

OCR Maths Core 1

Past Paper Pack

2006-2013

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education**

MATHEMATICS**4721**

Core Mathematics 1

Specimen Paper

Additional materials:
Answer booklet
Graph paper
List of Formulae (MF 1)

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.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **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.
- The total number of marks for this paper is 72.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**

This question paper consists of 4 printed pages.

1 Write down the exact values of

(i) 4^{-2} , [1]

(ii) $(2\sqrt{2})^2$, [1]

(iii) $(1^3 + 2^3 + 3^3)^{\frac{1}{2}}$. [2]

2 (i) Express $x^2 - 8x + 3$ in the form $(x + a)^2 + b$. [3]

(ii) Hence write down the coordinates of the minimum point on the graph of $y = x^2 - 8x + 3$. [2]

3 The quadratic equation $x^2 + kx + k = 0$ has no real roots for x .

(i) Write down the discriminant of $x^2 + kx + k$ in terms of k . [2]

(ii) Hence find the set of values that k can take. [4]

4 Find $\frac{dy}{dx}$ in each of the following cases:

(i) $y = 4x^3 - 1$, [2]

(ii) $y = x^2(x^2 + 2)$, [3]

(iii) $y = \sqrt{x}$ [2]

5 (i) Solve the simultaneous equations

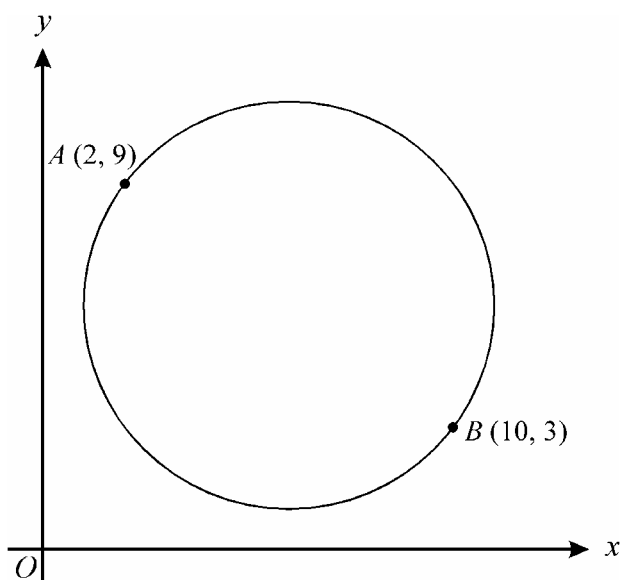
$$y = x^2 - 3x + 2, \quad y = 3x - 7. \quad [5]$$

(ii) What can you deduce from the solution to part (i) about the graphs of $y = x^2 - 3x + 2$ and $y = 3x - 7$? [2]

(iii) Hence, or otherwise, find the equation of the normal to the curve $y = x^2 - 3x + 2$ at the point $(3, 2)$, giving your answer in the form $ax + by + c = 0$ where a , b and c are integers. [4]

- 6 (i) Sketch the graph of $y = \frac{1}{x}$, where $x \neq 0$, showing the parts of the graph corresponding to both positive and negative values of x . [2]
- (ii) Describe fully the geometrical transformation that transforms the curve $y = \frac{1}{x}$ to the curve $y = \frac{1}{x+2}$.
Hence sketch the curve $y = \frac{1}{x+2}$. [5]
- (iii) Differentiate $\frac{1}{x}$ with respect to x . [2]
- (iv) Use parts (ii) and (iii) to find the gradient of the curve $y = \frac{1}{x+2}$ at the point where it crosses the y -axis. [3]

7



The diagram shows a circle which passes through the points $A(2, 9)$ and $B(10, 3)$. AB is a diameter of the circle.

- (i) Calculate the radius of the circle and the coordinates of the centre. [4]
- (ii) Show that the equation of the circle may be written in the form $x^2 + y^2 - 12x - 12y + 47 = 0$. [3]
- (iii) The tangent to the circle at the point B cuts the x -axis at C . Find the coordinates of C . [6]

- 8** (i) Find the coordinates of the stationary points on the curve $y = 2x^3 - 3x^2 - 12x - 7$. [6]
- (ii) Determine whether each stationary point is a maximum point or a minimum point. [3]
- (iii) By expanding the right-hand side, show that
- $$2x^3 - 3x^2 - 12x - 7 = (x+1)^2(2x-7). \quad [2]$$
- (iv) Sketch the curve $y = 2x^3 - 3x^2 - 12x - 7$, marking the coordinates of the stationary points and the points where the curve meets the axes. [3]

OXFORD CAMBRIDGE AND RSA EXAMINATIONS**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education****MATHEMATICS****4721**

Core Mathematics 1

Monday **10 JANUARY 2005** Afternoon 1 hour 30 minutesAdditional materials:
Answer booklet
Graph paper
List of Formulae (MF1)**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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
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a calculator in this paper.**

This question paper consists of 3 printed pages and 1 blank page.

- 1 (i) Express 11^{-2} as a fraction. [1]
- (ii) Evaluate $100^{\frac{3}{2}}$. [2]
- (iii) Express $\sqrt{50} + \frac{6}{\sqrt{3}}$ in the form $a\sqrt{2} + b\sqrt{3}$, where a and b are integers. [3]
- 2 Given that $2x^2 - 12x + p = q(x - r)^2 + 10$ for all values of x , find the constants p , q and r . [4]
- 3 (i) The curve $y = 5\sqrt{x}$ is transformed by a stretch, scale factor $\frac{1}{2}$, parallel to the x -axis. Find the equation of the curve after it has been transformed. [2]
- (ii) Describe the single transformation which transforms the curve $y = 5\sqrt{x}$ to the curve $y = (5\sqrt{x}) - 3$. [2]
- 4 Solve the simultaneous equations
- $$x^2 - 3y + 11 = 0, \quad 2x - y + 1 = 0. \quad [5]$$
- 5 On separate diagrams,
- (i) sketch the curve $y = \frac{1}{x}$, [2]
- (ii) sketch the curve $y = x(x^2 - 1)$, stating the coordinates of the points where it crosses the x -axis, [3]
- (iii) sketch the curve $y = -\sqrt{x}$. [2]
- 6 (i) Calculate the discriminant of $-2x^2 + 7x + 3$ and hence state the number of real roots of the equation $-2x^2 + 7x + 3 = 0$. [3]
- (ii) The quadratic equation $2x^2 + (p + 1)x + 8 = 0$ has equal roots. Find the possible values of p . [4]
- 7 Find $\frac{dy}{dx}$ in each of the following cases:
- (i) $y = \frac{1}{2}x^4 - 3x$, [2]
- (ii) $y = (2x^2 + 3)(x + 1)$, [4]
- (iii) $y = \sqrt[5]{x}$. [3]

- 8** The length of a rectangular children's playground is 10 m more than its width. The width of the playground is x metres.
- (i) The perimeter of the playground is greater than 64 m. Write down a linear inequality in x . [1]
 - (ii) The area of the playground is less than 299 m^2 . Show that $(x - 13)(x + 23) < 0$. [2]
 - (iii) By solving the inequalities in parts (i) and (ii), determine the set of possible values of x . [5]
- 9**
- (i) Find the gradient of the curve $y = 2x^2$ at the point where $x = 3$. [2]
 - (ii) At a point A on the curve $y = 2x^2$, the gradient of the normal is $\frac{1}{8}$. Find the coordinates of A . [3]
- Points $P_1(1, y_1)$, $P_2(1.01, y_2)$ and $P_3(1.1, y_3)$ lie on the curve $y = kx^2$. The gradient of the chord P_1P_3 is 6.3 and the gradient of the chord P_1P_2 is 6.03.
- (iii) What do these results suggest about the gradient of the tangent to the curve $y = kx^2$ at P_1 ? [1]
 - (iv) Deduce the value of k . [3]
- 10** The points D , E and F have coordinates $(-2, 0)$, $(0, -1)$ and $(2, 3)$ respectively.
- (i) Calculate the gradient of DE . [1]
 - (ii) Find the equation of the line through F , parallel to DE , giving your answer in the form $ax + by + c = 0$. [3]
 - (iii) By calculating the gradient of EF , show that DEF is a right-angled triangle. [2]
 - (iv) Calculate the length of DF . [2]
 - (v) Use the results of parts (iii) and (iv) to show that the circle which passes through D , E and F has equation $x^2 + y^2 - 3y - 4 = 0$. [5]

OXFORD CAMBRIDGE AND RSA EXAMINATIONS**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education****MATHEMATICS****4721**

Core Mathematics 1

Monday

23 MAY 2005

Morning

1 hour 30 minutes

Additional materials:

- Answer booklet
- Graph paper
- List of Formulae (MF1)

