will receive no marks.

A and B are points with coordinates $(-1, 4)$ and $(7, 8)$ respectively.

(i) Find the coordinates of the midpoint, M, of AB.

Show also that the equation of the perpendicular bisector of AB is $y + 2x = 12$. [6]

(ii) Find the area of the triangle bounded by the perpendicular bisector, the y-axis and the line AM, as sketched in Fig. 12. [6]



Not to scale

Fig. 12

13

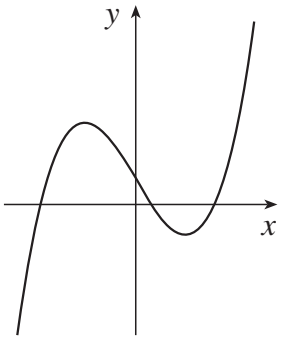


Fig. 13

Fig. 13 shows a sketch of the curve $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = x^3 - 5x + 2$.

(i) Use the fact that $x = 2$ is a root of $\mathrm{f}(x) = 0$ to find the exact values of the other two roots of $\mathrm{f}(x) = 0$, expressing your answers as simply as possible. [6]

(ii) Show that $\mathrm{f}(x - 3) = x^3 - 9x^2 + 22x - 10$. [4]

(iii) Write down the roots of $\mathrm{f}(x - 3) = 0$. [2]

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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT MATHEMATICS (MEI) **4751/01**

Introduction to Advanced Mathematics (C1)

INSERT

TUESDAY 16 JANUARY 2007 Morning
Time: 1 hour 30 minutes

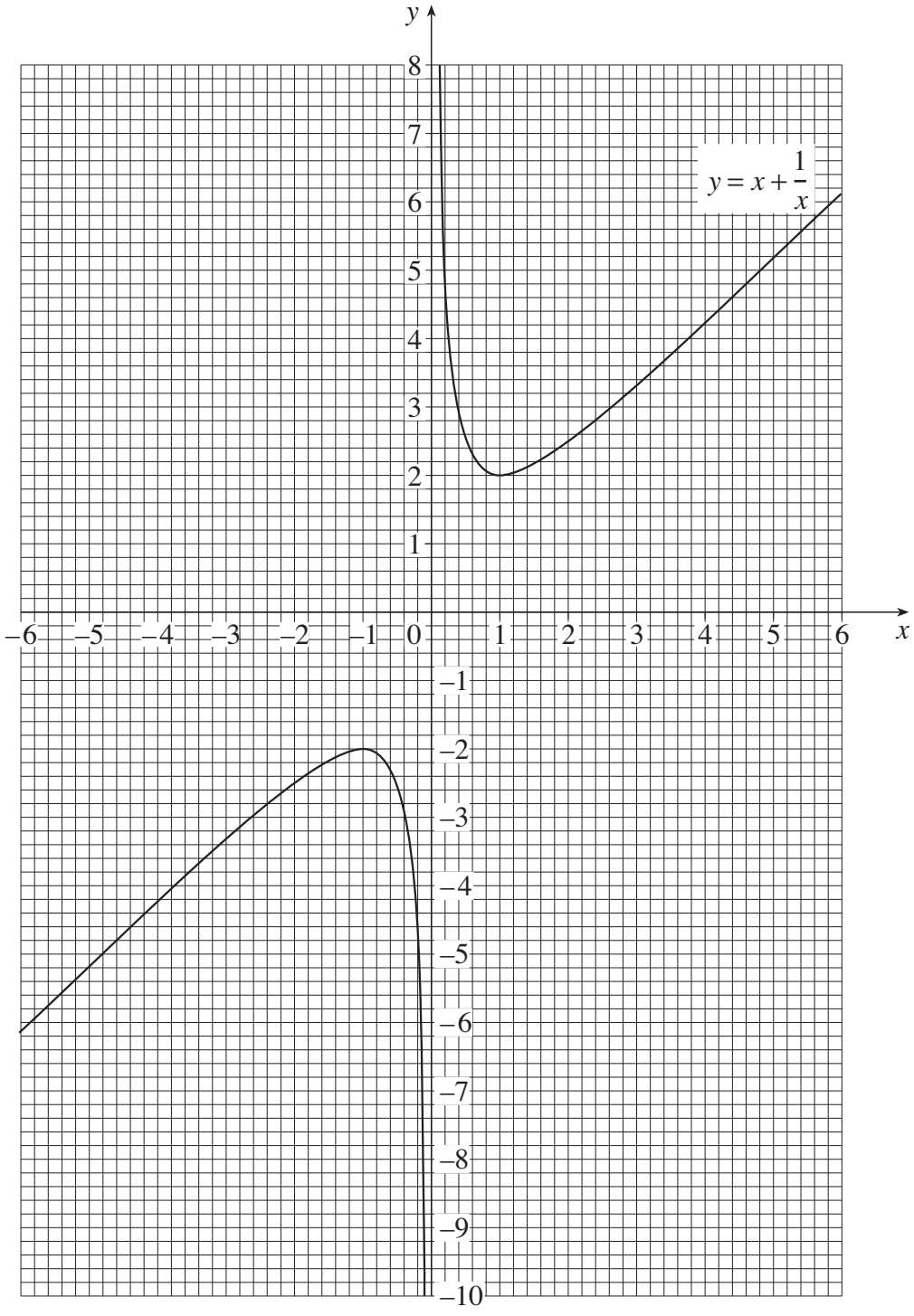
Candidate Name										
Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- This insert should be used in Question **11**.
- Write your name, centre number and candidate number in the spaces provided above and **attach the page to your answer booklet**.

This insert consists of 2 printed pages.

11 (i)



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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT **4751/01**

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

THURSDAY 7JUNE 2007

Morning
Time: 1 hour 30 minutes

Additional materials:
Answer booklet (8 pages)
MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

WARNING

You are not allowed to use a calculator in this paper

[Turn over

Section A (36 marks)

1 Solve the inequality $1 - 2x < 4 + 3x$. [3]

2 Make t the subject of the formula $s = \frac{1}{2}at^2$. [3]

3 The converse of the statement 'P $\Rightarrow$ Q' is 'Q $\Rightarrow$ P'.

Write down the converse of the following statement.

'n is an odd integer $\Rightarrow$ $2n$ is an even integer.'

Show that this converse is false. [2]

4 You are given that $f(x) = x^3 + kx + c$. The value of $f(0)$ is 6, and $x - 2$ is a factor of $f(x)$.

Find the values of k and c. [3]

5 **(i)** Find a, given that $a^3 = 64x^{12}y^3$. [2]

(ii) Find the value of $\left(\frac{1}{2}\right)^{-5}$. [2]

6 Find the coefficient of x^3 in the expansion of $(3 - 2x)^5$. [4]

7 Solve the equation $\frac{4x + 5}{2x} = -3$. [3]

8 **(i)** Simplify $\sqrt{98} - \sqrt{50}$. [2]

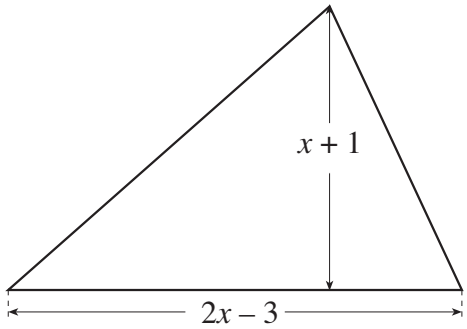
(ii) Express $\frac{6\sqrt{5}}{2 + \sqrt{5}}$ in the form $a + b\sqrt{5}$, where a and b are integers. [3]

9 **(i)** A curve has equation $y = x^2 - 4$. Find the x-coordinates of the points on the curve where $y = 21$. [2]

(ii) The curve $y = x^2 - 4$ is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

Write down an equation for the translated curve. You need not simplify your answer. [2]

10 The triangle shown in Fig. 10 has height $(x + 1)$ cm and base $(2x - 3)$ cm. Its area is 9 cm^2.



Not to scale

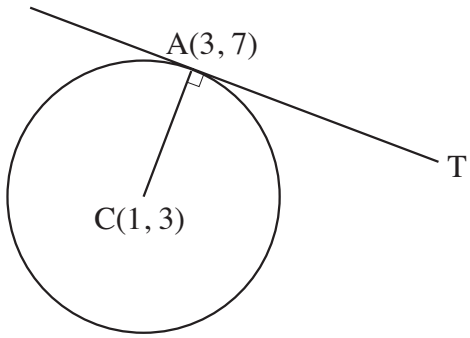
Fig. 10

(i) Show that $2x^2 - x - 21 = 0$. [2]

(ii) By factorising, solve the equation $2x^2 - x - 21 = 0$. Hence find the height and base of the triangle. [3]

Section B (36 marks)

11



Not to scale

Fig. 11

A circle has centre C$(1, 3)$ and passes through the point A$(3, 7)$ as shown in Fig. 11.

(i) Show that the equation of the tangent at A is $x + 2y = 17$. [4]

(ii) The line with equation $y = 2x - 9$ intersects this tangent at the point T.

Find the coordinates of T. [3]

(iii) The equation of the circle is $(x - 1)^2 + (y - 3)^2 = 20$.

Show that the line with equation $y = 2x - 9$ is a tangent to the circle. Give the coordinates of the point where this tangent touches the circle. [5]

12 **(i)** Write $4x^2 - 24x + 27$ in the form $a(x - b)^2 + c$. [4]

(ii) State the coordinates of the minimum point on the curve $y = 4x^2 - 24x + 27$. [2]

(iii) Solve the equation $4x^2 - 24x + 27 = 0$. [3]

(iv) Sketch the graph of the curve $y = 4x^2 - 24x + 27$. [3]

13 A cubic polynomial is given by $\mathrm{f}(x) = 2x^3 - x^2 - 11x - 12$.

(i) Show that $(x - 3)(2x^2 + 5x + 4) = 2x^3 - x^2 - 11x - 12$.

