

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Level Examination
June 2011

Mathematics

MPC4

Unit Pure Core 4

Thursday 16 June 2011 1.30 pm to 3.00 pm

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.
- You may use a graphics 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.

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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
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2	
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7	
8	
TOTAL	



J U N 1 1 M P C 4 0 1

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

- 1** The polynomial $f(x)$ is defined by $f(x) = 4x^3 - 13x + 6$.
- (a)** Find $f(-2)$. (1 mark)
- (b)** Use the Factor Theorem to show that $2x - 3$ is a factor of $f(x)$. (2 marks)
- (c)** Simplify $\frac{2x^2 + x - 6}{f(x)}$. (4 marks)

QUESTION
PART
REFERENCE



QUESTION
PART
REFERENCE

Turn over ►



The average weekly pay of a footballer at this club can be modelled by the equation

where $\text{£}P$ is the average weekly pay t years after 1 August 1960, and A and k are constants.

- (a) (i)** Write down the value of A . (1 mark)
- (ii)** Show that the value of k is 1.137411, correct to six decimal places. (2 marks)
- (b)** Use this model to predict the year in which, on 1 August, the average weekly pay of a footballer at this club will first exceed £100 000. (3 marks)

[illegible]

QUESTION
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Turn over ►



3 (a) (i) Find the binomial expansion of $(1 - x)^{\frac{1}{3}}$ up to and including the term in x^2 .
(2 marks)

(ii) Hence, or otherwise, show that

$$(125 - 27x)^{\frac{1}{3}} \approx 5 + \frac{m}{25}x + \frac{n}{3125}x^2$$

for small values of x , stating the values of the integers m and n . (3 marks)

(b) Use your result from part **(a)(ii)** to find an approximate value of $\sqrt[3]{119}$, giving your answer to five decimal places. (2 marks)

QUESTION
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Turn over ►



(ii) Show that $\frac{dy}{dx} = \frac{1}{k \cos \theta}$, where k is an integer. (4 marks)

(ii) Find an equation of the normal to the curve at the point where $\theta = \frac{\pi}{3}$. (4 marks)

(b) Find the exact value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x \, dx$. (5 marks)

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QUESTION
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Turn over ►



The line l has equation $\mathbf{r} = \begin{bmatrix} -8 \\ 5 \\ -6 \end{bmatrix} + \mu \begin{bmatrix} 5 \\ 0 \\ -2 \end{bmatrix}$.

- (a) Find a vector equation of the line that passes through A and B . (3 marks)
- (b) (i) Show that the line that passes through A and B intersects the line l , and find the coordinates of the point of intersection, P . (4 marks)
- (ii) The point C lies on l such that triangle PBC has a right angle at B . Find the coordinates of C . (5 marks)

QUESTION	PART	REFERENCE
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[illegible]

(a) Find the exact value of C . (1 mark)

(b) Find an expression for $\frac{dy}{dx}$ in terms of x and y . (7 marks)

(c) Verify that $P\left(1, \frac{1}{e}\right)$ is a stationary point on the curve. (2 marks)

QUESTION	PART	REFERENCE
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[illegible]

(ii) Use this model to find the number of days that it takes the snowball to melt completely. (1 mark)

[illegible]

[illegible]

(b) Solve the differential equation

$$\frac{dy}{dx} = \frac{2\sqrt{y}}{(3-2x)(1-x)^2}$$

$$y^p = q \ln[f(x)] + \frac{x}{1-x}$$

where p and q are constants. (9 marks)

QUESTION	PART	REFERENCE
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