

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
January 2013

Mathematics

MPC2

Unit Pure Core 2

Monday 14 January 2013 9.00 am to 10.30 am

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	
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TOTAL	

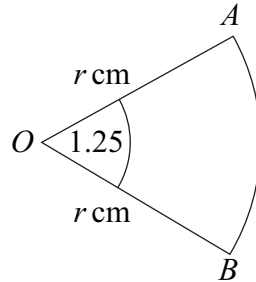


J A N 1 3 M P C 2 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** The diagram shows a sector OAB of a circle with centre O and radius r cm.



The angle AOB is 1.25 radians. The perimeter of the sector is 39 cm.

- (a) Show that $r = 12$. (3 marks)
- (b) Calculate the area of the sector OAB . (2 marks)

QUESTION
PART
REFERENCE

Answer space for question 1



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

- 2 (a)** Use the trapezium rule with five ordinates (four strips) to find an approximate value for

$$\int_1^5 \frac{1}{x^2 + 1} dx$$

giving your answer to three significant figures.

(4 marks)

- (b) (i)** Find $\int \left(x^{-\frac{3}{2}} + 6x^{\frac{1}{2}} \right) dx$, giving the coefficient of each term in its simplest form.

(3 marks)

- (ii)** Hence find the value of $\int_1^4 \left(x^{-\frac{3}{2}} + 6x^{\frac{1}{2}} \right) dx$.

(2 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



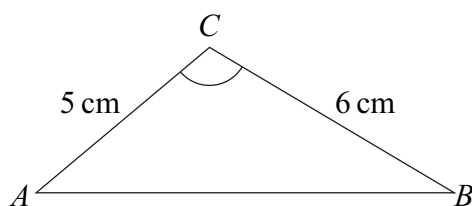
QUESTION
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Answer space for question 2

Area with horizontal dotted lines for writing the answer.



- 3 The diagram shows a triangle ABC .



The lengths of AC and BC are 5 cm and 6 cm respectively.

The area of triangle ABC is 12.5 cm^2 , and angle ACB is **obtuse**.

- (a) Find the size of angle ACB , giving your answer to the nearest 0.1° . (3 marks)
- (b) Find the length of AB , giving your answer to two significant figures. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE

Answer space for question 3

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Turn over ►



4

Given that

$$\log_a N - \log_a x = \frac{3}{2}$$

express x in terms of a and N , giving your answer in a form not involving logarithms.

(3 marks)

QUESTION
PART
REFERENCE

Answer space for question 4



QUESTION
PART
REFERENCE

Answer space for question 4

Handwriting practice area with horizontal dotted lines.

Turn over ►



- 5** The point $P(2, 8)$ lies on a curve, and the point M is the only stationary point of the curve.

The curve has equation $y = 6 + 2x - \frac{8}{x^2}$.

- (a) Find $\frac{dy}{dx}$. (3 marks)
- (b) Show that the normal to the curve at the point $P(2, 8)$ has equation $x + 4y = 34$. (3 marks)
- (c) (i) Show that the stationary point M lies on the x -axis. (3 marks)
- (ii) Hence **write down** the equation of the tangent to the curve at M . (1 mark)
- (d) The tangent to the curve at M and the normal to the curve at P intersect at the point T . Find the coordinates of T . (2 marks)

QUESTION
PART
REFERENCE

Answer space for question 5



Answer space for question 5

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Answer space for question 5

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Answer space for question 5

[illegible]

6 (a) A geometric series begins $420 + 294 + 205.8 + \dots$

(i) Show that the common ratio of the series is 0.7. (1 mark)

(ii) Find the sum to infinity of the series. (2 marks)

(iii) Write the n th term of the series in the form $p \times q^n$, where p and q are constants. (2 marks)

(b) The first term of an arithmetic series is 240 and the common difference of the series is -8 .

The n th term of the series is u_n .

(i) Write down an expression for u_n . (1 mark)

(ii) Given that $u_k = 0$, find the value of $\sum_{n=1}^k u_n$. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 6



Answer space for question 6

[illegible]

- 7 (a)** Describe a geometrical transformation that maps the graph of $y = 4^x$ onto the graph of $y = 3 \times 4^x$. (2 marks)
- (b)** Sketch the curve with equation $y = 3 \times 4^x$, indicating the value of the intercept on the y -axis. (2 marks)
- (c)** The curve with equation $y = 4^{-x}$ intersects the curve $y = 3 \times 4^x$ at the point P . Use logarithms to find the x -coordinate of P , giving your answer to three significant figures. (5 marks)

QUESTION
PART
REFERENCE

Answer space for question 7



Answer space for question 7

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8 (a) Expand $\left(1 + \frac{4}{x}\right)^2$. (1 mark)

(b) The first four terms of the binomial expansion of $\left(1 + \frac{x}{4}\right)^8$ in ascending powers of x are $1 + ax + bx^2 + cx^3$. Find the values of the constants a , b and c . (4 marks)

(c) Hence find the coefficient of x in the expansion of $\left(1 + \frac{4}{x}\right)^2 \left(1 + \frac{x}{4}\right)^8$. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 8



Answer space for question 8

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- 9 (a)** Write down the two solutions of the equation $\tan(x + 30^\circ) = \tan 79^\circ$ in the interval $0^\circ \leq x \leq 360^\circ$. (2 marks)
- (b)** Describe a single geometrical transformation that maps the graph of $y = \tan x$ onto the graph of $y = \tan(x + 30^\circ)$. (2 marks)
- (c) (i)** Given that $5 + \sin^2 \theta = (5 + 3 \cos \theta) \cos \theta$, show that $\cos \theta = \frac{3}{4}$. (5 marks)
- (ii)** Hence solve the equation $5 + \sin^2 2x = (5 + 3 \cos 2x) \cos 2x$ in the interval $0 < x < 2\pi$, giving your values of x in radians to three significant figures. (3 marks)

QUESTION
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END OF QUESTIONS



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