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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
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INFORMATION FOR CANDIDATES

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a calculator in this paper.**

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- 1 Solve the inequality $x^2 - 6x - 40 \geq 0$. [4]
- 2 (i) Express $3x^2 + 12x + 7$ in the form $3(x + a)^2 + b$. [4]
(ii) Hence write down the equation of the line of symmetry of the curve $y = 3x^2 + 12x + 7$. [1]
- 3 (i) Sketch the curve $y = x^3$. [1]
(ii) Describe a transformation that transforms the curve $y = x^3$ to the curve $y = -x^3$. [2]
(iii) The curve $y = x^3$ is translated by p units, parallel to the x -axis. State the equation of the curve after it has been transformed. [2]
- 4 Solve the equation $x^6 + 26x^3 - 27 = 0$. [5]
- 5 (a) Simplify $2x^{\frac{2}{3}} \times 3x^{-1}$. [2]
(b) Express $2^{40} \times 4^{30}$ in the form 2^n . [2]
(c) Express $\frac{26}{4 - \sqrt{3}}$ in the form $a + b\sqrt{3}$. [3]
- 6 Given that $f(x) = (x + 1)^2(3x - 4)$,
(i) express $f(x)$ in the form $ax^3 + bx^2 + cx + d$, [3]
(ii) find $f'(x)$, [2]
(iii) find $f''(x)$. [2]

7 (i) Calculate the discriminant of each of the following:

(a) $x^2 + 6x + 9$,

(b) $x^2 - 10x + 12$,

(c) $x^2 - 2x + 5$.

[3]

(ii)

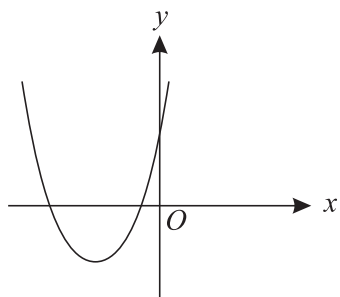


Fig. 1

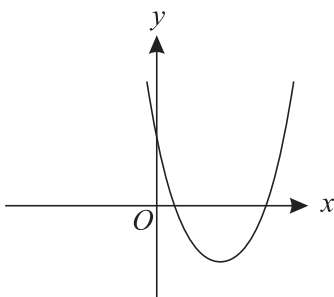


Fig. 2

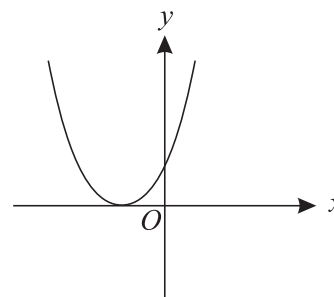


Fig. 3

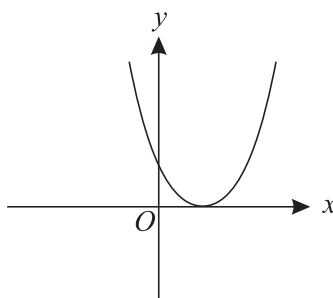


Fig. 4

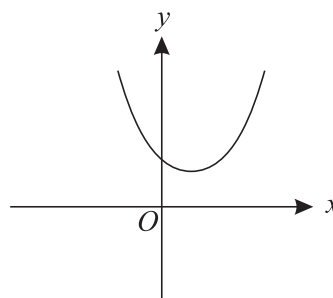


Fig. 5

State with reasons which of the diagrams corresponds to the curve

(a) $y = x^2 + 6x + 9$,

(b) $y = x^2 - 10x + 12$,

(c) $y = x^2 - 2x + 5$.

[4]

8 (i) Describe completely the curve $x^2 + y^2 = 25$.

[2]

(ii) Find the coordinates of the points of intersection of the curve $x^2 + y^2 = 25$ and the line $2x + y - 5 = 0$.

[6]

[Questions 9 and 10 are printed overleaf.]

- 9 (i) Find the gradient of the line l_1 which has equation $4x - 3y + 5 = 0$. [1]
- (ii) Find an equation of the line l_2 , which passes through the point $(1, 2)$ and which is perpendicular to the line l_1 , giving your answer in the form $ax + by + c = 0$. [4]

The line l_1 crosses the x -axis at P and the line l_2 crosses the y -axis at Q .

- (iii) Find the coordinates of the mid-point of PQ . [3]
- (iv) Calculate the length of PQ , giving your answer in the form $\frac{\sqrt{a}}{b}$, where a and b are integers. [3]
- 10 (i) Given that $y = \frac{1}{3}x^3 - 9x$, find $\frac{dy}{dx}$. [2]
- (ii) Find the coordinates of the stationary points on the curve $y = \frac{1}{3}x^3 - 9x$. [3]
- (iii) Determine whether each stationary point is a maximum point or a minimum point. [3]
- (iv) Given that $24x + 3y + 2 = 0$ is the equation of the tangent to the curve at the point (p, q) , find p and q . [5]

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education**

MATHEMATICS

4721

Core Mathematics 1

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

Additional materials:
8 page answer booklet
Graph paper
List of Formulae (MF1)

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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WARNING

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1 Solve the equations

(i) $x^{\frac{1}{3}} = 2$, [1]

(ii) $10^t = 1$, [1]

(iii) $(y^{-2})^2 = \frac{1}{81}$. [2]

2 (i) Simplify $(3x + 1)^2 - 2(2x - 3)^2$. [3]

(ii) Find the coefficient of x^3 in the expansion of

$(2x^3 - 3x^2 + 4x - 3)(x^2 - 2x + 1)$. [2]

3 Given that $y = 3x^5 - \sqrt{x} + 15$, find

(i) $\frac{dy}{dx}$, [3]

(ii) $\frac{d^2y}{dx^2}$. [2]

4 (i) Sketch the curve $y = \frac{1}{x^2}$. [2]

(ii) Hence sketch the curve $y = \frac{1}{(x-3)^2}$. [2]

(iii) Describe fully a transformation that transforms the curve $y = \frac{1}{x^2}$ to the curve $y = \frac{2}{x^2}$. [3]

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

(ii) Express $y^2 - 4y - \frac{11}{4}$ in the form $(y + p)^2 + q$. [2]

A circle has equation $x^2 + y^2 + 3x - 4y - \frac{11}{4} = 0$.

(iii) Write down the coordinates of the centre of the circle. [1]

(iv) Find the radius of the circle. [2]

6 (i) Find the coordinates of the stationary points on the curve $y = x^3 - 3x^2 + 4$. [6]

(ii) Determine whether each stationary point is a maximum point or a minimum point. [3]

(iii) For what values of x does $x^3 - 3x^2 + 4$ increase as x increases? [2]

- 7 (i) Solve the equation $x^2 - 8x + 11 = 0$, giving your answers in simplified surd form. [4]
- (ii) Hence sketch the curve $y = x^2 - 8x + 11$, labelling the points where the curve crosses the axes. [3]
- (iii) Solve the equation $y - 8y^{\frac{1}{2}} + 11 = 0$, giving your answers in the form $p \pm q\sqrt{5}$. [4]
- 8 (i) Given that $y = x^2 - 5x + 15$ and $5x - y = 10$, show that $x^2 - 10x + 25 = 0$. [2]
- (ii) Find the discriminant of $x^2 - 10x + 25$. [1]
- (iii) What can you deduce from the answer to part (ii) about the line $5x - y = 10$ and the curve $y = x^2 - 5x + 15$? [1]
- (iv) Solve the simultaneous equations
- $$y = x^2 - 5x + 15 \quad \text{and} \quad 5x - y = 10. \quad [3]$$
- (v) Hence, or otherwise, find the equation of the normal to the curve $y = x^2 - 5x + 15$ at the point $(5, 15)$, giving your answer in the form $ax + by = c$, where a, b and c are integers. [4]
- 9 The points A, B and C have coordinates $(5, 1), (p, 7)$ and $(8, 2)$ respectively.
- (i) Given that the distance between points A and B is twice the distance between points A and C , calculate the possible values of p . [7]
- (ii) Given also that the line passing through A and B has equation $y = 3x - 14$, find the coordinates of the mid-point of AB . [4]

OXFORD CAMBRIDGE AND RSA EXAMINATIONS**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education****MATHEMATICS****4721**

Core Mathematics 1

Tuesday

6 JUNE 2006

Afternoon

1 hour 30 minutes

Additional materials:

8 page answer booklet

Graph paper

List of Formulae (MF1)

TIME 1 hour 30 minutes**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
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This question paper consists of 3 printed pages and 1 blank page.