Hence show that $\mathrm{f}(x) = 0$ has exactly one real root. [4]

(ii) Show that $x = 2$ is a root of the equation $\mathrm{f}(x) = -22$ and find the other roots of this equation. [5]

(iii) Using the results from the previous parts, sketch the graph of $y = \mathrm{f}(x)$. [3]

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE **4751/01**

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

WEDNESDAY 9 JANUARY 2008 Afternoon

Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages)
MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

WARNING

You are not allowed to use a calculator in this paper.

This document consists of **4** printed pages.

Section A (36 marks)

1 Make v the subject of the formula $E = \frac{1}{2}mv^2$. [3]

2 Factorise and hence simplify $\dfrac{3x^2 - 7x + 4}{x^2 - 1}$. [3]

3 **(i)** Write down the value of $\left(\frac{1}{4}\right)^0$. [1]

(ii) Find the value of $16^{-\frac{3}{2}}$. [3]

4 Find, algebraically, the coordinates of the point of intersection of the lines $y = 2x - 5$ and $6x + 2y = 7$. [4]

5 **(i)** Find the gradient of the line $4x + 5y = 24$. [2]

(ii) A line parallel to $4x + 5y = 24$ passes through the point $(0, 12)$. Find the coordinates of its point of intersection with the x-axis. [3]

6 When $x^3 + kx + 7$ is divided by $(x - 2)$, the remainder is 3. Find the value of k. [3]

7 **(i)** Find the value of ${}^8\mathrm{C}_3$. [2]

(ii) Find the coefficient of x^3 in the binomial expansion of $\left(1 - \frac{1}{2}x\right)^8$. [2]

8 **(i)** Write $\sqrt{48} + \sqrt{3}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. [2]

(ii) Simplify $\dfrac{1}{5 + \sqrt{2}} + \dfrac{1}{5 - \sqrt{2}}$. [3]

9 **(i)** Prove that 12 is a factor of $3n^2 + 6n$ for all even positive integers n. [3]

(ii) Determine whether 12 is a factor of $3n^2 + 6n$ for all positive integers n. [2]

Section B (36 marks)

10 **(i)**

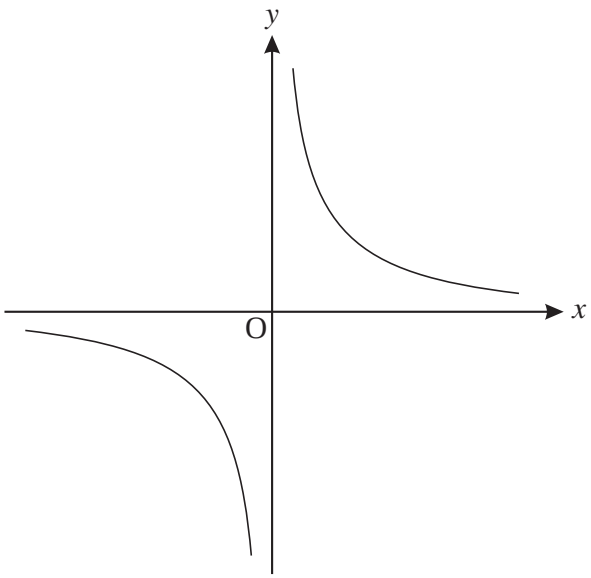


Fig. 10

Fig. 10 shows a sketch of the graph of $y = \frac{1}{x}$.

Sketch the graph of $y = \frac{1}{x-2}$, showing clearly the coordinates of any points where it crosses the axes. [3]

(ii) Find the value of x for which $\frac{1}{x-2} = 5$. [2]

(iii) Find the x-coordinates of the points of intersection of the graphs of $y = x$ and $y = \frac{1}{x-2}$. Give your answers in the form $a \pm \sqrt{b}$.

Show the position of these points on your graph in part **(i)**. [6]

11 **(i)** Write $x^2 - 5x + 8$ in the form $(x - a)^2 + b$ and hence show that $x^2 - 5x + 8 > 0$ for all values of x. [4]

(ii) Sketch the graph of $y = x^2 - 5x + 8$, showing the coordinates of the turning point. [3]

(iii) Find the set of values of x for which $x^2 - 5x + 8 > 14$. [3]

(iv) If $f(x) = x^2 - 5x + 8$, does the graph of $y = f(x) - 10$ cross the x-axis? Show how you decide. [2]

[Question 12 is printed overleaf.]

12 A circle has equation $x^2 + y^2 - 8x - 4y = 9$.

(i) Show that the centre of this circle is C (4, 2) and find the radius of the circle. [3]

(ii) Show that the origin lies inside the circle. [2]

(iii) Show that AB is a diameter of the circle, where A has coordinates (2, 7) and B has coordinates (6, −3). [4]

(iv) Find the equation of the tangent to the circle at A. Give your answer in the form $y = mx + c$. [4]

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE **4751/01**

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

THURSDAY 15 MAY 2008 Morning

Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages)
MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

WARNING

You are not allowed to use a calculator in this paper.

This document consists of **4** printed pages.

Section A (36 marks)

1 Solve the inequality $3x - 1 > 5 - x$. [2]

2 **(i)** Find the points of intersection of the line $2x + 3y = 12$ with the axes. [2]

(ii) Find also the gradient of this line. [2]

3 **(i)** Solve the equation $2x^2 + 3x = 0$. [2]

(ii) Find the set of values of k for which the equation $2x^2 + 3x - k = 0$ has no real roots. [3]

4 Given that n is a positive integer, write down whether the following statements are always true (T), always false (F) or could be either true or false (E).

(i) $2n + 1$ is an odd integer

(ii) $3n + 1$ is an even integer

(iii) n is odd $\Rightarrow$ n^2 is odd

(iv) n^2 is odd $\Rightarrow$ n^3 is even [3]

5 Make x the subject of the equation $y = \dfrac{x+3}{x-2}$. [4]

6 **(i)** Find the value of $\left(\frac{1}{25}\right)^{-\frac{1}{2}}$. [2]

(ii) Simplify $\dfrac{(2x^2y^3z)^5}{4y^2z}$. [3]

7 **(i)** Express $\dfrac{1}{5+\sqrt{3}}$ in the form $\dfrac{a+b\sqrt{3}}{c}$, where a, b and c are integers. [2]

(ii) Expand and simplify $\left(3 - 2\sqrt{7}\right)^2$. [3]

8 Find the coefficient of x^3 in the binomial expansion of $(5 - 2x)^5$. [4]

9 Solve the equation $y^2 - 7y + 12 = 0$.

Hence solve the equation $x^4 - 7x^2 + 12 = 0$. [4]

Section B (36 marks)

10 **(i)** Express $x^2 - 6x + 2$ in the form $(x - a)^2 - b$. [3]

(ii) State the coordinates of the turning point on the graph of $y = x^2 - 6x + 2$. [2]

(iii) Sketch the graph of $y = x^2 - 6x + 2$. You need not state the coordinates of the points where the graph intersects the x-axis. [2]

(iv) Solve the simultaneous equations $y = x^2 - 6x + 2$ and $y = 2x - 14$. Hence show that the line $y = 2x - 14$ is a tangent to the curve $y = x^2 - 6x + 2$. [5]

11 You are given that $\mathrm{f}(x) = 2x^3 + 7x^2 - 7x - 12$.

(i) Verify that $x = -4$ is a root of $\mathrm{f}(x) = 0$. [2]

(ii) Hence express $\mathrm{f}(x)$ in fully factorised form. [4]

(iii) Sketch the graph of $y = \mathrm{f}(x)$. [3]

(iv) Show that $\mathrm{f}(x - 4) = 2x^3 - 17x^2 + 33x$. [3]

12 **(i)** Find the equation of the line passing through A $(-1, 1)$ and B $(3, 9)$. [3]

(ii) Show that the equation of the perpendicular bisector of AB is $2y + x = 11$. [4]

(iii) A circle has centre $(5, 3)$, so that its equation is $(x - 5)^2 + (y - 3)^2 = k$. Given that the circle passes through A, show that $k = 40$. Show that the circle also passes through B. [2]

(iv) Find the x-coordinates of the points where this circle crosses the x-axis. Give your answers in surd form. [3]

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ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI)

4751

Introduction to Advanced Mathematics (C1)

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- Insert for Question 13 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Friday 9 January 2009
Morning

Duration: 1 hour 30 minutes

* 4 7 5 1 *

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- There is an **insert** for use in Question **13**.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

No calculator can be used for this paper

Section A (36 marks)

1 State the value of each of the following.

(i) 2^{-3} **[1]**

(ii) 9^0 **[1]**

2 Find the equation of the line passing through $(-1, -9)$ and $(3, 11)$. Give your answer in the form $y = mx + c$. **[3]**

3 Solve the inequality $7 - x < 5x - 2$. **[3]**

4 You are given that $f(x) = x^4 + ax - 6$ and that $x - 2$ is a factor of $f(x)$.

Find the value of a. **[3]**

5 **(i)** Find the coefficient of x^3 in the expansion of $(x^2 - 3)(x^3 + 7x + 1)$. **[2]**

(ii) Find the coefficient of x^2 in the binomial expansion of $(1 + 2x)^7$. **[3]**

