

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
January 2012

Mathematics

MPC1

Unit Pure Core 1

Friday 13 January 2012 9.00 am to 10.30 am

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.
- You must **not** use a calculator.



Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The use of calculators is **not** permitted.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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5	
6	
7	
TOTAL	



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Answer **all** questions in the spaces provided.

- 1** The point A has coordinates $(6, -4)$ and the point B has coordinates $(-2, 7)$.
- (a)** Given that the point O has coordinates $(0, 0)$, show that the length of OA is less than the length of OB . (3 marks)
- (b) (i)** Find the gradient of AB . (2 marks)
- (ii)** Find an equation of the line AB in the form $px + qy = r$, where p , q and r are integers. (3 marks)
- (c)** The point C has coordinates $(k, 0)$. The line AC is perpendicular to the line AB . Find the value of the constant k . (3 marks)

QUESTION
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REFERENCE



QUESTION
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REFERENCE

Turn over ►



- 2 (a)** Factorise $x^2 - 4x - 12$. (1 mark)
- (b)** Sketch the graph with equation $y = x^2 - 4x - 12$, stating the values where the curve crosses the coordinate axes. (4 marks)
- (c) (i)** Express $x^2 - 4x - 12$ in the form $(x - p)^2 - q$, where p and q are positive integers. (2 marks)
- (ii)** Hence find the minimum value of $x^2 - 4x - 12$. (1 mark)
- (d)** The curve with equation $y = x^2 - 4x - 12$ is translated by the vector $\begin{bmatrix} -3 \\ 2 \end{bmatrix}$.
Find an equation of the new curve. You need not simplify your answer. (2 marks)

QUESTION
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Turn over ►



(b) Express $\frac{4\sqrt{5} - 7\sqrt{2}}{2\sqrt{5} + \sqrt{2}}$ in the form $m - \sqrt{n}$, where m and n are integers. (4 marks)

QUESTION	PART	REFERENCE
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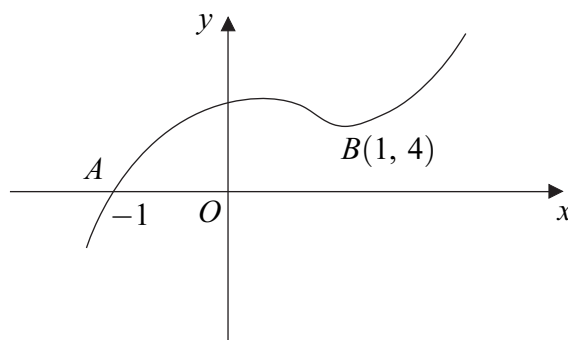


QUESTION
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- 4** The curve with equation $y = x^5 - 3x^2 + x + 5$ is sketched below. The point O is at the origin and the curve passes through the points $A(-1, 0)$ and $B(1, 4)$.



- (a) Given that $y = x^5 - 3x^2 + x + 5$, find:
- (i) $\frac{dy}{dx}$; (3 marks)
- (ii) $\frac{d^2y}{dx^2}$. (1 mark)
- (b) Find an equation of the tangent to the curve at the point $A(-1, 0)$. (2 marks)
- (c) Verify that the point B , where $x = 1$, is a minimum point of the curve. (3 marks)

QUESTION
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This image shows a blank sheet of white paper designed for handwriting practice. It features a solid vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced horizontal dashed lines, providing a guide for letter height and placement. There are no other markings, text, or illustrations on the page.

Turn over ►



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- A Cartesian coordinate system showing a function $y = f(x)$ on the interval $[-1, 1]$. The x-axis is labeled with -1 and 1 , and the y-axis is labeled with y . The origin is labeled O . The curve starts at point $A(-1, 0)$ and ends at point $B(1, 4)$. The area under the curve from $x = -1$ to $x = 1$ is shaded in gray.

- (i) Find $\int_{-1}^1 (x^5 - 3x^2 + x + 5) \, dx$. (5 marks)
- (ii) Hence find the area of the shaded region bounded by the curve between A and B and the line segments AO and OB . (2 marks)

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(c) By solving these two equations, find the value of c and the value of d . *(3 marks)*

QUESTION	PART	REFERENCE
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(d) Hence determine the possible values of the width of the garden. *(1 mark)*

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[illegible]

[illegible]

7 A circle with centre C has equation $x^2 + y^2 + 14x - 10y + 49 = 0$.

(a) Express this equation in the form

$$(x - a)^2 + (y - b)^2 = r^2 \quad (3 \text{ marks})$$

(b) Write down:

(i) the coordinates of C ;

(ii) the radius of the circle. (2 marks)

(c) Sketch the circle. (2 marks)

(d) A line has equation $y = kx + 6$, where k is a constant.

(i) Show that the x -coordinates of any points of intersection of the line and the circle satisfy the equation $(k^2 + 1)x^2 + 2(k + 7)x + 25 = 0$. (2 marks)

(ii) The equation $(k^2 + 1)x^2 + 2(k + 7)x + 25 = 0$ has equal roots. Show that

$$12k^2 - 7k - 12 = 0 \quad (3 \text{ marks})$$

(iii) Hence find the values of k for which the line is a tangent to the circle. (2 marks)

QUESTION
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ANSWER IN THE SPACES PROVIDED**