- 1** The points $A(1, 3)$ and $B(4, 21)$ lie on the curve $y = x^2 + x + 1$.
- (i) Find the gradient of the line AB . [2]
- (ii) Find the gradient of the curve $y = x^2 + x + 1$ at the point where $x = 3$. [2]
- 2** (i) Evaluate $27^{-\frac{2}{3}}$. [2]
- (ii) Express $5\sqrt{5}$ in the form 5^n . [1]
- (iii) Express $\frac{1 - \sqrt{5}}{3 + \sqrt{5}}$ in the form $a + b\sqrt{5}$. [3]
- 3** (i) Express $2x^2 + 12x + 13$ in the form $a(x + b)^2 + c$. [4]
- (ii) Solve $2x^2 + 12x + 13 = 0$, giving your answers in simplified surd form. [3]
- 4** (i) By expanding the brackets, show that
- $$(x - 4)(x - 3)(x + 1) = x^3 - 6x^2 + 5x + 12. \quad [3]$$
- (ii) Sketch the curve
- $$y = x^3 - 6x^2 + 5x + 12,$$
- giving the coordinates of the points where the curve meets the axes. Label the curve C_1 . [3]
- (iii) On the same diagram as in part (ii), sketch the curve
- $$y = -x^3 + 6x^2 - 5x - 12.$$
- Label this curve C_2 . [2]
- 5** Solve the inequalities
- (i) $1 < 4x - 9 < 5$, [3]
- (ii) $y^2 \geq 4y + 5$. [5]
- 6** (i) Solve the equation $x^4 - 10x^2 + 25 = 0$. [4]
- (ii) Given that $y = \frac{2}{5}x^5 - \frac{20}{3}x^3 + 50x + 3$, find $\frac{dy}{dx}$. [2]
- (iii) Hence find the number of stationary points on the curve $y = \frac{2}{5}x^5 - \frac{20}{3}x^3 + 50x + 3$. [2]

- 7 (i) Solve the simultaneous equations

$$y = x^2 - 5x + 4, \quad y = x - 1. \quad [4]$$

- (ii) State the number of points of intersection of the curve $y = x^2 - 5x + 4$ and the line $y = x - 1$. [1]

- (iii) Find the value of c for which the line $y = x + c$ is a tangent to the curve $y = x^2 - 5x + 4$. [4]

- 8 A cuboid has a volume of 8 m^3 . The base of the cuboid is square with sides of length x metres. The surface area of the cuboid is $A \text{ m}^2$.

(i) Show that $A = 2x^2 + \frac{32}{x}$. [3]

(ii) Find $\frac{dA}{dx}$. [3]

- (iii) Find the value of x which gives the smallest surface area of the cuboid, justifying your answer. [4]

- 9 The points A and B have coordinates $(4, -2)$ and $(10, 6)$ respectively. C is the mid-point of AB . Find

(i) the coordinates of C , [2]

(ii) the length of AC , [2]

(iii) the equation of the circle that has AB as a diameter, [3]

(iv) the equation of the tangent to the circle in part (iii) at the point A , giving your answer in the form $ax + by = c$. [5]



**ADVANCED SUBSIDIARY GCE UNIT
MATHEMATICS**

4721/01

Core Mathematics 1

TUESDAY 16 JANUARY 2007

Morning

Time: 1 hour 30 minutes

Additional Materials: Answer Booklet (8 pages)
List of Formulae (MF1)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
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INFORMATION FOR CANDIDATES

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ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- **You are reminded of the need for clear presentation in your answers.**



WARNING

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a calculator in this paper.**

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

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

2 Evaluate

(i) 6^0 , [1]

(ii) $2^{-1} \times 32^{\frac{4}{3}}$. [3]

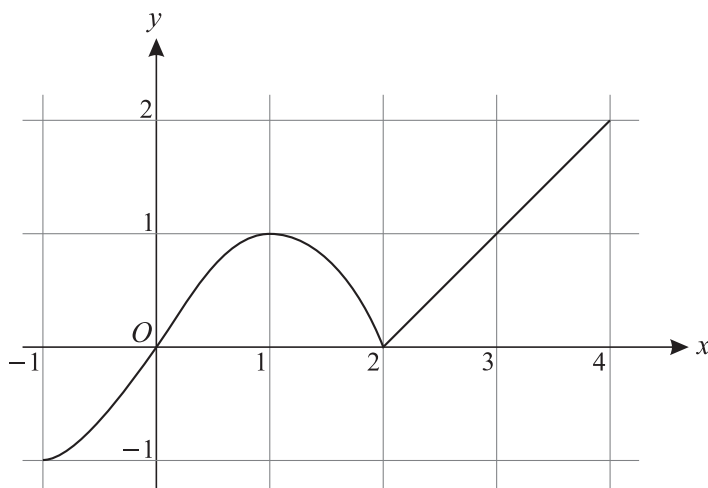
3 Solve the inequalities

(i) $3(x-5) \leq 24$, [2]

(ii) $5x^2 - 2 > 78$. [3]

4 Solve the equation $x^{\frac{2}{3}} + 3x^{\frac{1}{3}} - 10 = 0$. [5]

5



The graph of $y = f(x)$ for $-1 \leq x \leq 4$ is shown above.

(i) Sketch the graph of $y = -f(x)$ for $-1 \leq x \leq 4$. [2]

(ii) The point $P(1, 1)$ on $y = f(x)$ is transformed to the point Q on $y = 3f(x)$. State the coordinates of Q . [2]

(iii) Describe the transformation which transforms the graph of $y = f(x)$ to the graph of $y = f(x+2)$. [2]

6 (i) Express $2x^2 - 24x + 80$ in the form $a(x-b)^2 + c$. [4]

(ii) State the equation of the line of symmetry of the curve $y = 2x^2 - 24x + 80$. [1]

(iii) State the equation of the tangent to the curve $y = 2x^2 - 24x + 80$ at its minimum point. [1]

- 7 Find $\frac{dy}{dx}$ in each of the following cases.
- (i) $y = 5x + 3$ [1]
- (ii) $y = \frac{2}{x^2}$ [3]
- (iii) $y = (2x + 1)(5x - 7)$ [4]
- 8 (i) Find the coordinates of the stationary points of the curve $y = 27 + 9x - 3x^2 - x^3$. [6]
- (ii) Determine, in each case, whether the stationary point is a maximum or minimum point. [3]
- (iii) Hence state the set of values of x for which $27 + 9x - 3x^2 - x^3$ is an increasing function. [2]
- 9 A is the point $(2, 7)$ and B is the point $(-1, -2)$.
- (i) Find the equation of the line through A parallel to the line $y = 4x - 5$, giving your answer in the form $y = mx + c$. [3]
- (ii) Calculate the length of AB , giving your answer in simplified surd form. [3]
- (iii) Find the equation of the line which passes through the mid-point of AB and which is perpendicular to AB . Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. [6]
- 10 A circle has equation $x^2 + y^2 + 2x - 4y - 8 = 0$.
- (i) Find the centre and radius of the circle. [3]
- (ii) The circle passes through the point $(-3, k)$, where $k < 0$. Find the value of k . [3]
- (iii) Find the coordinates of the points where the circle meets the line with equation $x + y = 6$. [6]

**ADVANCED SUBSIDIARY GCE UNIT
MATHEMATICS**

4721/01

Core Mathematics 1

THURSDAY 7 JUNE 2007

Morning

Time: 1 hour 30 minutes

Additional Materials: Answer Booklet (8 pages)
List of Formulae (MF1)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **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.
- 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 reminded of the need for clear presentation in your answers.**



WARNING

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

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1 Simplify $(2x + 5)^2 - (x - 3)^2$, giving your answer in the form $ax^2 + bx + c$. [3]

2 (a) On separate diagrams, sketch the graphs of

(i) $y = \frac{1}{x}$, [2]

(ii) $y = x^4$. [1]

(b) Describe a transformation that transforms the curve $y = x^3$ to the curve $y = 8x^3$. [2]

3 Simplify the following, expressing each answer in the form $a\sqrt{5}$.

(i) $3\sqrt{10} \times \sqrt{2}$ [2]

(ii) $\sqrt{500} + \sqrt{125}$ [3]

4 (i) Find the discriminant of $kx^2 - 4x + k$ in terms of k . [2]

(ii) The quadratic equation $kx^2 - 4x + k = 0$ has equal roots. Find the possible values of k . [3]

5



The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is x metres.