6 Solve the equation $\dfrac{3x + 1}{2x} = 4$. **[3]**

7 **(i)** Express $125\sqrt{5}$ in the form 5^k. **[2]**

(ii) Simplify $\left(4a^3b^5\right)^2$. **[2]**

8 Find the range of values of k for which the equation $2x^2 + kx + 18 = 0$ does not have real roots. **[4]**

9 Rearrange $y + 5 = x(y + 2)$ to make y the subject of the formula. **[4]**

10 **(i)** Express $\sqrt{75} + \sqrt{48}$ in the form $a\sqrt{3}$. **[2]**

(ii) Express $\dfrac{14}{3 - \sqrt{2}}$ in the form $b + c\sqrt{d}$. **[3]**

Section B (36 marks)

11

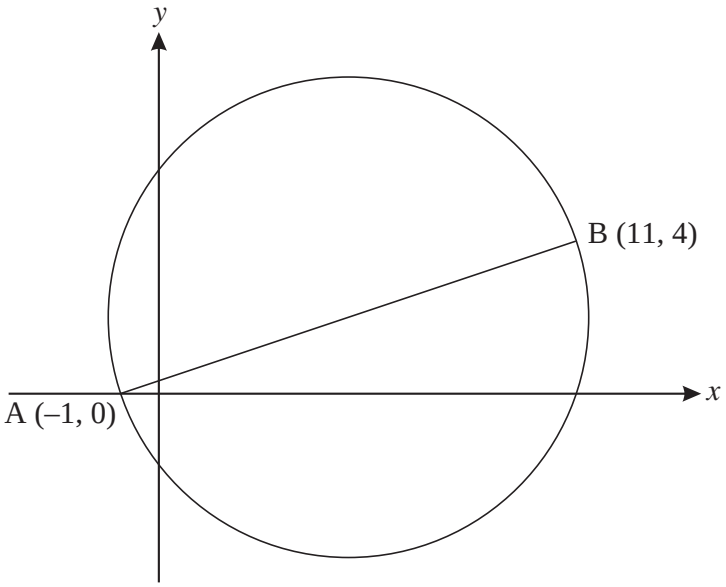

Fig. 11

Fig. 11 shows the points A and B, which have coordinates (–1, 0) and (11, 4) respectively.

(i) Show that the equation of the circle with AB as diameter may be written as

$$(x - 5)^2 + (y - 2)^2 = 40.$$ **[4]**

(ii) Find the coordinates of the points of intersection of this circle with the y-axis. Give your answer in the form $a \pm \sqrt{b}$. **[4]**

(iii) Find the equation of the tangent to the circle at B. Hence find the coordinates of the points of intersection of this tangent with the axes. **[6]**

12 **(i)** Find algebraically the coordinates of the points of intersection of the curve $y = 3x^2 + 6x + 10$ and the line $y = 2 - 4x$. **[5]**

(ii) Write $3x^2 + 6x + 10$ in the form $a(x + b)^2 + c$. **[4]**

(iii) Hence or otherwise, show that the graph of $y = 3x^2 + 6x + 10$ is always above the x-axis. **[2]**

[Question 13 is printed overleaf.]

13 Answer part (i) of this question on the insert provided.

The insert shows the graph of $y = \frac{1}{x}$.

(i) **On the insert**, on the same axes, plot the graph of $y = x^2 - 5x + 5$ for $0 \leqslant x \leqslant 5$. **[4]**

(ii) Show algebraically that the x-coordinates of the points of intersection of the curves $y = \frac{1}{x}$ and $y = x^2 - 5x + 5$ satisfy the equation $x^3 - 5x^2 + 5x - 1 = 0$. **[2]**

(iii) Given that $x = 1$ at one of the points of intersection of the curves, factorise $x^3 - 5x^2 + 5x - 1$ into a linear and a quadratic factor.

Show that only one of the three roots of $x^3 - 5x^2 + 5x - 1 = 0$ is rational. **[5]**

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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI)

4751

Introduction to Advanced Mathematics (C1)
INSERT for Question 13

Friday 9 January 2009
Morning

Duration: 1 hour 30 minutes

Candidate Forename						Candidate Surname					
Centre Number						Candidate Number					

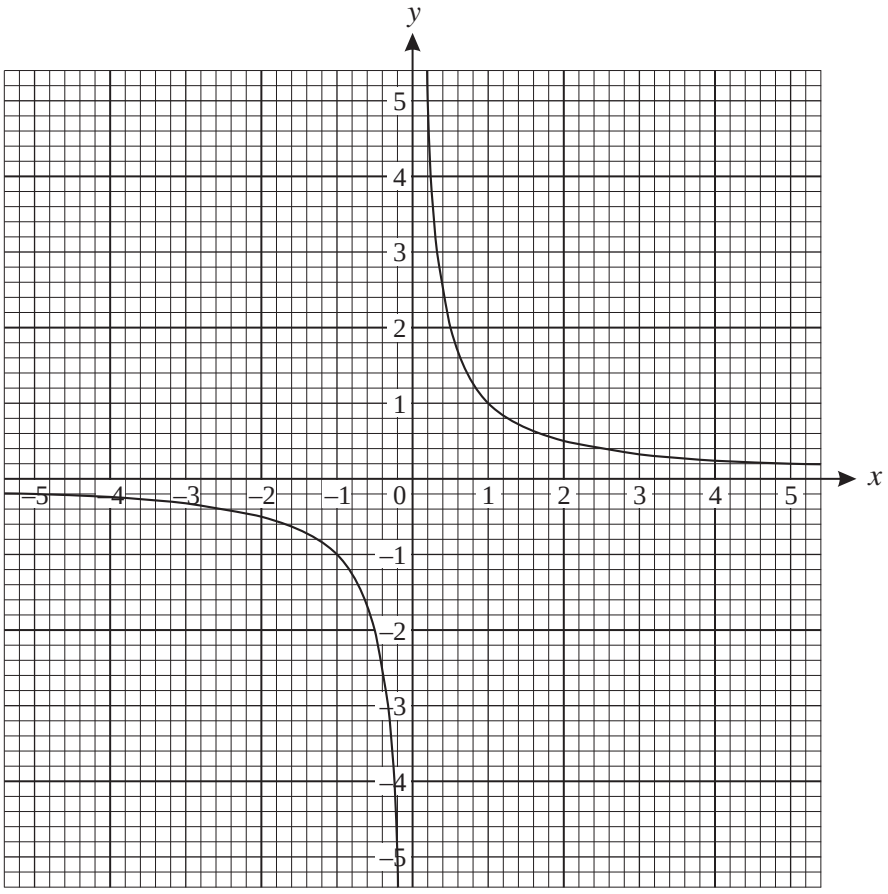
INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- This insert should be used to answer Question **13** part **(i)**.
- Write your answers to Question **13** part **(i)** in the spaces provided in this insert, and **attach it to your Answer Booklet**.

INFORMATION FOR CANDIDATES

- This document consists of **2** pages. Any blank pages are indicated.

13 (i)



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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Wednesday 20 May 2009
Afternoon

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

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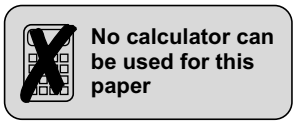

Section A (36 marks)

1 A line has gradient −4 and passes through the point (2, 6). Find the coordinates of its points of intersection with the axes. **[4]**

2 Make a the subject of the formula $s = ut + \frac{1}{2}at^2$. **[3]**

3 When $x^3 - kx + 4$ is divided by $x - 3$, the remainder is 1. Use the remainder theorem to find the value of k. **[3]**

4 Solve the inequality $x(x - 6) > 0$. **[2]**

5 **(i)** Calculate ${}^5C_3$. **[2]**

(ii) Find the coefficient of x^3 in the expansion of $(1 + 2x)^5$. **[2]**

6 Prove that, when n is an integer, $n^3 - n$ is always even. **[3]**

7 Find the value of each of the following.

(i) $5^2 \times 5^{-2}$ **[2]**

(ii) $100^{\frac{3}{2}}$ **[1]**

8 **(i)** Simplify $\dfrac{\sqrt{48}}{2\sqrt{27}}$. **[2]**

(ii) Expand and simplify $\left(5 - 3\sqrt{2}\right)^2$. **[3]**

9 **(i)** Express $x^2 + 6x + 5$ in the form $(x + a)^2 + b$. **[3]**

(ii) Write down the coordinates of the minimum point on the graph of $y = x^2 + 6x + 5$. **[2]**

10 Find the real roots of the equation $x^4 - 5x^2 - 36 = 0$ by considering it as a quadratic equation in x^2. **[4]**

Section B (36 marks)

11

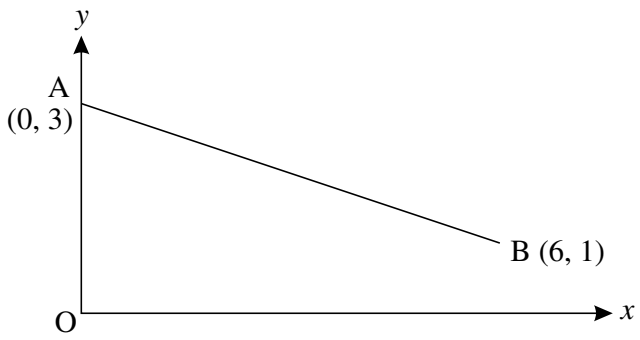

Fig. 11

Fig. 11 shows the line joining the points A (0, 3) and B (6, 1).

