

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.**

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**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

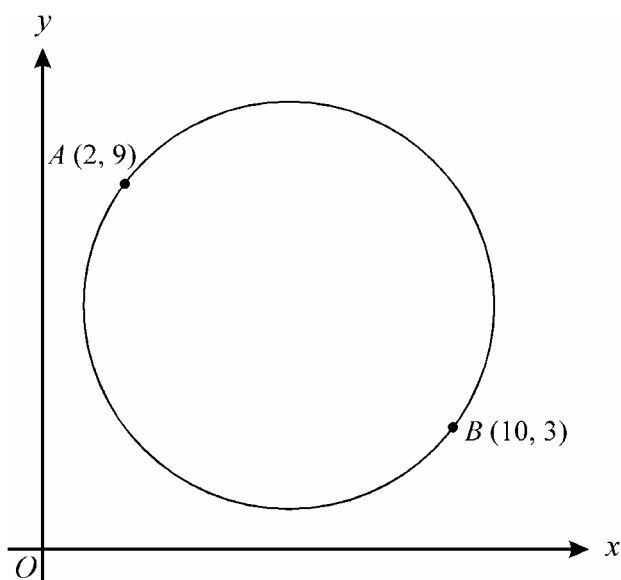
$$y = x^2 - 3x + 2, \quad y = 3x - 7. \quad [5]$$

(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.**

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**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  $299 \text{ m}^2$ . 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  
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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.
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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)

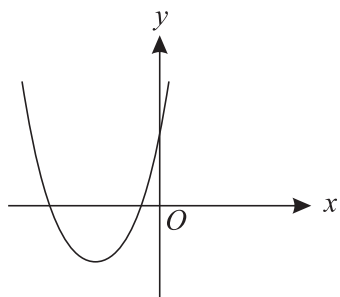


Fig. 1

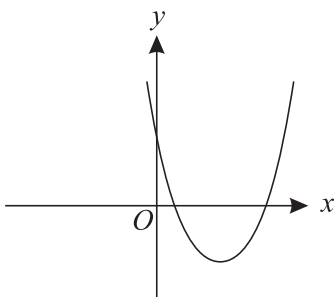


Fig. 2

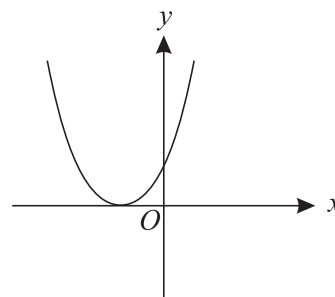


Fig. 3

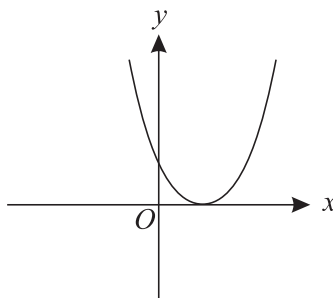


Fig. 4

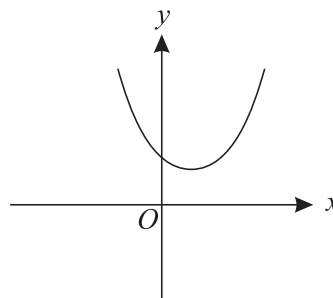


Fig. 5

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**

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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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- 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  $8 \text{ m}^3$ . 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.
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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.**



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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]

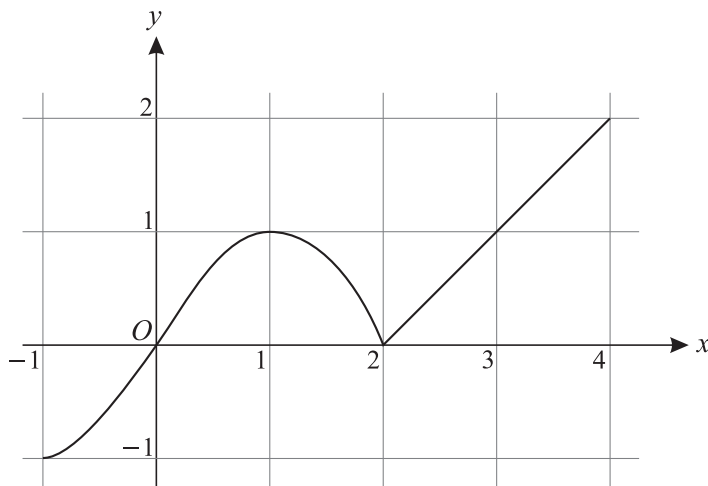
3 Solve the inequalities

(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.**

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

- 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

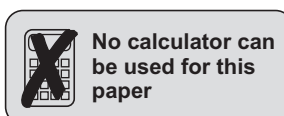


**INSTRUCTIONS TO CANDIDATES**

- 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.
- **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 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 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