(i) Show that the enclosed area, $A \text{ m}^2$, is given by

$$A = 20x - 2x^2. \quad [2]$$

(ii) Use differentiation to find the maximum value of A . [4]

6 By using the substitution $y = (x + 2)^2$, find the real roots of the equation

$$(x + 2)^4 + 5(x + 2)^2 - 6 = 0. \quad [6]$$

7 (a) Given that $f(x) = x + \frac{3}{x}$, find $f'(x)$. [4]

(b) Find the gradient of the curve $y = x^{\frac{5}{2}}$ at the point where $x = 4$. [5]

- 8** (i) Express $x^2 + 8x + 15$ in the form $(x + a)^2 - b$. [3]
- (ii) Hence state the coordinates of the vertex of the curve $y = x^2 + 8x + 15$. [2]
- (iii) Solve the inequality $x^2 + 8x + 15 > 0$. [4]
- 9** The circle with equation $x^2 + y^2 - 6x - k = 0$ has radius 4.
- (i) Find the centre of the circle and the value of k . [4]
- The points $A(3, a)$ and $B(-1, 0)$ lie on the circumference of the circle, with $a > 0$.
- (ii) Calculate the length of AB , giving your answer in simplified surd form. [5]
- (iii) Find an equation for the line AB . [3]
- 10** (i) Solve the equation $3x^2 - 14x - 5 = 0$. [3]
- A curve has equation $y = 3x^2 - 14x - 5$.
- (ii) Sketch the curve, indicating the coordinates of all intercepts with the axes. [3]
- (iii) Find the value of c for which the line $y = 4x + c$ is a tangent to the curve. [6]



**ADVANCED SUBSIDIARY GCE
MATHEMATICS**

4721/01

Core Mathematics 1

WEDNESDAY 9 JANUARY 2008

Afternoon

Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages)
List of Formulae (MF1)

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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **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.
- The total number of marks for this paper is 72.
- **You are reminded of the need for clear presentation in your answers.**



WARNING

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

This document consists of 4 printed pages.

- 1 Express $\frac{4}{3 - \sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers. [3]
- 2 (i) Write down the equation of the circle with centre $(0, 0)$ and radius 7. [1]
(ii) A circle with centre $(3, 5)$ has equation $x^2 + y^2 - 6x - 10y - 30 = 0$. Find the radius of the circle. [2]
- 3 Given that $3x^2 + bx + 10 = a(x + 3)^2 + c$ for all values of x , find the values of the constants a , b and c . [4]
- 4 Solve the equations
(i) $10^p = 0.1$, [1]
(ii) $(25k^2)^{\frac{1}{2}} = 15$, [3]
(iii) $t^{-\frac{1}{3}} = \frac{1}{2}$. [2]
- 5 (i) Sketch the curve $y = x^3 + 2$. [2]
(ii) Sketch the curve $y = 2\sqrt{x}$. [2]
(iii) Describe a transformation that transforms the curve $y = 2\sqrt{x}$ to the curve $y = 3\sqrt{x}$. [3]
- 6 (i) Solve the equation $x^2 + 8x + 10 = 0$, giving your answers in simplified surd form. [3]
(ii) Sketch the curve $y = x^2 + 8x + 10$, giving the coordinates of the point where the curve crosses the y -axis. [3]
(iii) Solve the inequality $x^2 + 8x + 10 \geq 0$. [2]
- 7 (i) Find the gradient of the line l which has equation $x + 2y = 4$. [1]
(ii) Find the equation of the line parallel to l which passes through the point $(6, 5)$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [3]
(iii) Solve the simultaneous equations
$$y = x^2 + x + 1 \quad \text{and} \quad x + 2y = 4. \quad [4]$$
- 8 (i) Find the coordinates of the stationary points on the curve $y = x^3 + x^2 - x + 3$. [6]
(ii) Determine whether each stationary point is a maximum point or a minimum point. [3]
(iii) For what values of x does $x^3 + x^2 - x + 3$ decrease as x increases? [2]

9 The points A and B have coordinates $(-5, -2)$ and $(3, 1)$ respectively.

(i) Find the equation of the line AB , giving your answer in the form $ax + by + c = 0$. [3]

(ii) Find the coordinates of the mid-point of AB . [2]

The point C has coordinates $(-3, 4)$.

(iii) Calculate the length of AC , giving your answer in simplified surd form. [3]

(iv) Determine whether the line AC is perpendicular to the line BC , showing all your working. [4]

10 Given that $f(x) = 8x^3 + \frac{1}{x^3}$,

(i) find $f''(x)$, [5]

(ii) solve the equation $f(x) = -9$. [5]



**ADVANCED SUBSIDIARY GCE
MATHEMATICS**

4721/01

Core Mathematics 1

THURSDAY 15 MAY 2008

Morning
Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages)
List of Formulae (MF1)

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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **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.
- The total number of marks for this paper is 72.
- **You are reminded of the need for clear presentation in your answers.**



WARNING

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

This document consists of 4 printed pages.

- 1 Express each of the following in the form 4^n :
- (i) $\frac{1}{16}$, [1]
 - (ii) 64, [1]
 - (iii) 8. [2]
- 2
- (i) The curve $y = x^2$ is translated 2 units in the positive x -direction. Find the equation of the curve after it has been translated. [2]
 - (ii) The curve $y = x^3 - 4$ is reflected in the x -axis. Find the equation of the curve after it has been reflected. [1]
- 3 Express each of the following in the form $k\sqrt{2}$, where k is an integer:
- (i) $\sqrt{200}$, [1]
 - (ii) $\frac{12}{\sqrt{2}}$, [1]
 - (iii) $5\sqrt{8} - 3\sqrt{2}$. [2]
- 4 Solve the equation $2x - 7x^{\frac{1}{2}} + 3 = 0$. [5]
- 5 Find the gradient of the curve $y = 8\sqrt{x} + x$ at the point whose x -coordinate is 9. [5]
- 6
- (i) Expand and simplify $(x - 5)(x + 2)(x + 5)$. [3]
 - (ii) Sketch the curve $y = (x - 5)(x + 2)(x + 5)$, giving the coordinates of the points where the curve crosses the axes. [3]
- 7 Solve the inequalities
- (i) $8 < 3x - 2 < 11$, [3]
 - (ii) $y^2 + 2y \geq 0$. [4]
- 8 The curve $y = x^3 - kx^2 + x - 3$ has two stationary points.
- (i) Find $\frac{dy}{dx}$. [2]
 - (ii) Given that there is a stationary point when $x = 1$, find the value of k . [3]
 - (iii) Determine whether this stationary point is a minimum or maximum point. [2]
 - (iv) Find the x -coordinate of the other stationary point. [3]

- 9** (i) Find the equation of the circle with radius 10 and centre (2, 1), giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]
- (ii) The circle passes through the point (5, k) where $k > 0$. Find the value of k in the form $p + \sqrt{q}$. [3]
- (iii) Determine, showing all working, whether the point (-3, 9) lies inside or outside the circle. [3]
- (iv) Find an equation of the tangent to the circle at the point (8, 9). [5]
- 10** (i) Express $2x^2 - 6x + 11$ in the form $p(x + q)^2 + r$. [4]
- (ii) State the coordinates of the vertex of the curve $y = 2x^2 - 6x + 11$. [2]
- (iii) Calculate the discriminant of $2x^2 - 6x + 11$. [2]
- (iv) State the number of real roots of the equation $2x^2 - 6x + 11 = 0$. [1]
- (v) Find the coordinates of the points of intersection of the curve $y = 2x^2 - 6x + 11$ and the line $7x + y = 14$. [5]



ADVANCED SUBSIDIARY GCE
MATHEMATICS
 Core Mathematics 1

4721

Candidates answer on the Answer Booklet

OCR Supplied Materials:

- 8 page Answer Booklet
- List of Formulae (MF1)

Other Materials Required:

None

Friday 9 January 2009
Morning

Duration: 1 hour 30 minutes

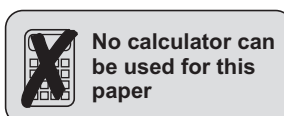


INSTRUCTIONS TO CANDIDATES

- 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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
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INFORMATION FOR CANDIDATES

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- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.