(i) Find the equation of the line perpendicular to AB that passes through the origin, O. **[2]**

(ii) Find the coordinates of the point where this perpendicular meets AB. **[4]**

(iii) Show that the perpendicular distance of AB from the origin is $\frac{9\sqrt{10}}{10}$. **[2]**

(iv) Find the length of AB, expressing your answer in the form $a\sqrt{10}$. **[2]**

(v) Find the area of triangle OAB. **[2]**

12 **(i)** You are given that $f(x) = (x + 1)(x - 2)(x - 4)$.

(*A*) Show that $f(x) = x^3 - 5x^2 + 2x + 8$. **[2]**

(*B*) Sketch the graph of $y = f(x)$. **[3]**

(*C*) The graph of $y = f(x)$ is translated by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$.

State an equation for the resulting graph. You need not simplify your answer.

Find the coordinates of the point at which the resulting graph crosses the *y*-axis. **[3]**

(ii) Show that 3 is a root of $x^3 - 5x^2 + 2x + 8 = -4$. Hence solve this equation completely, giving the other roots in surd form. **[5]**

13 A circle has equation $(x - 5)^2 + (y - 2)^2 = 20$.

(i) State the coordinates of the centre and the radius of this circle. **[2]**

(ii) State, with a reason, whether or not this circle intersects the *y*-axis. **[2]**

(iii) Find the equation of the line parallel to the line $y = 2x$ that passes through the centre of the circle. **[2]**

(iv) Show that the line $y = 2x + 2$ is a tangent to the circle. State the coordinates of the point of contact. **[5]**

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book

OCR Supplied Materials:
- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Monday 11 January 2010
Morning

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** If you need more space for an answer use a 4-page answer book; label your answer clearly. Write your Centre Number and Candidate Number on the 4-page answer book and attach it securely to the Printed Answer Book.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES
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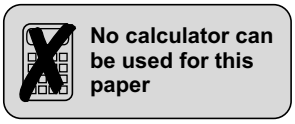
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.



Answer all questions on the Printed Answer Book provided.

Section A (36 marks)

1 Rearrange the formula $c = \sqrt{\frac{a+b}{2}}$ to make a the subject. **[3]**

2 Solve the inequality $\frac{5x-3}{2} < x + 5$. **[3]**

3 **(i)** Find the coordinates of the point where the line $5x + 2y = 20$ intersects the x-axis. **[1]**

(ii) Find the coordinates of the point of intersection of the lines $5x + 2y = 20$ and $y = 5 - x$. **[3]**

4 **(i)** Describe fully the transformation which maps the curve $y = x^2$ onto the curve $y = (x + 4)^2$. **[2]**

(ii) Sketch the graph of $y = x^2 - 4$. **[2]**

5 **(i)** Find the value of $144^{-\frac{1}{2}}$. **[2]**

(ii) Simplify $\frac{1}{5+\sqrt{7}} + \frac{4}{5-\sqrt{7}}$. Give your answer in the form $\frac{a+b\sqrt{7}}{c}$. **[3]**

6 You are given that $f(x) = (x + 1)^2(2x - 5)$.

(i) Sketch the graph of $y = f(x)$. **[3]**

(ii) Express $f(x)$ in the form $ax^3 + bx^2 + cx + d$. **[2]**

7 When $x^3 + 2x^2 + 5x + k$ is divided by $(x + 3)$, the remainder is 6. Find the value of k. **[3]**

8 Find the binomial expansion of $\left(x + \frac{5}{x}\right)^3$, simplifying the terms. **[4]**

9 Prove that the line $y = 3x - 10$ does not intersect the curve $y = x^2 - 5x + 7$. **[5]**

Section B (36 marks)

10

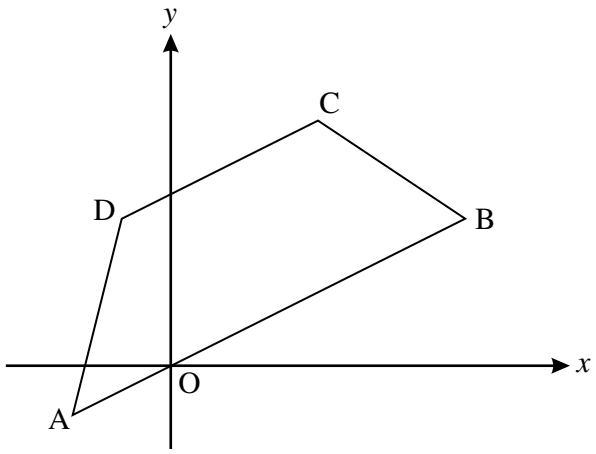


Fig. 10

Fig. 10 shows a trapezium ABCD. The coordinates of its vertices are A (−2, −1), B (6, 3), C (3, 5) and D (−1, 3).

(i) Verify that the lines AB and DC are parallel. **[3]**

(ii) Prove that the trapezium is not isosceles. **[3]**

(iii) The diagonals of the trapezium meet at M. Find the exact coordinates of M. **[4]**

(iv) Show that neither diagonal of the trapezium bisects the other. **[3]**

11 A circle has equation $(x - 3)^2 + (y + 2)^2 = 25$.

(i) State the coordinates of the centre of this circle and its radius. **[2]**

(ii) Verify that the point A with coordinates (6, −6) lies on this circle. Show also that the point B on the circle for which AB is a diameter has coordinates (0, 2). **[3]**

(iii) Find the equation of the tangent to the circle at A. **[4]**

(iv) A second circle touches the original circle at A. Its radius is 10 and its centre is at C, where BAC is a straight line. Find the coordinates of C and hence write down the equation of this second circle. **[3]**

[Question 12 is printed overleaf.]

12 The curve with equation $y = \frac{1}{5}x(10 - x)$ is used to model the arch of a bridge over a road, where x and y are distances in metres, with the origin as shown in Fig. 12.1. The x-axis represents the road surface.

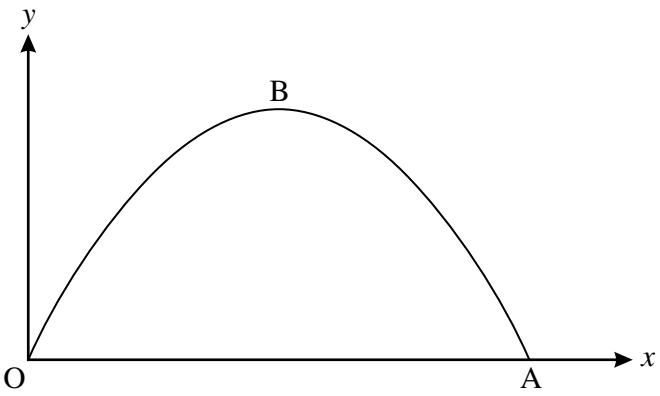


Fig. 12.1

(i) State the value of x at A, where the arch meets the road. **[1]**

(ii) Using symmetry, or otherwise, state the value of x at the maximum point B of the graph.

Hence find the height of the arch. **[2]**

(iii) Fig. 12.2 shows a lorry which is 4 m high and 3 m wide, with its cross-section modelled as a rectangle. Find the value of d when the lorry is in the centre of the road. Hence show that the lorry can pass through this arch. **[3]**

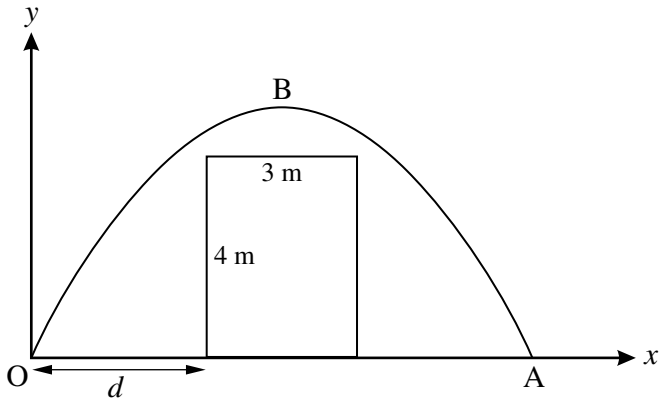


Fig. 12.2

(iv) Another lorry, also modelled as having a rectangular cross-section, has height 4.5 m and just touches the arch when it is in the centre of the road. Find the width of this lorry, giving your answer in surd form. **[5]**

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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book

OCR Supplied Materials:
- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Monday 24 May 2010
Afternoon

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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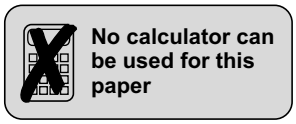

Section A (36 marks)

1 Find the equation of the line which is parallel to $y = 3x + 1$ and which passes through the point with coordinates (4, 5). **[3]**

2 **(i)** Simplify $(5a^2b)^3 \times 2b^4$. **[2]**

(ii) Evaluate $\left(\frac{1}{16}\right)^{-1}$. **[1]**

(iii) Evaluate $(16)^{\frac{3}{2}}$. **[2]**

3 Make y the subject of the formula $a = \dfrac{\sqrt{y} - 5}{c}$. **[3]**

4 Solve the following inequalities.

(i) $2(1 - x) > 6x + 5$ **[3]**

(ii) $(2x - 1)(x + 4) < 0$ **[2]**

5 **(i)** Express $\sqrt{48} + \sqrt{27}$ in the form $a\sqrt{3}$. **[2]**

(ii) Simplify $\dfrac{5\sqrt{2}}{3 - \sqrt{2}}$. Give your answer in the form $\dfrac{b + c\sqrt{2}}{d}$. **[3]**

6 You are given that

- the coefficient of x^3 in the expansion of $(5 + 2x^2)(x^3 + kx + m)$ is 29,
- when $x^3 + kx + m$ is divided by $(x - 3)$, the remainder is 59.