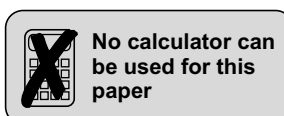


**INSTRUCTIONS TO CANDIDATES**

- 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.
- **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 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**

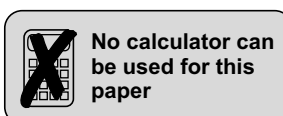
These instructions are the same on the Printed Answer Book and the Question Paper.

- 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**

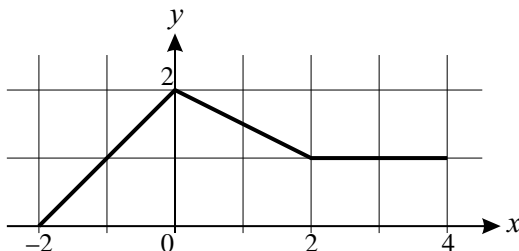
This information is the same on the Printed Answer Book and the Question Paper.

- 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

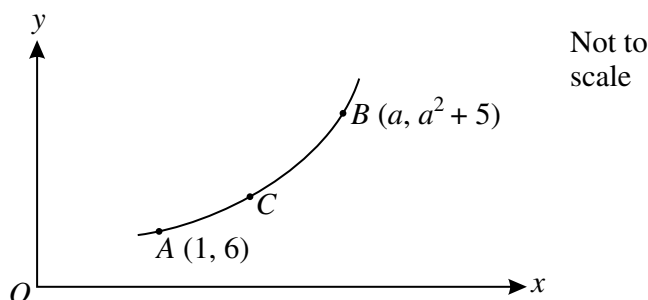
(i)  $3^m = 81$ , [1]

(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

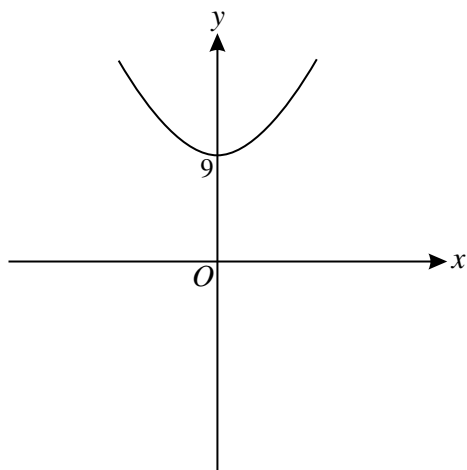


Fig. 1

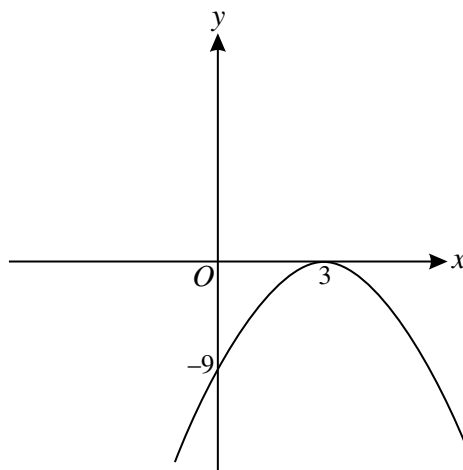


Fig. 2

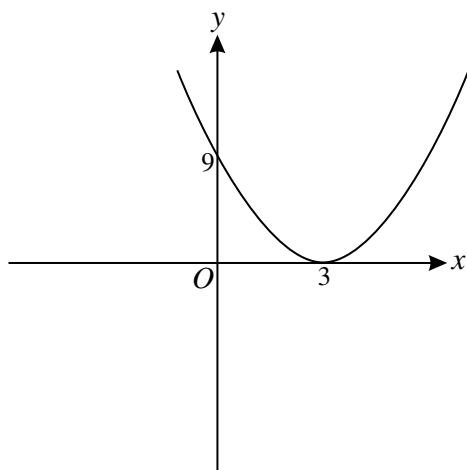


Fig. 3

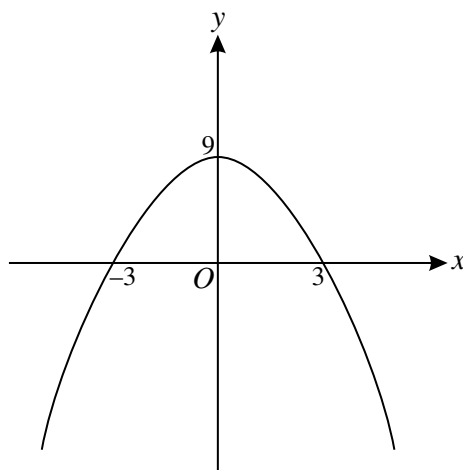


Fig. 4

(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]

