

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2013

Mathematics

MPC1

Unit Pure Core 1

Monday 13 May 2013 1.30 pm to 3.00 pm

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 3 M P C 1 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** The line AB has equation $3x - 4y + 5 = 0$.
- (a) The point with coordinates $(p, p + 2)$ lies on the line AB . Find the value of the constant p . (2 marks)
- (b) Find the gradient of AB . (2 marks)
- (c) The point A has coordinates $(1, 2)$. The point $C(-5, k)$ is such that AC is perpendicular to AB . Find the value of k . (3 marks)
- (d) The line AB intersects the line with equation $2x - 5y = 6$ at the point D . Find the coordinates of D . (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 1



Answer space for question 1

[illegible]

2 (a) (i) Express $\sqrt{48}$ in the form $n\sqrt{3}$, where n is an integer. (1 mark)

(ii) Solve the equation

$$x\sqrt{12} = 7\sqrt{3} - \sqrt{48}$$

giving your answer in its simplest form. (3 marks)

(b) Express $\frac{11\sqrt{3} + 2\sqrt{5}}{2\sqrt{3} + \sqrt{5}}$ in the form $m - \sqrt{15}$, where m is an integer. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



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

3 A circle C has equation

$$x^2 + y^2 - 10x + 14y + 25 = 0$$

(a) Write the equation of C in the form

$$(x - a)^2 + (y - b)^2 = k$$

where a , b and k are integers.

(3 marks)

(b) Hence, for the circle C , write down:

(i) the coordinates of its centre;

(1 mark)

(ii) its radius.

(1 mark)

(c) (i) Sketch the circle C .

(2 marks)

(ii) Write down the coordinates of the point on C that is furthest away from the x -axis.

(2 marks)

(d) Given that k has the same value as in part **(a)**, describe geometrically the transformation which maps the circle with equation $(x + 1)^2 + y^2 = k$ onto the circle C .

(3 marks)

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE**Answer space for question 3****Turn over ►**

4 (a) The polynomial $f(x)$ is given by $f(x) = x^3 - 4x + 15$.

(i) Use the Factor Theorem to show that $x + 3$ is a factor of $f(x)$. (2 marks)

(ii) Express $f(x)$ in the form $(x + 3)(x^2 + px + q)$, where p and q are integers. (2 marks)

(b) A curve has equation $y = x^4 - 8x^2 + 60x + 7$.

(i) Find $\frac{dy}{dx}$. (3 marks)

(ii) Show that the x -coordinates of any stationary points of the curve satisfy the equation

$$x^3 - 4x + 15 = 0 \quad (1 \text{ mark})$$

(iii) Use the results above to show that the only stationary point of the curve occurs when $x = -3$. (2 marks)

(iv) Find the value of $\frac{d^2y}{dx^2}$ when $x = -3$. (3 marks)

(v) Hence determine, with a reason, whether the curve has a maximum point or a minimum point when $x = -3$. (1 mark)

QUESTION
PART
REFERENCE

Answer space for question 4



QUESTION
PART
REFERENCE

Answer space for question 4

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

Turn over ►



Answer space for question 4

This image shows a blank sheet of white paper designed for handwriting practice. It features a series of horizontal dashed lines spaced evenly down the page. A single vertical solid line runs parallel to the left edge, creating a narrow margin. The rest of the page is open space between the margin line and the right edge, bounded by the horizontal dashed lines.

QUESTION
PART
REFERENCE**Answer space for question 4****Turn over ►**

- 5 (a) (i)** Express $2x^2 + 6x + 5$ in the form $2(x + p)^2 + q$, where p and q are rational numbers. (2 marks)
- (ii)** Hence write down the minimum value of $2x^2 + 6x + 5$. (1 mark)
- (b)** The point A has coordinates $(-3, 5)$ and the point B has coordinates $(x, 3x + 9)$.
- (i)** Show that $AB^2 = 5(2x^2 + 6x + 5)$. (3 marks)
- (ii)** Use your result from part **(a)(ii)** to find the minimum value of the length AB as x varies, giving your answer in the form $\frac{1}{2}\sqrt{n}$, where n is an integer. (2 marks)

QUESTION
PART
REFERENCE

Answer space for question 5



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 in handwriting practice. There are no other markings or text on the page.

6 A curve has equation $y = x^5 - 2x^2 + 9$. The point P with coordinates $(-1, 6)$ lies on the curve.

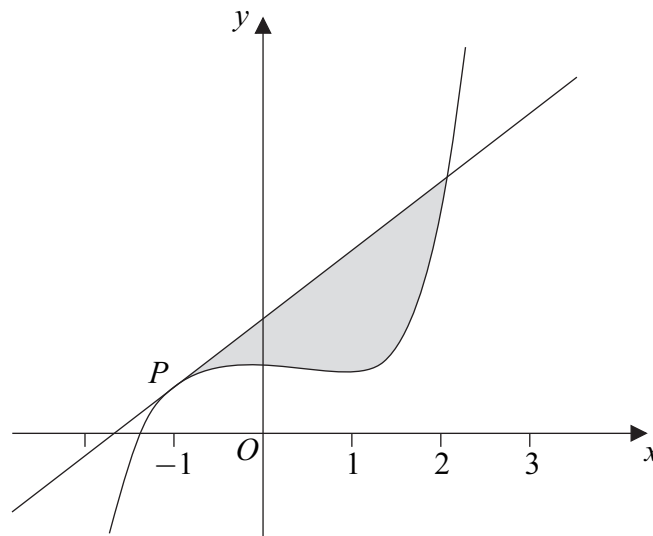
(a) Find the equation of the tangent to the curve at the point P , giving your answer in the form $y = mx + c$. (5 marks)

(b) The point Q with coordinates $(2, k)$ lies on the curve.

(i) Find the value of k . (1 mark)

(ii) Verify that Q also lies on the tangent to the curve at the point P . (1 mark)

(c) The curve and the tangent to the curve at P are sketched below.



(i) Find $\int_{-1}^2 (x^5 - 2x^2 + 9) dx$. (5 marks)

(ii) Hence find the area of the shaded region bounded by the curve and the tangent to the curve at P . (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 6



Answer space for question 6

[illegible]

Answer space for question 6

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 pre-written words or numbers on the page.

Answer space for question 6

This image shows a blank sheet of white paper designed for writing. It features a series of evenly spaced horizontal blue lines across its entire width. A single vertical red line runs down the left side, creating a narrow margin. The paper is otherwise empty, with no text or markings.

7 The quadratic equation

$$(2k - 7)x^2 - (k - 2)x + (k - 3) = 0$$

has real roots.

(a) Show that $7k^2 - 48k + 80 \leq 0$. (4 marks)

(b) Find the possible values of k . (4 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 and placement. There are no pre-written words or numbers on the page.

Answer space for question 7

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