Find the values of k and m. **[5]**

7 Expand $\left(1 + \frac{1}{2}x\right)^4$, simplifying the coefficients. **[4]**

8 Express $5x^2 + 20x + 6$ in the form $a(x + b)^2 + c$. **[4]**

9 Show that the following statement is false.

$$x - 5 = 0 \iff x^2 = 25$$ **[2]**

Section B (36 marks)

10 **(i)** Solve, by factorising, the equation $2x^2 - x - 3 = 0$. **[3]**

(ii) Sketch the graph of $y = 2x^2 - x - 3$. **[3]**

(iii) Show that the equation $x^2 - 5x + 10 = 0$ has no real roots. **[2]**

(iv) Find the x-coordinates of the points of intersection of the graphs of $y = 2x^2 - x - 3$ and $y = x^2 - 5x + 10$. Give your answer in the form $a \pm \sqrt{b}$. **[4]**

11

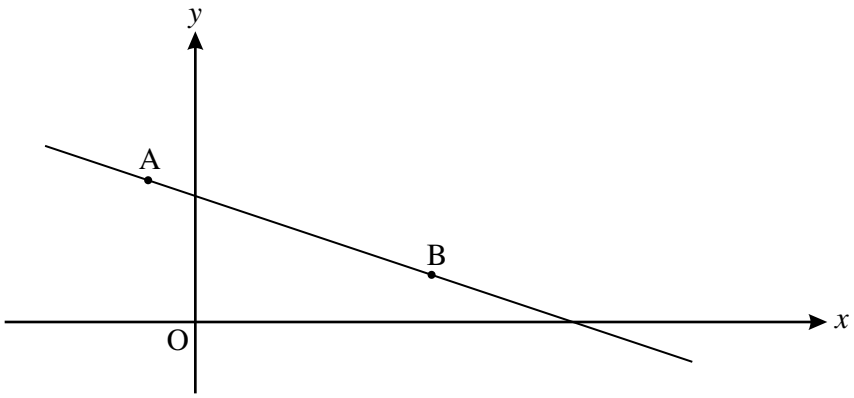

Fig. 11

Fig. 11 shows the line through the points A (−1, 3) and B (5, 1).

(i) Find the equation of the line through A and B. **[3]**

(ii) Show that the area of the triangle bounded by the axes and the line through A and B is $\frac{32}{3}$ square units. **[2]**

(iii) Show that the equation of the perpendicular bisector of AB is $y = 3x - 4$. **[3]**

(iv) A circle passing through A and B has its centre on the line $x = 3$. Find the centre of the circle and hence find the radius and equation of the circle. **[4]**

12 You are given that $f(x) = x^3 + 6x^2 - x - 30$.

(i) Use the factor theorem to find a root of $f(x) = 0$ and hence factorise $f(x)$ completely. **[6]**

(ii) Sketch the graph of $y = f(x)$. **[3]**

(iii) The graph of $y = f(x)$ is translated by $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$.

Show that the equation of the translated graph may be written as

$$y = x^3 + 3x^2 - 10x - 24.$$ **[3]**

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:
- Printed answer book 4751
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Monday 10 January 2011
Morning

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES
These instructions are the same on the printed answer book and the question paper.

- The question paper will be found in the centre of the printed answer book.
- Write your name, centre number and candidate number in the spaces provided on the printed answer book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the printed answer book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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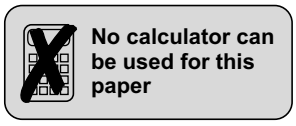

Section A (36 marks)

1 Find the equation of the line which is parallel to $y = 5x - 4$ and which passes through the point (2, 13). Give your answer in the form $y = ax + b$. **[3]**

2 **(i)** Write down the value of each of the following.

(*A*) 4^{-2} **[1]**

(*B*) 9^0 **[1]**

(ii) Find the value of $\left(\frac{64}{125}\right)^{\frac{4}{3}}$. **[2]**

3 Simplify $\frac{(3xy^4)^3}{6x^5y^2}$. **[3]**

4 Solve the inequality $5 - 2x < 0$. **[2]**

5 The volume V of a cone with base radius r and slant height l is given by the formula

$$V = \tfrac{1}{3}\pi r^2\sqrt{l^2 - r^2}.$$

Rearrange this formula to make l the subject. **[4]**

6 Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 - 3x)^5$, simplifying each term. **[4]**

7 **(i)** Express $\frac{81}{\sqrt{3}}$ in the form 3^k. **[2]**

(ii) Express $\frac{5 + \sqrt{3}}{5 - \sqrt{3}}$ in the form $\frac{a + b\sqrt{3}}{c}$, where a, b and c are integers. **[3]**

8 Find the coordinates of the point of intersection of the lines $x + 2y = 5$ and $y = 5x - 1$. **[3]**

9 Fig. 9 shows a trapezium ABCD, with the lengths in centimetres of three of its sides.

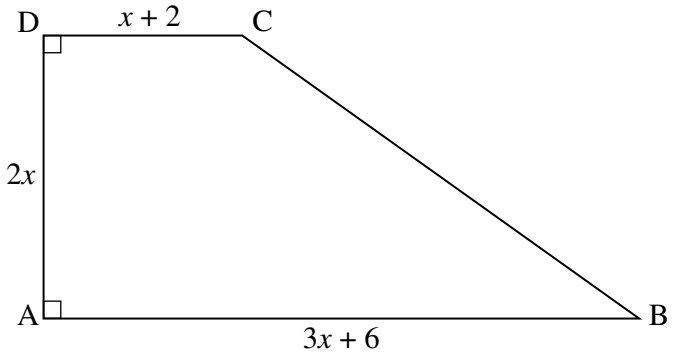

Fig. 9

This trapezium has area 140 cm^2.

(i) Show that $x^2 + 2x - 35 = 0$. **[2]**

(ii) Hence find the length of side AB of the trapezium. **[3]**

10 Select the best statement from

$P \Rightarrow Q$
$P \Leftarrow Q$
$P \Leftrightarrow Q$
none of the above

to describe the relationship between P and Q in each of the following cases.

(i) P : WXYZ is a quadrilateral with 4 equal sides
Q : WXYZ is a square

(ii) P : n is an odd integer
Q : $(n + 1)^2$ is an odd integer

(iii) P : n is greater than 1 and n is a prime number
Q : $\sqrt{n}$ is not an integer **[3]**

Section B (36 marks)

11 The points A (−1, 6), B (1, 0) and C (13, 4) are joined by straight lines.

(i) Prove that the lines AB and BC are perpendicular. **[3]**

(ii) Find the area of triangle ABC. **[3]**

(iii) A circle passes through the points A, B and C. Justify the statement that AC is a diameter of this circle. Find the equation of this circle. **[6]**

(iv) Find the coordinates of the point on this circle that is furthest from B. **[1]**

12 **(i)** You are given that $f(x) = (2x - 5)(x - 1)(x - 4)$.

(*A*) Sketch the graph of $y = f(x)$. **[3]**

(*B*) Show that $f(x) = 2x^3 - 15x^2 + 33x - 20$. **[2]**

(ii) You are given that $g(x) = 2x^3 - 15x^2 + 33x - 40$.

(*A*) Show that $g(5) = 0$. **[1]**

(*B*) Express $g(x)$ as the product of a linear and quadratic factor. **[3]**

(*C*) Hence show that the equation $g(x) = 0$ has only one real root. **[2]**

(iii) Describe fully the transformation that maps $y = f(x)$ onto $y = g(x)$. **[2]**

13

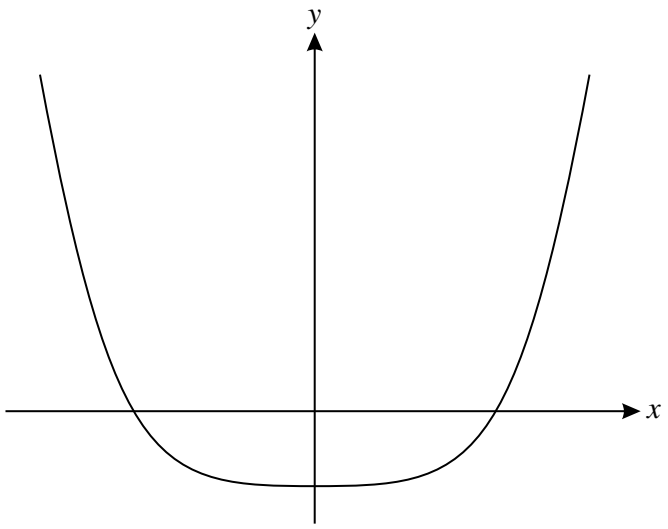

Fig. 13

Fig. 13 shows the curve $y = x^4 - 2$.