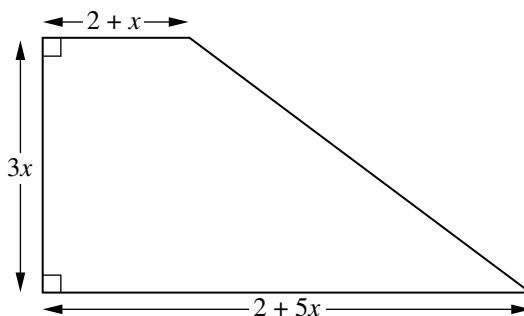
8 A circle has equation  $x^2 + y^2 + 6x - 4y - 4 = 0$ .

- (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,  $A$  m<sup>2</sup>, 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 m<sup>2</sup>.

(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).
- 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.

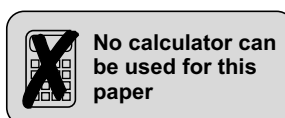
**INFORMATION FOR CANDIDATES**

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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**.
- 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 destroyed.

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

- 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.
- **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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- 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.
- 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.

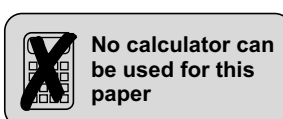
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This information is the same on the printed answer book and the question paper.

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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**.
- 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 destroyed.



- 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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- 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.
- 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.

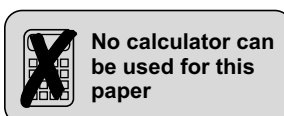
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- The total number of marks for this paper is **72**.
- The printed answer book consists of **12** pages. The question paper consists of **4** pages. Any blank pages are indicated.

**INSTRUCTION TO EXAMS OFFICER / INVIGILATOR**

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



- 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

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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- 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.
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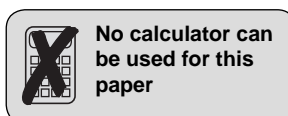
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### INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

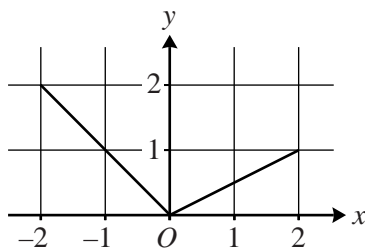
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No calculator can be used for this paper

- 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

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

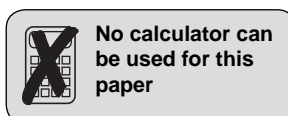
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### INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

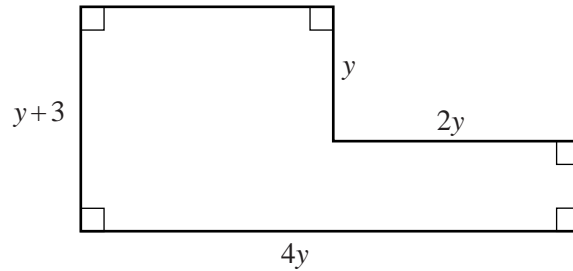
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No calculator can be used for this paper

- 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  $112 \text{ cm}^2$ . 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**

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.

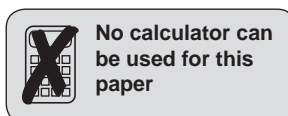
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**INSTRUCTION TO EXAMS OFFICER/INVIGILATOR**

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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**

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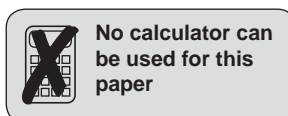
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- 1 Express each of the following in the form  $a\sqrt{5}$ , where  $a$  is an integer.
- (i)  $4\sqrt{15} \times \sqrt{3}$  [2]
- (ii)  $\frac{20}{\sqrt{5}}$  [1]
- (iii)  $5^{\frac{3}{2}}$  [1]
- 2 Solve the equation  $8x^6 + 7x^3 - 1 = 0$ . [5]
- 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]