

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2012

Mathematics

MPC1

Unit Pure Core 1

Wednesday 16 May 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 each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- 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	
4	
5	
6	
7	
TOTAL	



J U N 1 2 M P C 1 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** Express $\frac{5\sqrt{3} - 6}{2\sqrt{3} + 3}$ in the form $m + n\sqrt{3}$, where m and n are integers. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 1



QUESTION
PART
REFERENCE**Answer space for question 1****Turn over ►**

2 The line AB has equation $4x - 3y = 7$.

(a) (i) Find the gradient of AB . (2 marks)

(ii) Find an equation of the straight line that is parallel to AB and which passes through the point $C(3, -5)$, giving your answer in the form $px + qy = r$, where p , q and r are integers. (3 marks)

(b) The line AB intersects the line with equation $3x - 2y = 4$ at the point D . Find the coordinates of D . (3 marks)

(c) The point E with coordinates $(k - 2, 2k - 3)$ lies on the line AB . Find the value of the constant k . (2 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



QUESTION
PART
REFERENCE**Answer space for question 2****Turn over ►**

3 The polynomial $p(x)$ is given by

$$p(x) = x^3 + 2x^2 - 5x - 6$$

(a) (i) Use the Factor Theorem to show that $x + 1$ is a factor of $p(x)$. (2 marks)

(ii) Express $p(x)$ as the product of three linear factors. (3 marks)

(b) Verify that $p(0) > p(1)$. (2 marks)

(c) Sketch the curve with equation $y = x^3 + 2x^2 - 5x - 6$, indicating the values where the curve crosses the x -axis. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE

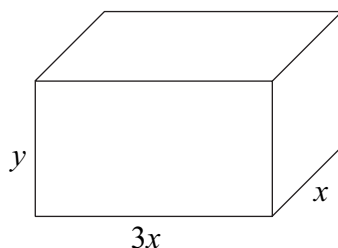
Answer space for question 3

Handwriting practice area with horizontal dotted lines.

Turn over ►



- 4 The diagram shows a solid cuboid with sides of lengths x cm, $3x$ cm and y cm.



The total surface area of the cuboid is 32 cm^2 .

- (a) (i) Show that $3x^2 + 4xy = 16$. (2 marks)

- (ii) Hence show that the volume, $V \text{ cm}^3$, of the cuboid is given by

$$V = 12x - \frac{9x^3}{4} \quad (2 \text{ marks})$$

- (b) Find $\frac{dV}{dx}$. (2 marks)

- (c) (i) Verify that a stationary value of V occurs when $x = \frac{4}{3}$. (2 marks)

- (ii) Find $\frac{d^2V}{dx^2}$ and hence determine whether V has a maximum value or a minimum value when $x = \frac{4}{3}$. (2 marks)

QUESTION
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REFERENCE

Answer space for question 4



QUESTION
PART
REFERENCE

Answer space for question 4

Area for writing the answer to question 4, consisting of horizontal dotted lines.

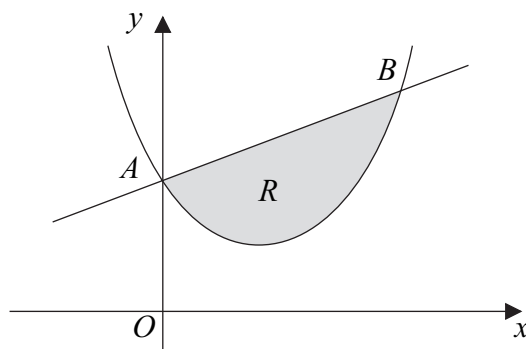


Answer space for question 4

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height in handwriting practice. There are no other markings or text on the page.

QUESTION
PART
REFERENCE**Answer space for question 4**

- (b)** The curve C with equation $y = x^2 - 3x + 5$ and the straight line $y = x + 5$ intersect at the point $A(0, 5)$ and at the point B , as shown in the diagram below.



- (iii)** Find the area of the shaded region R bounded by the curve C and the line segment AB .
(4 marks)

Answer space for question 5

This image shows a blank sheet of white paper designed for handwriting practice. It features ten horizontal dashed lines spaced evenly across the page. A single vertical solid line runs down the left side, creating a narrow margin. The rest of the page is open space between the dashed lines, intended for writing practice.

QUESTION
PART
REFERENCE**Answer space for question 5****Turn over ►**

Answer space for question 5

[illegible]

Answer space for question 5

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height and placement. There are no markings, text, or illustrations on the page.

- (ii) Hence find the area of triangle PCQ . (3 marks)

Answer space for question 6

[illegible]

QUESTION
PART
REFERENCE

Answer space for question 6

Area for writing the answer to question 6, consisting of horizontal dotted lines.

Turn over ►



7 The gradient, $\frac{dy}{dx}$, of a curve C at the point (x, y) is given by

$$\frac{dy}{dx} = 20x - 6x^2 - 16$$

(a) (i) Show that y is increasing when $3x^2 - 10x + 8 < 0$. (2 marks)

(ii) Solve the inequality $3x^2 - 10x + 8 < 0$. (4 marks)

(b) The curve C passes through the point $P(2, 3)$.

(i) Verify that the tangent to the curve at P is parallel to the x -axis. (2 marks)

(ii) The point $Q(3, -1)$ also lies on the curve. The normal to the curve at Q and the tangent to the curve at P intersect at the point R . Find the coordinates of R . (7 marks)

QUESTION
PART
REFERENCE

Answer space for question 7



Answer space for question 7

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height in handwriting practice. There are no other markings or text on the page.

QUESTION
PART
REFERENCE**Answer space for question 7****END OF QUESTIONS**

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