(i) Find the exact coordinates of the points of intersection of this curve with the axes. **[3]**

(ii) Find the exact coordinates of the points of intersection of the curve $y = x^4 - 2$ with the curve $y = x^2$. **[5]**

(iii) Show that the curves $y = x^4 - 2$ and $y = kx^2$ intersect for all values of k. **[2]**

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:
- Printed answer book 4751
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Wednesday 18 May 2011
Morning

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES
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- Write your name, centre number and candidate number in the spaces provided on the printed answer book. Please write clearly and in capital letters.
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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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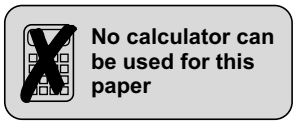

Section A (36 marks)

1 Solve the inequality $6(x + 3) > 2x + 5$. **[3]**

2 A line has gradient 3 and passes through the point (1, −5). The point (5, k) is on this line. Find the value of k. **[2]**

3 **(i)** Evaluate $\left(\frac{9}{16}\right)^{-\frac{1}{2}}$. **[2]**

(ii) Simplify $\dfrac{(2ac^2)^3 \times 9a^2c}{36a^4c^{12}}$. **[3]**

4 The point P (5, 4) is on the curve $y = \mathrm{f}(x)$. State the coordinates of the image of P when the graph of $y = \mathrm{f}(x)$ is transformed to the graph of

(i) $y = \mathrm{f}(x - 5)$, **[2]**

(ii) $y = \mathrm{f}(x) + 7$. **[2]**

5 Find the coefficient of x^4 in the binomial expansion of $(5 + 2x)^6$. **[4]**

6 Expand $(2x + 5)(x - 1)(x + 3)$, simplifying your answer. **[3]**

7 Find the discriminant of $3x^2 + 5x + 2$. Hence state the number of distinct real roots of the equation $3x^2 + 5x + 2 = 0$. **[3]**

8 Make x the subject of the formula $y = \dfrac{1 - 2x}{x + 3}$. **[4]**

9 A line L is parallel to the line $x + 2y = 6$ and passes through the point (10, 1). Find the area of the region bounded by the line L and the axes. **[5]**

10 Factorise $n^3 + 3n^2 + 2n$. Hence prove that, when n is a positive integer, $n^3 + 3n^2 + 2n$ is always divisible by 6. **[3]**

Section B (36 marks)

11 **(i)** Find algebraically the coordinates of the points of intersection of the curve $y = 4x^2 + 24x + 31$ and the line $x + y = 10$. **[5]**

(ii) Express $4x^2 + 24x + 31$ in the form $a(x + b)^2 + c$. **[4]**

(iii) For the curve $y = 4x^2 + 24x + 31$,

(*A*) write down the equation of the line of symmetry, **[1]**

(*B*) write down the minimum y-value on the curve. **[1]**

12

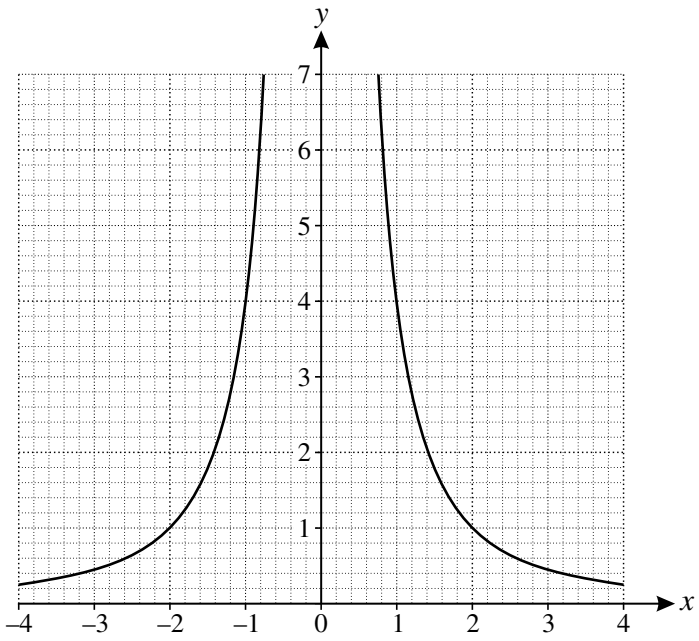

Fig. 12

Fig. 12 shows the graph of $y = \frac{4}{x^2}$.

(i) On the copy of Fig. 12, draw accurately the line $y = 2x + 5$ and hence find graphically the three roots of the equation $\frac{4}{x^2} = 2x + 5$. **[3]**

(ii) Show that the equation you have solved in part **(i)** may be written as $2x^3 + 5x^2 - 4 = 0$. Verify that $x = -2$ is a root of this equation and hence find, in exact form, the other two roots. **[6]**

(iii) By drawing a suitable line on the copy of Fig. 12, find the number of real roots of the equation $x^3 + 2x^2 - 4 = 0$. **[3]**

[Question 13 is printed overleaf.]

13

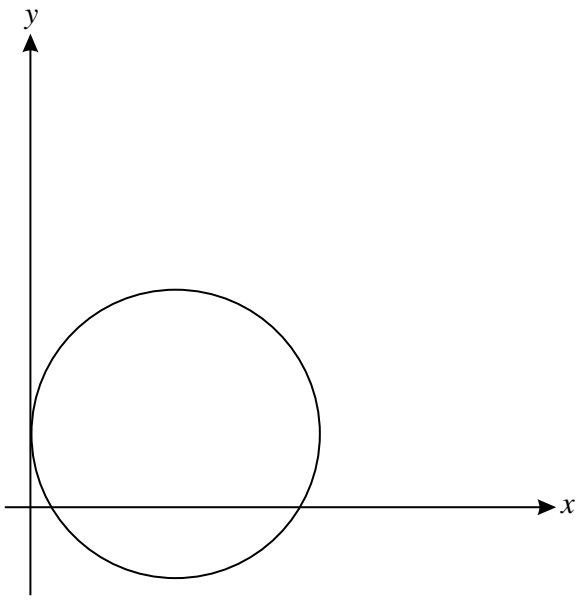

Fig. 13

Fig. 13 shows the circle with equation $(x - 4)^2 + (y - 2)^2 = 16$.

(i) Write down the radius of the circle and the coordinates of its centre. **[2]**

(ii) Find the x-coordinates of the points where the circle crosses the x-axis. Give your answers in surd form. **[4]**

(iii) Show that the point A $\left(4 + 2\sqrt{2},\ 2 + 2\sqrt{2}\right)$ lies on the circle and mark point A on the copy of Fig. 13.

Sketch the tangent to the circle at A and the other tangent that is parallel to it.

Find the equations of both these tangents. **[7]**

OCR
RECOGNISING ACHIEVEMENT

Friday 13 January 2012 – Morning

AS GCE MATHEMATICS (MEI)

4751 Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

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- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
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- You are **not** permitted to use a calculator in this paper.
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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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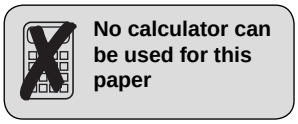

DC (NH/SW) 44312/4

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Section A (36 marks)

1 Find the equation of the line which is perpendicular to the line $y = 5x + 2$ and which passes through the point (1, 6). Give your answer in the form $y = ax + b$. **[3]**

2 **(i)** Evaluate $9^{-\frac{1}{2}}$. **[2]**

(ii) Simplify $\dfrac{(4x^4)^3 y^2}{2x^2y^5}$. **[3]**

3 Expand and simplify $(n + 2)^3 - n^3$. **[3]**

4 **(i)** Expand and simplify $(7 + 3\sqrt{2})(5 - 2\sqrt{2})$. **[3]**

(ii) Simplify $\sqrt{54} + \dfrac{12}{\sqrt{6}}$. **[2]**

5 Solve the following inequality.

$$\frac{2x + 1}{5} < \frac{3x + 4}{6}$$ **[4]**

6 Rearrange the following equation to make h the subject.

$$4h + 5 = 9a - ha^2$$ **[3]**

7

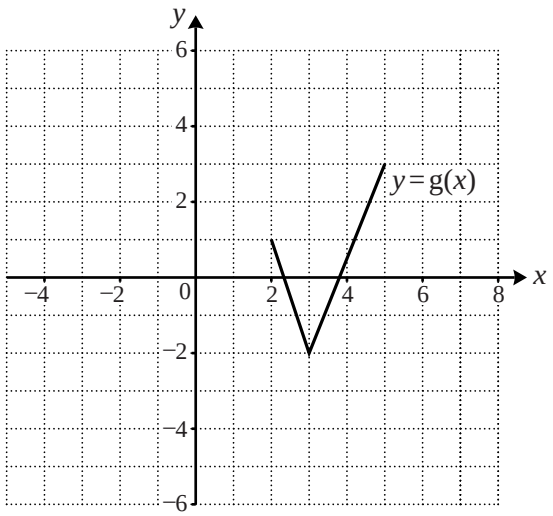

Fig. 7

Fig. 7 shows the graph of $y = g(x)$. Draw the graphs of the following.

(i) $y = g(x) + 3$ **[2]**

(ii) $y = g(x + 2)$ **[2]**

8 Express $5x^2 + 15x + 12$ in the form $a(x + b)^2 + c$.

Hence state the minimum value of y on the curve $y = 5x^2 + 15x + 12$. **[5]**

9 Complete each of the following by putting the best connecting symbol ($\Leftrightarrow$, $\Leftarrow$ or $\Rightarrow$) in the box. Explain your choice, giving full reasons.

(i) $n^3 + 1$ is an odd integer ☐ n is an even integer **[2]**

(ii) $(x – 3)(x – 2) > 0$ ☐ $x > 3$ **[2]**

Section B (36 marks)

10 Point A has coordinates (4, 7) and point B has coordinates (2, 1).

(i) Find the equation of the line through A and B. **[3]**

(ii) Point C has coordinates (–1, 2). Show that angle ABC = 90° and calculate the area of triangle ABC. **[5]**

(iii) Find the coordinates of D, the midpoint of AC.

