

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
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7	
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9	
TOTAL	



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.

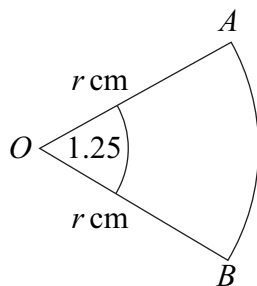


J A N 1 3 M P C 2 0 1

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)

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- 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)

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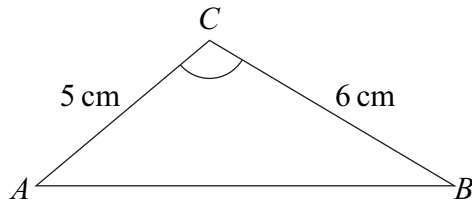
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- 3 The diagram shows a triangle ABC .



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)

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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)

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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)

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- 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)

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- 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)

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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)

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Answer space for question 9

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END OF QUESTIONS



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