- 1 Express $\sqrt{45} + \frac{20}{\sqrt{5}}$ in the form $k\sqrt{5}$, where k is an integer. [3]
- 2 Simplify
- (i) $(\sqrt[3]{x})^6$, [1]
- (ii) $\frac{3y^4 \times (10y)^3}{2y^5}$. [3]
- 3 Solve the equation $3x^{\frac{2}{3}} + x^{\frac{1}{3}} - 2 = 0$. [5]
- 4 (i) Sketch the curve $y = \frac{1}{x^2}$. [2]
- (ii) The curve $y = \frac{1}{x^2}$ is translated by 3 units in the negative x -direction. State the equation of the curve after it has been translated. [2]
- (iii) The curve $y = \frac{1}{x^2}$ is stretched parallel to the y -axis with scale factor 4 and, as a result, the point $P(1, 1)$ is transformed to the point Q . State the coordinates of Q . [2]
- 5 Find $\frac{dy}{dx}$ in each of the following cases:
- (i) $y = 10x^{-5}$, [2]
- (ii) $y = \sqrt[4]{x}$, [3]
- (iii) $y = x(x + 3)(1 - 5x)$. [4]
- 6 (i) Express $5x^2 + 20x - 8$ in the form $p(x + q)^2 + r$. [4]
- (ii) State the equation of the line of symmetry of the curve $y = 5x^2 + 20x - 8$. [1]
- (iii) Calculate the discriminant of $5x^2 + 20x - 8$. [2]
- (iv) State the number of real roots of the equation $5x^2 + 20x - 8 = 0$. [1]

- 7 The line with equation $3x + 4y - 10 = 0$ passes through point $A(2, 1)$ and point $B(10, k)$.
- (i) Find the value of k . [2]
 - (ii) Calculate the length of AB . [2]
- A circle has equation $(x - 6)^2 + (y + 2)^2 = 25$.
- (iii) Write down the coordinates of the centre and the radius of the circle. [2]
 - (iv) Verify that AB is a diameter of the circle. [2]
- 8
- (i) Solve the equation $5 - 8x - x^2 = 0$, giving your answers in simplified surd form. [3]
 - (ii) Solve the inequality $5 - 8x - x^2 \leq 0$. [2]
 - (iii) Sketch the curve $y = (5 - 8x - x^2)(x + 4)$, giving the coordinates of the points where the curve crosses the coordinate axes. [5]
- 9 The curve $y = x^3 + px^2 + 2$ has a stationary point when $x = 4$. Find the value of the constant p and determine whether the stationary point is a maximum or minimum point. [7]
- 10 A curve has equation $y = x^2 + x$.
- (i) Find the gradient of the curve at the point for which $x = 2$. [2]
 - (ii) Find the equation of the normal to the curve at the point for which $x = 2$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [4]
 - (iii) Find the values of k for which the line $y = kx - 4$ is a tangent to the curve. [6]



ADVANCED SUBSIDIARY GCE
MATHEMATICS
 Core Mathematics 1

4721

Candidates answer on the Answer Booklet

OCR Supplied Materials:

- 8 page Answer Booklet
- List of Formulae (MF1)

Other Materials Required:

None

Wednesday 20 May 2009
Afternoon

Duration: 1 hour 30 minutes

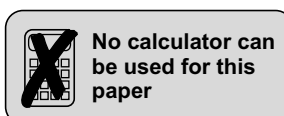


INSTRUCTIONS TO CANDIDATES

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INFORMATION FOR CANDIDATES

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- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.



- 1 Given that $y = x^5 + \frac{1}{x^2}$, find
- (i) $\frac{dy}{dx}$, [3]
- (ii) $\frac{d^2y}{dx^2}$. [2]
- 2 Express $\frac{8 + \sqrt{7}}{2 + \sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers. [4]
- 3 Express each of the following in the form 3^n :
- (i) $\frac{1}{9}$, [1]
- (ii) $\sqrt[3]{3}$, [1]
- (iii) $3^{10} \times 9^{15}$. [2]
- 4 Solve the simultaneous equations
- $$4x^2 + y^2 = 10, \quad 2x - y = 4. \quad [6]$$
- 5 (i) Expand and simplify $(2x + 1)(x - 3)(x + 4)$. [3]
- (ii) Find the coefficient of x^4 in the expansion of
- $$x(x^2 + 2x + 3)(x^2 + 7x - 2). \quad [2]$$
- 6 (i) Sketch the curve $y = -\sqrt{x}$. [2]
- (ii) Describe fully a transformation that transforms the curve $y = -\sqrt{x}$ to the curve $y = 5 - \sqrt{x}$. [2]
- (iii) The curve $y = -\sqrt{x}$ is stretched by a scale factor of 2 parallel to the x -axis. State the equation of the curve after it has been stretched. [2]
- 7 (i) Express $x^2 - 5x + \frac{1}{4}$ in the form $(x - a)^2 - b$. [3]
- (ii) Find the centre and radius of the circle with equation $x^2 + y^2 - 5x + \frac{1}{4} = 0$. [3]
- 8 Solve the inequalities
- (i) $-35 < 6x + 7 < 1$, [3]
- (ii) $3x^2 > 48$. [3]

- 9** A is the point $(4, -3)$ and B is the point $(-1, 9)$.
- (i) Calculate the length of AB . [2]
 - (ii) Find the coordinates of the mid-point of AB . [2]
 - (iii) Find the equation of the line through $(1, 3)$ which is parallel to AB , giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [4]
- 10**
- (i) Solve the equation $9x^2 + 18x - 7 = 0$. [3]
 - (ii) Find the coordinates of the stationary point on the curve $y = 9x^2 + 18x - 7$. [4]
 - (iii) Sketch the curve $y = 9x^2 + 18x - 7$, giving the coordinates of all intercepts with the axes. [3]
 - (iv) For what values of x does $9x^2 + 18x - 7$ increase as x increases? [1]
- 11** The point P on the curve $y = k\sqrt{x}$ has x -coordinate 4. The normal to the curve at P is parallel to the line $2x + 3y = 0$.
- (i) Find the value of k . [6]
 - (ii) This normal meets the x -axis at the point Q . Calculate the area of the triangle OPQ , where O is the point $(0, 0)$. [5]

**ADVANCED SUBSIDIARY GCE****MATHEMATICS**

Core Mathematics 1

QUESTION PAPER**4721**

Candidates answer on the Printed Answer Book

OCR Supplied Materials:

- Printed Answer Book 4721
- List of Formulae (MF1)

Other Materials Required:

None

Monday 11 January 2010
Morning**Duration:** 1 hour 30 minutes**INSTRUCTIONS TO CANDIDATES**

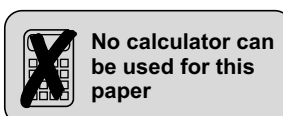
These instructions are the same on the Printed Answer Book and the Question Paper.

- 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.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.

INFORMATION FOR CANDIDATES

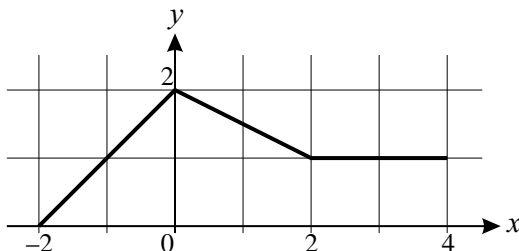
This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- 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.

**No calculator can
be used for this
paper**

1 Express $x^2 - 12x + 1$ in the form $(x - p)^2 + q$. [3]

2



The graph of $y = f(x)$ for $-2 \leq x \leq 4$ is shown above.

(i) Sketch the graph of $y = 2f(x)$ for $-2 \leq x \leq 4$ on the axes provided. [2]

(ii) Describe the transformation which transforms the graph of $y = f(x)$ to the graph of $y = f(x - 1)$. [2]

3 Find the equation of the normal to the curve $y = x^3 - 4x^2 + 7$ at the point $(2, -1)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [7]

4 Solve the equations

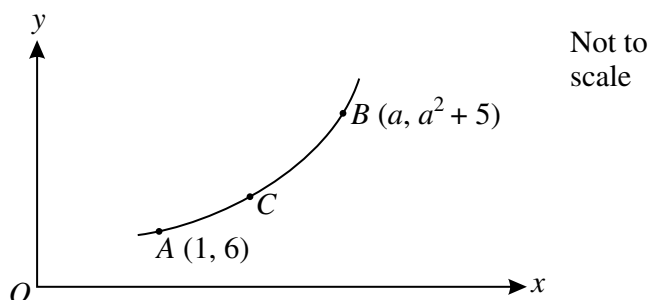
(i) $3^m = 81$, [1]

(ii) $(36p^4)^{\frac{1}{2}} = 24$, [3]

(iii) $5^n \times 5^{n+4} = 25$. [3]

5 Solve the equation $x - 8\sqrt{x} + 13 = 0$, giving your answers in the form $p \pm q\sqrt{r}$, where p, q and r are integers. [7]

6



The diagram shows part of the curve $y = x^2 + 5$. The point A has coordinates $(1, 6)$. The point B has coordinates $(a, a^2 + 5)$, where a is a constant greater than 1. The point C is on the curve between A and B .