Explain also how you can tell, without having to work it out, that A, B and C are all the same distance from D. **[3]**

11 You are given that $f(x) = 2x^3 – 3x^2 – 23x + 12$.

(i) Show that $x = –3$ is a root of $f(x) = 0$ and hence factorise $f(x)$ fully. **[6]**

(ii) Sketch the curve $y = f(x)$. **[3]**

(iii) Find the x-coordinates of the points where the line $y = 4x + 12$ intersects $y = f(x)$. **[4]**

12 A circle has equation $(x – 2)^2 + y^2 = 20$.

(i) Write down the radius of the circle and the coordinates of its centre. **[2]**

(ii) Find the points of intersection of the circle with the y-axis and sketch the circle. **[3]**

(iii) Show that, where the line $y = 2x + k$ intersects the circle,

$$5x^2 + (4k – 4)\,x + k^2 – 16 = 0.$$ **[3]**

(iv) Hence find the values of k for which the line $y = 2x + k$ is a tangent to the circle. **[4]**

THERE ARE NO QUESTIONS WRITTEN ON THIS PAGE.

OCR
RECOGNISING ACHIEVEMENT

Wednesday 16 May 2012 – Morning

AS GCE MATHEMATICS (MEI)

4751 Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book**. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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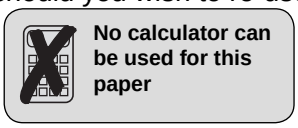

Section A (36 marks)

1 Find the equation of the line with gradient –2 which passes through the point (3, 1). Give your answer in the form $y = ax + b$.

Find also the points of intersection of this line with the axes. **[3]**

2 Make b the subject of the following formula.

$$a = \tfrac{2}{3} b^2 c$$ **[3]**

3 **(i)** Evaluate $\left(\frac{1}{5}\right)^{-2}$. **[2]**

(ii) Evaluate $\left(\frac{8}{27}\right)^{\frac{2}{3}}$. **[2]**

4 Factorise and hence simplify the following expression.

$$\frac{x^2 - 9}{x^2 + 5x + 6}$$ **[3]**

5 **(i)** Simplify $\frac{10(\sqrt{6})^3}{\sqrt{24}}$. **[3]**

(ii) Simplify $\frac{1}{4 - \sqrt{5}} + \frac{1}{4 + \sqrt{5}}$. **[2]**

6 **(i)** Evaluate ${}^5C_3$. **[1]**

(ii) Find the coefficient of x^3 in the expansion of $(3 - 2x)^5$. **[4]**

7 Find the set of values of k for which the graph of $y = x^2 + 2kx + 5$ does not intersect the x-axis. **[4]**

8 The function $f(x) = x^4 + bx + c$ is such that $f(2) = 0$. Also, when $f(x)$ is divided by $x + 3$, the remainder is 85.

Find the values of b and c. **[5]**

9 Simplify $(n + 3)^2 - n^2$. Hence explain why, when n is an integer, $(n + 3)^2 - n^2$ is never an even number.

Given also that $(n + 3)^2 - n^2$ is divisible by 9, what can you say about n? **[4]**

Section B (36 marks)

10

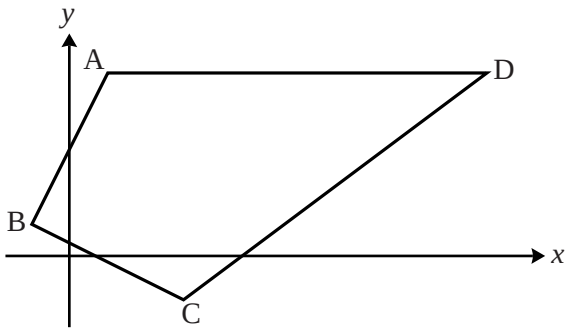

Fig. 10

Fig. 10 is a sketch of quadrilateral ABCD with vertices A (1, 5), B (–1, 1), C (3, –1) and D (11, 5).

(i) Show that AB = BC. **[3]**

(ii) Show that the diagonals AC and BD are perpendicular. **[3]**

(iii) Find the midpoint of AC. Show that BD bisects AC but AC does not bisect BD. **[5]**

11 A cubic curve has equation $y = f(x)$. The curve crosses the x-axis where $x = -\frac{1}{2}$, –2 and 5.

(i) Write down three linear factors of $f(x)$. Hence find the equation of the curve in the form $y = 2x^3 + ax^2 + bx + c$. **[4]**

(ii) Sketch the graph of $y = f(x)$. **[3]**

(iii) The curve $y = f(x)$ is translated by $\begin{pmatrix} 0 \\ -8 \end{pmatrix}$. State the coordinates of the point where the translated curve intersects the y-axis. **[1]**

(iv) The curve $y = f(x)$ is translated by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give the curve $y = g(x)$.

Find an expression in factorised form for $g(x)$ and state the coordinates of the point where the curve $y = g(x)$ intersects the y-axis. **[4]**

[Question 12 is printed overleaf.]

12

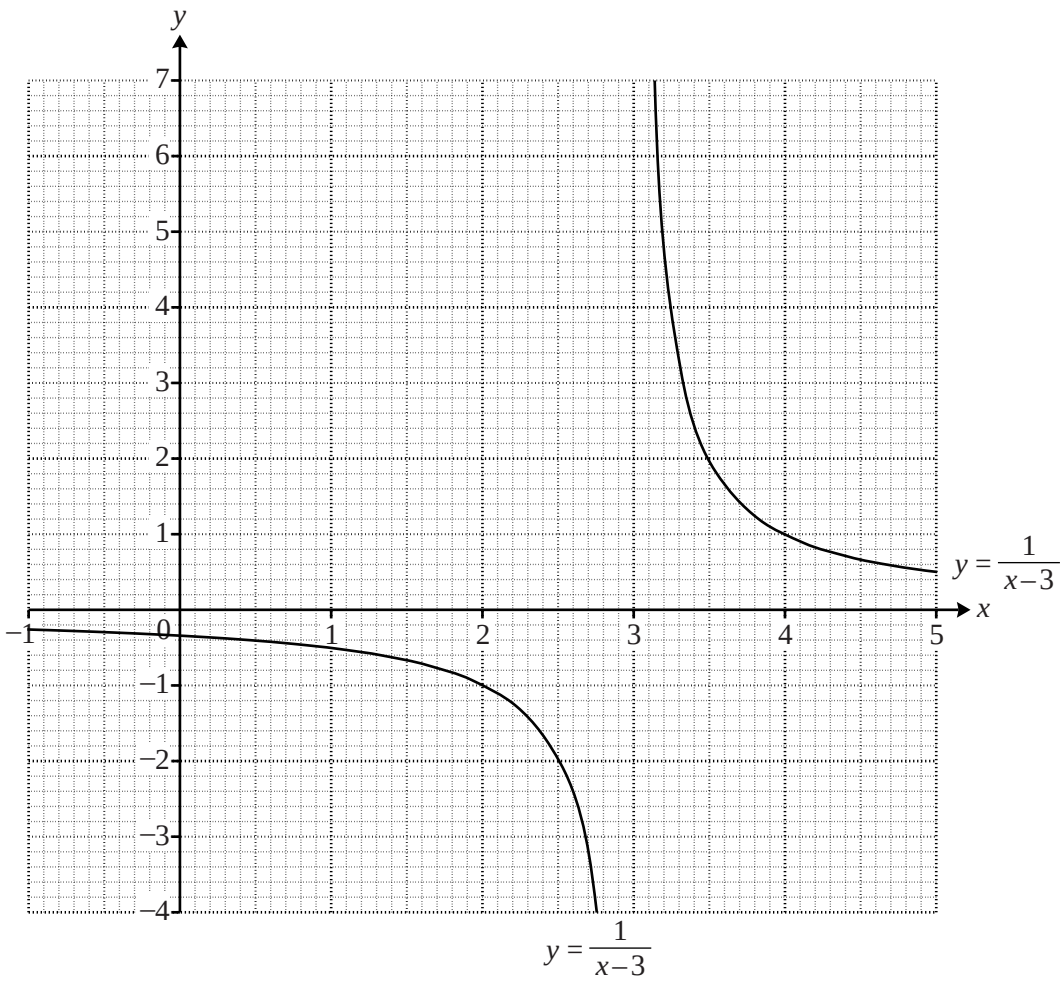

Fig. 12

Fig. 12 shows the graph of $y = \frac{1}{x-3}$.

(i) Draw accurately, on the copy of Fig. 12, the graph of $y = x^2 - 4x + 1$ for $-1 \leqslant x \leqslant 5$. Use your graph to estimate the coordinates of the intersections of $y = \frac{1}{x-3}$ and $y = x^2 - 4x + 1$. **[5]**

(ii) Show algebraically that, where the curves intersect, $x^3 - 7x^2 + 13x - 4 = 0$. **[3]**

(iii) Use the fact that $x = 4$ is a root of $x^3 - 7x^2 + 13x - 4 = 0$ to find a quadratic factor of $x^3 - 7x^2 + 13x - 4$. Hence find the exact values of the other two roots of this equation. **[5]**

OCR
RECOGNISING ACHIEVEMENT

Monday 14 January 2013 – Morning

AS GCE MATHEMATICS (MEI)

4751/01 Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4751/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

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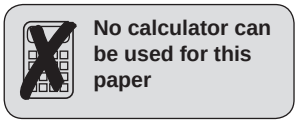

This paper has been pre modified for carrier language

Section A (36 marks)

1 Find the value of each of the following.

(i) $\left(\frac{5}{3}\right)^{-2}$ **[2]**

(ii) $81^{\frac{3}{4}}$ **[2]**

2 Simplify $\frac{(4x^5y)^3}{(2xy^2)\times(8x^{10}y^4)}$. **[3]**

3 A circle has diameter d, circumference C, and area A. Starting with the standard formulae for a circle, show that $Cd = kA$, finding the numerical value of k. **[3]**

