

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2013

Mathematics

MPC2

Unit Pure Core 2

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 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 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.

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	
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4	
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6	
7	
8	
9	
TOTAL	



J U N 1 3 M P C 2 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** A geometric series has first term 80 and common ratio $\frac{1}{2}$.
- (a) Find the third term of the series. (1 mark)
- (b) Find the sum to infinity of the series. (2 marks)
- (c) Find the sum of the first 12 terms of the series, giving your answer to two decimal places. (2 marks)

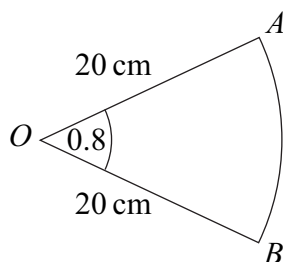
QUESTION
PART
REFERENCE

Answer space for question 1



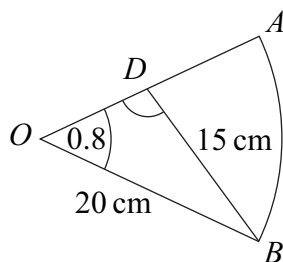
QUESTION
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REFERENCE**Answer space for question 1****Turn over ►**

- 2 The diagram shows a sector OAB of a circle with centre O .



The radius of the circle is 20 cm and the angle $AOB = 0.8$ radians.

- (a) Find the length of the arc AB . (2 marks)
- (b) Find the area of the sector OAB . (2 marks)
- (c) A line from B meets the radius OA at the point D , as shown in the diagram below.



The length of BD is 15 cm. Find the size of the **obtuse** angle ODB , in **radians**, giving your answer to three significant figures. (4 marks)

QUESTION
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Answer space for question 2

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QUESTION
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3 (a) (i) Using the binomial expansion, or otherwise, express $(2 + y)^3$ in the form $a + by + cy^2 + y^3$, where a , b and c are integers. (2 marks)

(ii) Hence show that $(2 + x^{-2})^3 + (2 - x^{-2})^3$ can be expressed in the form $p + qx^{-4}$, where p and q are integers. (3 marks)

(b) (i) Hence find $\int [(2 + x^{-2})^3 + (2 - x^{-2})^3] dx$. (2 marks)

(ii) Hence find the value of $\int_1^2 [(2 + x^{-2})^3 + (2 - x^{-2})^3] dx$. (2 marks)

QUESTION
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Answer space for question 3



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

- 4 (a)** Sketch the graph of $y = 9^x$, indicating the value of the intercept on the y -axis. (2 marks)
- (b)** Use logarithms to solve the equation $9^x = 15$, giving your value of x to three significant figures. (2 marks)
- (c)** The curve $y = 9^x$ is reflected in the y -axis to give the curve with equation $y = f(x)$. Write down an expression for $f(x)$. (1 mark)

QUESTION
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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.

Turn over ►



- 5 (a)** Use the trapezium rule with five ordinates (four strips) to find an approximate value for $\int_0^2 \sqrt{8x^3 + 1} \, dx$, giving your answer to three significant figures. (4 marks)
- (b)** Describe the single transformation that maps the graph of $y = \sqrt{8x^3 + 1}$ onto the graph of $y = \sqrt{x^3 + 1}$. (2 marks)
- (c)** The curve with equation $y = \sqrt{x^3 + 1}$ is translated by $\begin{bmatrix} 2 \\ -0.7 \end{bmatrix}$ to give the curve with equation $y = g(x)$. Find the value of $g(4)$. (3 marks)

QUESTION
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Answer space for question 5



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

6 A curve has the equation

$$y = \frac{12 + x^2\sqrt{x}}{x}, \quad x > 0$$

(a) Express $\frac{12 + x^2\sqrt{x}}{x}$ in the form $12x^p + x^q$. (3 marks)

(b) (i) Hence find $\frac{dy}{dx}$. (2 marks)

(ii) Find an equation of the normal to the curve at the point on the curve where $x = 4$. (4 marks)

(iii) The curve has a stationary point P . Show that the x -coordinate of P can be written in the form 2^k , where k is a rational number. (3 marks)

QUESTION
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Answer space for question 6



Answer space for question 6

[illegible]

7 The n th term of a sequence is u_n . The sequence is defined by

$$u_{n+1} = pu_n + q$$

where p and q are constants.

The first two terms of the sequence are given by $u_1 = 96$ and $u_2 = 72$.

The limit of u_n as n tends to infinity is 24.

(a) Show that $p = \frac{2}{3}$. (4 marks)

(b) Find the value of u_3 . (2 marks)

QUESTION
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Answer space for question 7



QUESTION
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8 (a) Given that $\log_a b = c$, express b in terms of a and c . (1 mark)

(b) By forming a quadratic equation, show that there is only one value of x which satisfies the equation $2 \log_2(x + 7) - \log_2(x + 5) = 3$. (6 marks)

QUESTION
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Answer space for question 8

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9 (a) (i) On the axes given below, sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$. (3 marks)

(ii) Solve the equation $\tan x = -1$, giving all values of x in the interval $0^\circ \leq x \leq 360^\circ$. (2 marks)

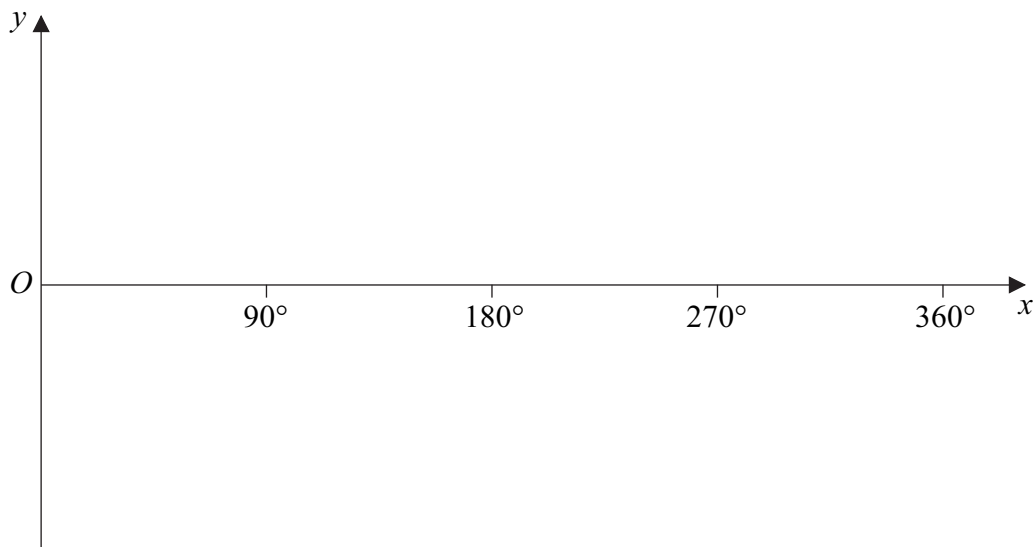
(b) (i) Given that $6 \tan \theta \sin \theta = 5$, show that $6 \cos^2 \theta + 5 \cos \theta - 6 = 0$. (3 marks)

(ii) Hence solve the equation $6 \tan 3x \sin 3x = 5$, giving all values of x to the nearest degree in the interval $0^\circ \leq x \leq 180^\circ$. (6 marks)

QUESTION
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Answer space for question 9

(a)(i)



Answer space for question 9

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Answer space for question 9

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