(i) Find by differentiation the value of the gradient of the curve at the point A . [2]

(ii) The line segment joining the points A and B has gradient 2.3. Find the value of a . [4]

(iii) State a possible value for the gradient of the line segment joining the points A and C . [1]

7

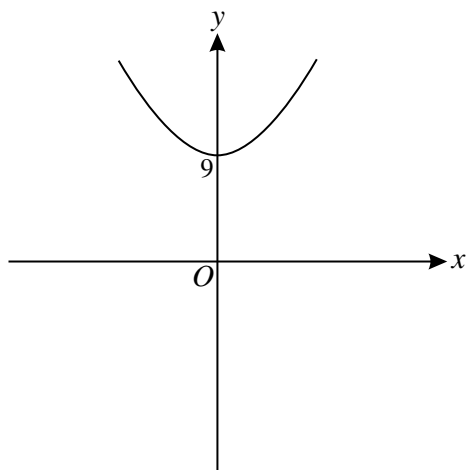


Fig. 1

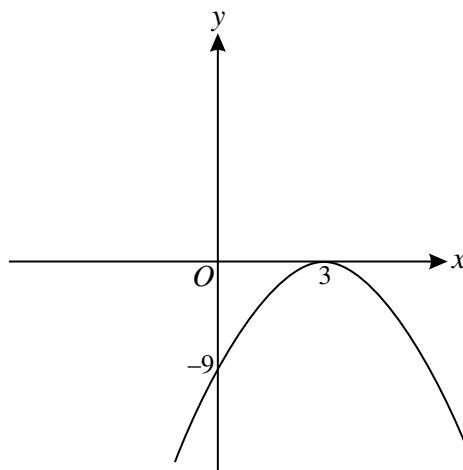


Fig. 2

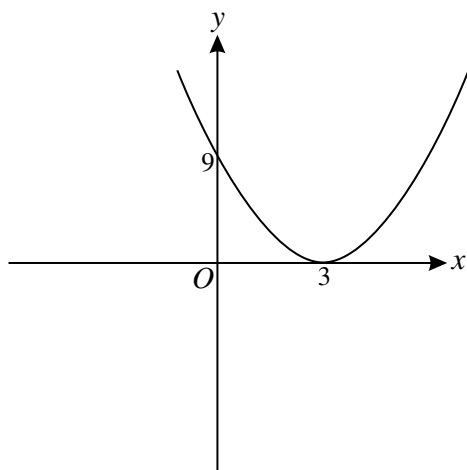


Fig. 3

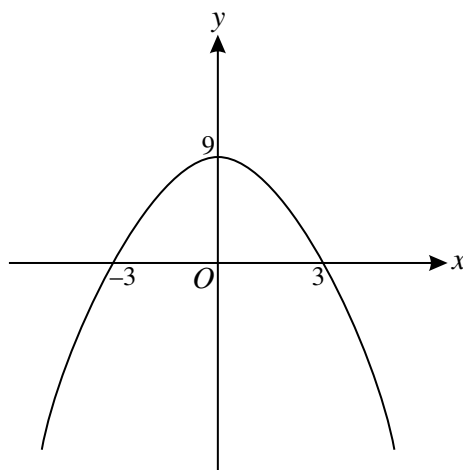


Fig. 4

(i) Each diagram shows a quadratic curve. State which diagram corresponds to the curve

- (a) $y = (3 - x)^2$, [1]
- (b) $y = x^2 + 9$, [1]
- (c) $y = (3 - x)(x + 3)$. [1]

(ii) Give the equation of the curve which does not correspond to any of the equations in part (i). [2]

8 A circle has equation $x^2 + y^2 + 6x - 4y - 4 = 0$.

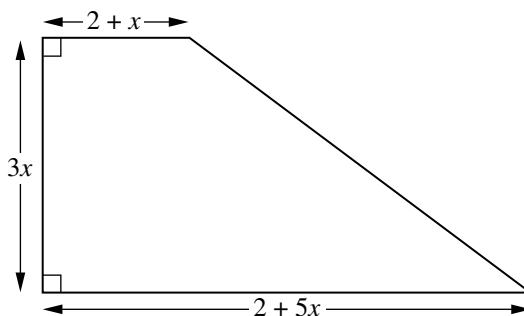
- (i) Find the centre and radius of the circle. [3]
- (ii) Find the coordinates of the points where the circle meets the line with equation $y = 3x + 4$. [6]

9 Given that $f(x) = \frac{1}{x} - \sqrt{x} + 3$,

- (i) find $f'(x)$, [3]
- (ii) find $f''(4)$. [5]

10 The quadratic equation $kx^2 - 30x + 25k = 0$ has equal roots. Find the possible values of k . [4]

11 A lawn is to be made in the shape shown below. The units are metres.



(i) The perimeter of the lawn is P m. Find P in terms of x . [2]

(ii) Show that the area, A m², of the lawn is given by $A = 9x^2 + 6x$. [2]

The perimeter of the lawn must be at least 39 m and the area of the lawn must be less than 99 m².

(iii) By writing down and solving appropriate inequalities, determine the set of possible values of x . [7]

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**ADVANCED SUBSIDIARY GCE****MATHEMATICS**

Core Mathematics 1

4721**QUESTION PAPER**

Candidates answer on the Printed Answer Book

OCR Supplied Materials:

- Printed Answer Book 4721
- List of Formulae (MF1)

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).
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- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
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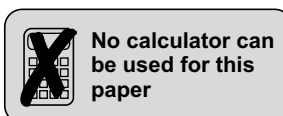
INFORMATION FOR CANDIDATES

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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or destroyed.



- 1 (i) Evaluate 9^0 . [1]
(ii) Express $9^{-\frac{1}{2}}$ as a fraction. [2]
- 2 (i) Sketch the curve $y = -\frac{1}{x^2}$. [2]
(ii) Sketch the curve $y = 3 - \frac{1}{x^2}$. [2]
(iii) The curve $y = -\frac{1}{x^2}$ is stretched parallel to the y-axis with scale factor 2. State the equation of the transformed curve. [1]
- 3 (i) Express $\frac{12}{3 + \sqrt{5}}$ in the form $a - b\sqrt{5}$, where a and b are positive integers. [3]
(ii) Express $\sqrt{18} - \sqrt{2}$ in simplified surd form. [2]
- 4 (i) Expand $(x - 2)^2(x + 1)$, simplifying your answer. [3]
(ii) Sketch the curve $y = (x - 2)^2(x + 1)$, indicating the coordinates of all intercepts with the axes. [3]
- 5 Find the real roots of the equation $4x^4 + 3x^2 - 1 = 0$. [5]
- 6 Find the gradient of the curve $y = 2x + \frac{6}{\sqrt{x}}$ at the point where $x = 4$. [5]
- 7 Solve the simultaneous equations
$$x + 2y - 6 = 0, \quad 2x^2 + y^2 = 57.$$
 [6]
- 8 (i) Express $2x^2 + 5x$ in the form $2(x + p)^2 + q$. [3]
(ii) State the coordinates of the minimum point of the curve $y = 2x^2 + 5x$. [2]
(iii) State the equation of the normal to the curve at its minimum point. [1]
(iv) Solve the inequality $2x^2 + 5x > 0$. [4]

- 9** (i) The line joining the points $A(4, 5)$ and $B(p, q)$ has mid-point $M(-1, 3)$. Find p and q . [3]
- AB is the diameter of a circle.
- (ii) Find the radius of the circle. [2]
- (iii) Find the equation of the circle, giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]
- (iv) Find an equation of the tangent to the circle at the point $(4, 5)$. [5]
- 10** (i) Find the coordinates of the stationary points of the curve $y = 2x^3 + 5x^2 - 4x$. [6]
- (ii) State the set of values for x for which $2x^3 + 5x^2 - 4x$ is a decreasing function. [2]
- (iii) Show that the equation of the tangent to the curve at the point where $x = \frac{1}{2}$ is $10x - 4y - 7 = 0$. [4]
- (iv) Hence, with the aid of a sketch, show that the equation $2x^3 + 5x^2 - 4x = \frac{5}{2}x - \frac{7}{4}$ has two distinct real roots. [2]



**ADVANCED SUBSIDIARY GCE
MATHEMATICS**

Core Mathematics 1

4721

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:

- Printed answer book 4721
- List of Formulae (MF1)

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.
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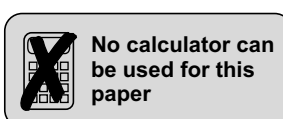
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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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- 1 The points A and B have coordinates $(6, 1)$ and $(-2, 7)$ respectively.
- (i) Find the length of AB . [2]
 - (ii) Find the gradient of the line AB . [2]
 - (iii) Determine whether the line $4x - 3y - 10 = 0$ is perpendicular to AB . [3]
- 2 Given that
- $$(x - p)(2x^2 + 9x + 10) = (x^2 - 4)(2x + q)$$
- for all values of x , find the constants p and q . [3]
- 3 Express each of the following in the form 8^p :
- (i) $\sqrt{8}$, [1]
 - (ii) $\frac{1}{64}$, [1]
 - (iii) $2^6 \times 2^2$. [3]
- 4 By using the substitution $u = (3x - 2)^2$, find the roots of the equation
- $$(3x - 2)^4 - 5(3x - 2)^2 + 4 = 0. [6]$$
- 5
- (i) Sketch the curve $y = -x^3$. [2]
 - (ii) The curve $y = -x^3$ is translated by 3 units in the positive x -direction. Find the equation of the curve after it has been translated. [2]
 - (iii) Describe a transformation that transforms the curve $y = -x^3$ to the curve $y = -5x^3$. [2]
- 6 Given that $y = \frac{5}{x^2} - \frac{1}{4x} + x$, find
- (i) $\frac{dy}{dx}$, [4]
 - (ii) $\frac{d^2y}{dx^2}$. [2]