4 Solve the inequality $5x^2 - 28x - 12 \leqslant 0$. **[4]**

5 You are given that $\mathrm{f}(x) = x^2 + kx + c$.

Given also that $\mathrm{f}(2) = 0$ and $\mathrm{f}(-3) = 35$, find the values of the constants k and c. **[4]**

6 The binomial expansion of $\left(2x + \frac{5}{x}\right)^6$ has a term which is a constant. Find this term. **[4]**

7 **(i)** Express $\sqrt{48} + \sqrt{75}$ in the form $a\sqrt{b}$, where a and b are integers. **[2]**

(ii) Simplify $\frac{7 + 2\sqrt{5}}{7 + \sqrt{5}}$, expressing your answer in the form $\frac{a + b\sqrt{5}}{c}$, where a, b and c are integers. **[3]**

8 Rearrange the equation $5c + 9t = a(2c + t)$ to make c the subject. **[4]**

9 You are given that $\mathrm{f}(x) = (x + 2)^2(x - 3)$.

(i) Sketch the graph of $y = \mathrm{f}(x)$. **[3]**

(ii) State the values of x which satisfy $\mathrm{f}(x + 3) = 0$. **[2]**

Section B (36 marks)

10 **(i)** Points A and B have coordinates (–2, 1) and (3, 4) respectively. Find the equation of the perpendicular bisector of AB and show that it may be written as $5x + 3y = 10$. **[6]**

(ii) Points C and D have coordinates (–5, 4) and (3, 6) respectively. The line through C and D has equation $4y = x + 21$. The point E is the intersection of CD and the perpendicular bisector of AB. Find the coordinates of point E. **[3]**

(iii) Find the equation of the circle with centre E which passes through A and B. Show also that CD is a diameter of this circle. **[5]**

11 **(i)** Express $x^2 - 5x + 6$ in the form $(x - a)^2 - b$. Hence state the coordinates of the turning point of the curve $y = x^2 - 5x + 6$. **[4]**

(ii) Find the coordinates of the intersections of the curve $y = x^2 - 5x + 6$ with the axes and sketch this curve. **[4]**

(iii) Solve the simultaneous equations $y = x^2 - 5x + 6$ and $x + y = 2$. Hence show that the line $x + y = 2$ is a tangent to the curve $y = x^2 - 5x + 6$ at one of the points where the curve intersects the axes. **[4]**

12 You are given that $\mathrm{f}(x) = x^4 - x^3 + x^2 + 9x - 10$.

(i) Show that $x = 1$ is a root of $\mathrm{f}(x) = 0$ and hence express $\mathrm{f}(x)$ as a product of a linear factor and a cubic factor. **[3]**

(ii) Hence or otherwise find another root of $\mathrm{f}(x) = 0$. **[2]**

(iii) Factorise $\mathrm{f}(x)$, showing that it has only two linear factors. Show also that $\mathrm{f}(x) = 0$ has only two real roots. **[5]**

THERE ARE NO QUESTIONS WRITTEN ON THIS PAGE.

OCR
RECOGNISING ACHIEVEMENT

Monday 13 May 2013 – Afternoon

AS GCE MATHEMATICS (MEI)

4751/01 Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4751/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
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Duration: 1 hour 30 minutes

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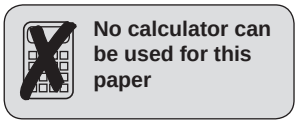

Section A (36 marks)

1 Find the equation of the line which is perpendicular to the line $y = 2x - 5$ and which passes through the point $(4, 1)$. Give your answer in the form $y = ax + b$. **[3]**

2 Find the coordinates of the point of intersection of the lines $y = 3x - 2$ and $x + 3y = 1$. **[4]**

3 **(i)** Evaluate $(0.2)^{-2}$. **[2]**

(ii) Simplify $(16a^{12})^{\frac{3}{4}}$. **[3]**

4 Rearrange the following formula to make r the subject, where $r > 0$.

$$V = \frac{1}{3}\pi r^2(a + b)$$ **[3]**

5 You are given that $f(x) = x^5 + kx - 20$. When $f(x)$ is divided by $(x - 2)$, the remainder is 18. Find the value of k. **[3]**

6 Find the coefficient of x^3 in the binomial expansion of $(2 - 4x)^5$. **[4]**

7 **(i)** Express $125\sqrt{5}$ in the form 5^k. **[2]**

(ii) Simplify $10 + 7\sqrt{5} + \dfrac{38}{1 - 2\sqrt{5}}$, giving your answer in the form $a + b\sqrt{5}$. **[3]**

8 Express $3x^2 - 12x + 5$ in the form $a(x - b)^2 - c$. Hence state the minimum value of y on the curve $y = 3x^2 - 12x + 5$. **[5]**

9 $n - 1$, n and $n + 1$ are any three consecutive integers.

(i) Show that the sum of these integers is always divisible by 3. **[1]**

(ii) Find the sum of the squares of these three consecutive integers and explain how this shows that the sum of the squares of any three consecutive integers is never divisible by 3. **[3]**

Section B (36 marks)

10 The circle $(x-3)^2+(y-2)^2=20$ has centre C.

(i) Write down the radius of the circle and the coordinates of C. **[2]**

(ii) Find the coordinates of the intersections of the circle with the x- and y-axes. **[5]**

(iii) Show that the points $A(1,6)$ and $B(7,4)$ lie on the circle. Find the coordinates of the midpoint of AB. Find also the distance of the chord AB from the centre of the circle. **[5]**

11 You are given that $f(x)=(2x-3)(x+2)(x+4)$.

(i) Sketch the graph of $y=f(x)$. **[3]**

(ii) State the roots of $f(x-2)=0$. **[2]**

(iii) You are also given that $g(x)=f(x)+15$.

(*A*) Show that $g(x)=2x^3+9x^2-2x-9$. **[2]**

(*B*) Show that $g(1)=0$ and hence factorise $g(x)$ completely. **[5]**

[Question 12 is printed overleaf.]

12

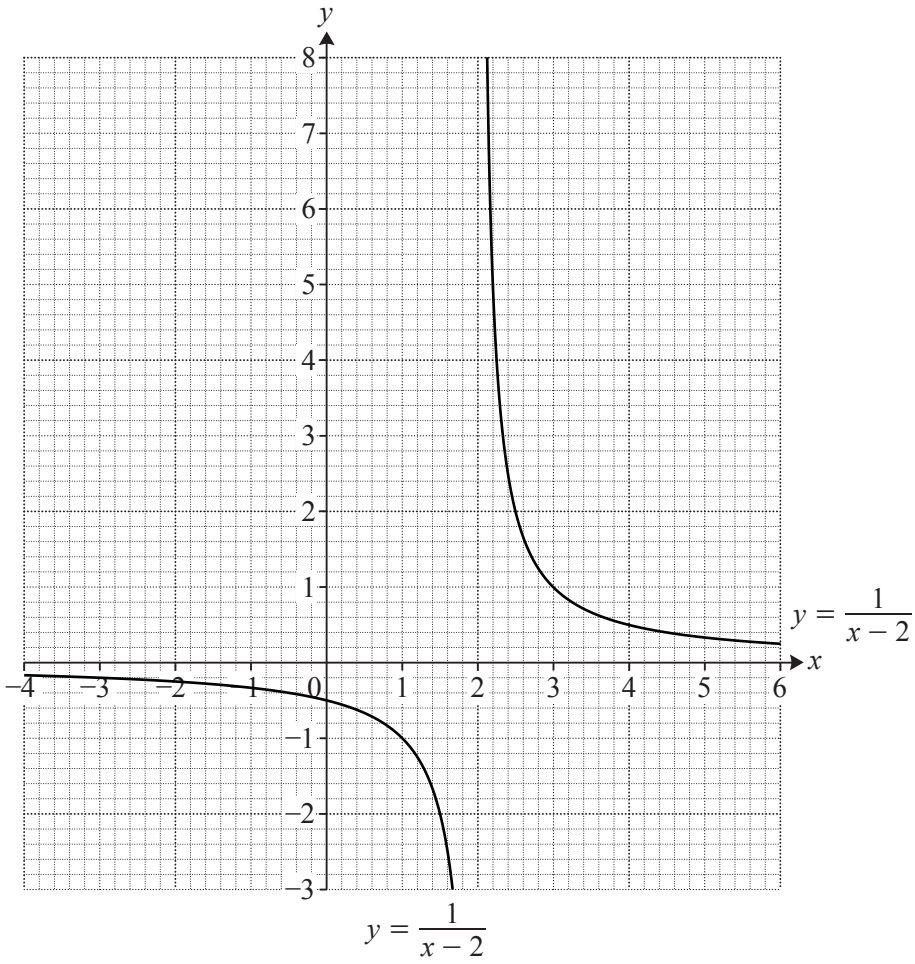

Fig. 12

Fig. 12 shows the graph of $y = \frac{1}{x-2}$.

(i) Draw accurately the graph of $y = 2x + 3$ on the copy of Fig. 12 and use it to estimate the coordinates of the points of intersection of $y = \frac{1}{x-2}$ and $y = 2x + 3$. **[3]**

(ii) Show algebraically that the x-coordinates of the points of intersection of $y = \frac{1}{x-2}$ and $y = 2x + 3$ satisfy the equation $2x^2 - x - 7 = 0$. Hence find the exact values of the x-coordinates of the points of intersection. **[5]**

(iii) Find the quadratic equation satisfied by the x-coordinates of the points of intersection of $y = \frac{1}{x-2}$ and $y = -x + k$. Hence find the exact values of k for which $y = -x + k$ is a tangent to $y = \frac{1}{x-2}$. **[4]**