- 7 (i) Express $4x^2 + 12x - 3$ in the form $p(x + q)^2 + r$. [4]
- (ii) Solve the equation $4x^2 + 12x - 3 = 0$, giving your answers in simplified surd form. [4]
- (iii) The quadratic equation $4x^2 + 12x - k = 0$ has equal roots. Find the value of k . [3]
- 8 (i) Find the equation of the tangent to the curve $y = 7 + 6x - x^2$ at the point P where $x = 5$, giving your answer in the form $ax + by + c = 0$. [6]
- (ii) This tangent meets the x -axis at Q . Find the coordinates of the mid-point of PQ . [3]
- (iii) Find the equation of the line of symmetry of the curve $y = 7 + 6x - x^2$. [2]
- (iv) State the set of values of x for which $7 + 6x - x^2$ is an increasing function. [2]
- 9 A circle with centre C has equation $x^2 + y^2 - 8x - 2y - 3 = 0$.
- (i) Find the coordinates of C and the radius of the circle. [3]
- (ii) Find the values of k for which the line $y = k$ is a tangent to the circle, giving your answers in simplified surd form. [3]
- (iii) The points S and T lie on the circumference of the circle. M is the mid-point of the chord ST . Given that the length of CM is 2, calculate the length of the chord ST . [3]
- (iv) Find the coordinates of the point where the circle meets the line $x - 2y - 12 = 0$. [6]



**ADVANCED SUBSIDIARY GCE
MATHEMATICS**

Core Mathematics 1

4721

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:

- Printed answer book 4721
- List of Formulae (MF1)

Other materials required:

None

**Wednesday 18 May 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.
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- Do **not** write in the bar codes.
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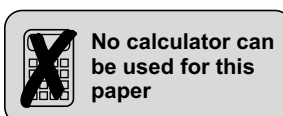
INFORMATION FOR CANDIDATES

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INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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- 1 Express $3x^2 - 18x + 4$ in the form $p(x + q)^2 + r$. [4]
- 2 (i) Sketch the curve $y = \frac{1}{x}$. [2]
- (ii) Describe fully the single transformation that transforms the curve $y = \frac{1}{x}$ to the curve $y = \frac{1}{x} + 4$. [2]
- 3 Simplify
- (i) $\frac{(4x)^2 \times 2x^3}{x}$, [2]
- (ii) $(36x^{-2})^{-\frac{1}{2}}$. [3]
- 4 Solve the simultaneous equations
- $$y = 2(x - 2)^2, \quad 3x + y = 26. \quad [5]$$
- 5 (i) Express $\sqrt{300} - \sqrt{48}$ in the form $k\sqrt{3}$, where k is an integer. [3]
- (ii) Express $\frac{15 + \sqrt{40}}{\sqrt{5}}$ in the form $a\sqrt{5} + b\sqrt{2}$, where a and b are integers. [3]
- 6 Solve the equation $3x^{\frac{1}{2}} - 8x^{\frac{1}{4}} + 4 = 0$. [5]
- 7 Solve the inequalities
- (i) $-9 \leq 6x + 5 \leq 0$, [3]
- (ii) $6x + 5 < x^2 + 2x - 7$. [5]
- 8 (i) Find the coordinates of the stationary point on the curve $y = 3x^2 - \frac{6}{x} - 2$. [5]
- (ii) Determine whether the stationary point is a maximum point or a minimum point. [2]
- 9 The points $A(1, 3)$, $B(7, 1)$ and $C(-3, -9)$ are joined to form a triangle.
- (i) Show that this triangle is right-angled and state whether the right angle is at A , B or C . [5]
- (ii) The points A , B and C lie on the circumference of a circle. Find the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$. [7]

10 A curve has equation $y = (2x - 1)(x + 3)(x - 1)$.

- (i)** Sketch the curve, indicating the coordinates of all points of intersection with the axes. [3]
- (ii)** Show that the gradient of the curve at the point $P(1, 0)$ is 4. [6]
- (iii)** The line l is parallel to the tangent to the curve at the point P . The curve meets l at the point where $x = -2$. Find the equation of l , giving your answer in the form $y = mx + c$. [4]
- (iv)** Determine whether l is a tangent to the curve at the point where $x = -2$. [3]



Friday 13 January 2012 – Morning

AS GCE MATHEMATICS

4721 Core Mathematics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer book 4721
- List of Formulae (MF1)

Other materials required:

None

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

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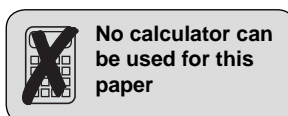
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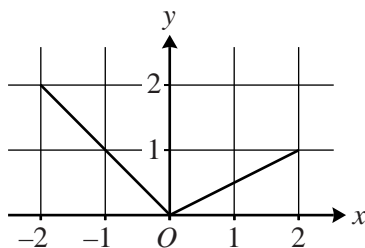
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No calculator can be used for this paper

- 1 Express $\frac{15 + \sqrt{3}}{3 - \sqrt{3}}$ in the form $a + b\sqrt{3}$, where a and b are integers. [4]

2



The graph of $y = f(x)$ for $-2 \leq x \leq 2$ is shown above.

- (i) Sketch the graph of $y = f(-x)$ for $-2 \leq x \leq 2$. [2]
- (ii) Sketch the graph of $y = f(x) + 2$ for $-2 \leq x \leq 2$. [2]

3 Given that

$$5x^2 + px - 8 = q(x - 1)^2 + r$$

for all values of x , find the values of the constants p , q and r . [4]

4 Evaluate

- (i) 3^{-2} , [1]
- (ii) $16^{\frac{3}{4}}$, [2]
- (iii) $\frac{\sqrt{200}}{\sqrt{8}}$. [2]

5 Find the real roots of the equation $\frac{3}{y^4} - \frac{10}{y^2} - 8 = 0$. [5]

6 Given that $f(x) = \frac{4}{x} - 3x + 2$,

- (i) find $f'(x)$, [3]
- (ii) find $f''(\frac{1}{2})$. [4]

7 A curve has equation $y = (x + 2)(x^2 - 3x + 5)$.

- (i) Find the coordinates of the minimum point, justifying that it is a minimum. [8]
- (ii) Calculate the discriminant of $x^2 - 3x + 5$. [2]
- (iii) Explain why $(x + 2)(x^2 - 3x + 5)$ is always positive for $x > -2$. [2]

- 8 The line l has gradient -2 and passes through the point $A(3, 5)$. B is a point on the line l such that the distance AB is $6\sqrt{5}$. Find the coordinates of each of the possible points B . [6]
- 9 (i) Sketch the curve $y = 12 - x - x^2$, giving the coordinates of all intercepts with the axes. [5]
- (ii) Solve the inequality $12 - x - x^2 > 0$. [2]
- (iii) Find the coordinates of the points of intersection of the curve $y = 12 - x - x^2$ and the line $3x + y = 4$. [5]
- 10 A circle has centre $C(-2, 4)$ and radius 5.
- (i) Find the equation of the circle, giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]
- (ii) Show that the tangent to the circle at the point $P(-5, 8)$ has equation $3x - 4y + 47 = 0$. [5]
- (iii) Verify that the point $T(3, 14)$ lies on this tangent. [1]
- (iv) Find the area of the triangle CPT . [4]



Wednesday 16 May 2012 – Morning

AS GCE MATHEMATICS

4721 Core Mathematics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer book 4721
- List of Formulae (MF1)

Other materials required:

None

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

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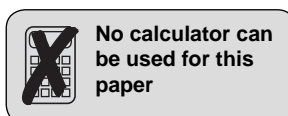
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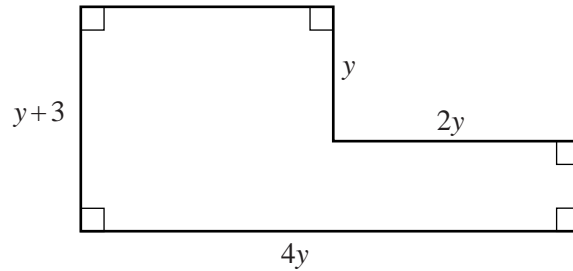
- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.



No calculator can be used for this paper

- 1 Simplify $(x - 5)(x^2 + 3) - (x + 4)(x - 1)$. [3]
- 2 Express each of the following in the form 7^k :
- (i) $\sqrt[4]{7}$, [1]
- (ii) $\frac{1}{7\sqrt{7}}$, [2]
- (iii) $7^4 \times 49^{10}$. [2]
- 3 (i) Find the gradient of the line l which has equation $3x - 5y - 20 = 0$. [1]
- (ii) The line l crosses the x -axis at P and the y -axis at Q . Find the coordinates of the mid-point of PQ . [4]
- 4 (i) Express $2x^2 - 20x + 49$ in the form $p(x - q)^2 + r$. [4]
- (ii) State the coordinates of the vertex of the curve $y = 2x^2 - 20x + 49$. [2]
- 5 (i) Sketch the curve $y = \sqrt{x}$. [2]
- (ii) Describe the transformation that transforms the curve $y = \sqrt{x}$ to the curve $y = \sqrt{x - 4}$. [2]
- (iii) The curve $y = \sqrt{x}$ is stretched by a scale factor of 5 parallel to the x -axis. State the equation of the transformed curve. [2]
- 6 Find the equation of the normal to the curve $y = \frac{6}{x^2} - 5$ at the point on the curve where $x = 2$. Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. [7]
- 7 Solve the equation $x - 6x^{\frac{1}{2}} + 2 = 0$, giving your answers in the form $p \pm q\sqrt{r}$, where p , q and r are integers. [6]
- 8 (i) Find the coordinates of the stationary point on the curve $y = x^4 + 32x$. [5]
- (ii) Determine whether this stationary point is a maximum or a minimum. [2]
- (iii) For what values of x does $x^4 + 32x$ increase as x increases? [1]

- 9 (i) A rectangular tile has length $4x$ cm and width $(x + 3)$ cm. The area of the rectangle is less than 112 cm^2 . By writing down and solving an inequality, determine the set of possible values of x . [6]
- (ii) A second rectangular tile of length $4y$ cm and width $(y + 3)$ cm has a rectangle of length $2y$ cm and width y cm removed from one corner as shown in the diagram.



Given that the perimeter of this tile is between 20 cm and 54 cm, determine the set of possible values of y . [5]

- 10 A circle has equation $(x - 5)^2 + (y + 2)^2 = 25$.
- (i) Find the coordinates of the centre C and the length of the diameter. [3]
- (ii) Find the equation of the line which passes through C and the point $P(7, 2)$. [4]
- (iii) Calculate the length of CP and hence determine whether P lies inside or outside the circle. [3]
- (iv) Determine algebraically whether the line with equation $y = 2x$ meets the circle. [5]

Monday 14 January 2013 – Morning

AS GCE MATHEMATICS

4721 Core Mathematics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer book 4721
- List of Formulae (MF1)

Other materials required:

None

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

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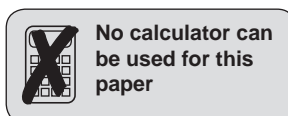
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INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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- 1 (i) Solve the equation $x^2 - 6x - 2 = 0$, giving your answers in simplified surd form. [3]
- (ii) Find the gradient of the curve $y = x^2 - 6x - 2$ at the point where $x = -5$. [2]
- 2 Solve the equations
- (i) $3^n = 1$, [1]
- (ii) $t^{-3} = 64$, [2]
- (iii) $(8p^6)^{\frac{1}{3}} = 8$. [3]
- 3 (i) Sketch the curve $y = (1 + x)(2 - x)(3 + x)$, giving the coordinates of all points of intersection with the axes. [3]
- (ii) Describe the transformation that transforms the curve $y = (1 + x)(2 - x)(3 + x)$ to the curve $y = (1 - x)(2 + x)(3 - x)$. [2]
- 4 (i) Solve the simultaneous equations
- $$y = 2x^2 - 3x - 5, \quad 10x + 2y + 11 = 0. \quad [5]$$
- (ii) What can you deduce from the answer to part (i) about the curve $y = 2x^2 - 3x - 5$ and the line $10x + 2y + 11 = 0$? [1]
- 5 (i) Simplify $(x + 4)(5x - 3) - 3(x - 2)^2$. [3]
- (ii) The coefficient of x^2 in the expansion of
- $$(x + 3)(x + k)(2x - 5)$$
- is -3 . Find the value of the constant k . [3]

- 6 (i) The line joining the points $(-2, 7)$ and $(-4, p)$ has gradient 4. Find the value of p . [3]
- (ii) The line segment joining the points $(-2, 7)$ and $(6, q)$ has mid-point $(m, 5)$. Find m and q . [3]
- (iii) The line segment joining the points $(-2, 7)$ and $(d, 3)$ has length $2\sqrt{13}$. Find the two possible values of d . [4]
- 7 Find $\frac{dy}{dx}$ in each of the following cases:
- (i) $y = \frac{(3x)^2 \times x^4}{x}$, [3]
- (ii) $y = \sqrt[3]{x}$, [3]
- (iii) $y = \frac{1}{2x^3}$. [2]
- 8 The quadratic equation $kx^2 + (3k - 1)x - 4 = 0$ has no real roots. Find the set of possible values of k . [7]
- 9 A circle with centre C has equation $x^2 + y^2 - 2x + 10y - 19 = 0$.
- (i) Find the coordinates of C and the radius of the circle. [3]
- (ii) Verify that the point $(7, -2)$ lies on the circumference of the circle. [1]
- (iii) Find the equation of the tangent to the circle at the point $(7, -2)$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [5]
- 10 Find the coordinates of the points on the curve $y = \frac{1}{3}x^3 + \frac{9}{x}$ at which the tangent is parallel to the line $y = 8x + 3$. [10]

Monday 13 May 2013 – Afternoon

AS GCE MATHEMATICS

4721/01 Core Mathematics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer book 4721/01
- List of Formulae (MF1)

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.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.

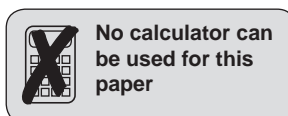
INFORMATION FOR CANDIDATES

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 reminded of the need for clear presentation in your answers.**
- 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

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.



- 1 Express each of the following in the form $a\sqrt{5}$, where a is an integer.
- (i) $4\sqrt{15} \times \sqrt{3}$ [2]
- (ii) $\frac{20}{\sqrt{5}}$ [1]
- (iii) $5^{\frac{3}{2}}$ [1]
- 2 Solve the equation $8x^6 + 7x^3 - 1 = 0$. [5]
- 3 It is given that $f(x) = \frac{6}{x^2} + 2x$.
- (i) Find $f'(x)$. [3]
- (ii) Find $f''(x)$. [2]
- 4 (i) Express $3x^2 + 9x + 10$ in the form $3(x + p)^2 + q$. [3]
- (ii) State the coordinates of the minimum point of the curve $y = 3x^2 + 9x + 10$. [2]
- (iii) Calculate the discriminant of $3x^2 + 9x + 10$. [2]
- 5 (i) Sketch the curve $y = \frac{2}{x^2}$. [2]
- (ii) The curve $y = \frac{2}{x^2}$ is translated by 5 units in the negative x -direction. Find the equation of the curve after it has been translated. [2]
- (iii) Describe a transformation that transforms the curve $y = \frac{2}{x^2}$ to the curve $y = \frac{1}{x^2}$. [2]
- 6 A circle C has equation $x^2 + y^2 + 8y - 24 = 0$.
- (i) Find the centre and radius of the circle. [3]
- (ii) The point $A(2, 2)$ lies on the circumference of C . Given that AB is a diameter of the circle, find the coordinates of B . [2]
- 7 Solve the inequalities
- (i) $3 - 8x > 4$, [2]
- (ii) $(2x - 4)(x - 3) \leq 12$. [5]

- 8** A is the point $(-2, 6)$ and B is the point $(3, -8)$. The line l is perpendicular to the line $x - 3y + 15 = 0$ and passes through the mid-point of AB . Find the equation of l , giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [7]
- 9** (i) Sketch the curve $y = 2x^2 - x - 6$, giving the coordinates of all points of intersection with the axes. [5]
(ii) Find the set of values of x for which $2x^2 - x - 6$ is a decreasing function. [3]
(iii) The line $y = 4$ meets the curve $y = 2x^2 - x - 6$ at the points P and Q . Calculate the distance PQ . [4]
- 10** The curve $y = (1 - x)(x^2 + 4x + k)$ has a stationary point when $x = -3$.
(i) Find the value of the constant k . [7]
(ii) Determine whether the stationary point is a maximum or minimum point. [2]
(iii) Given that $y = 9x - 9$ is the equation of the tangent to the curve at the point A , find the coordinates of A . [5]