

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	



General Certificate of Education
Advanced Subsidiary Examination
January 2012

Mathematics

MPC2

Unit Pure Core 2

Friday 13 January 2012 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 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

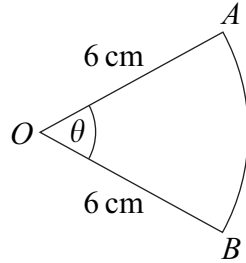
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.



J A N 1 2 M P C 2 0 1

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

1 The diagram shows a sector OAB of a circle with centre O and radius 6 cm.



The angle between the radii OA and OB is θ radians.

The area of the sector OAB is 21.6 cm^2 .

- (a) Find the value of θ . (2 marks)
- (b) Find the length of the arc AB . (2 marks)

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

$$\int_0^4 \frac{2^x}{x+1} dx$$

giving your answer to three significant figures.

(4 marks)

- (b)** State how you could obtain a better approximation to the value of the integral using the trapezium rule.

(1 mark)

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QUESTION
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A large rectangular area with horizontal dotted lines for writing.



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3 (a) Write $\sqrt[4]{x^3}$ in the form x^k .

(1 mark)

(b) Write $\frac{1 - x^2}{\sqrt[4]{x^3}}$ in the form $x^p - x^q$.

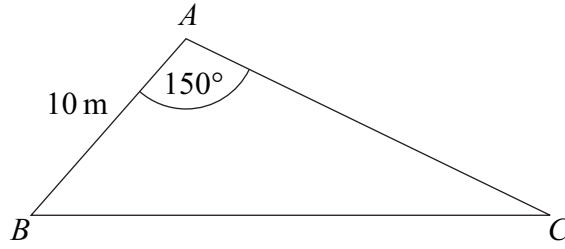
(2 marks)

QUESTION
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Area with horizontal dotted lines for writing answers.



4 The triangle ABC , shown in the diagram, is such that AB is 10 metres and angle BAC is 150° .



The area of triangle ABC is 40 m^2 .

- (a) Show that the length of AC is 16 metres. (2 marks)
- (b) Calculate the length of BC , giving your answer, in metres, to two decimal places. (3 marks)
- (c) Calculate the smallest angle of triangle ABC , giving your answer to the nearest 0.1° . (3 marks)

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5 (a) (i) Describe the geometrical transformation that maps the graph of $y = \left(1 + \frac{x}{3}\right)^6$ onto the graph of $y = (1 + 2x)^6$. (2 marks)

(ii) The curve $y = \left(1 + \frac{x}{3}\right)^6$ is translated by the vector $\begin{bmatrix} 3 \\ 0 \end{bmatrix}$ to give the curve $y = g(x)$. Find an expression for $g(x)$, simplifying your answer. (2 marks)

(b) The first four terms in the binomial expansion of $\left(1 + \frac{x}{3}\right)^6$ are $1 + ax + bx^2 + cx^3$. Find the values of the constants a , b and c , giving your answers in their simplest form. (4 marks)

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6 An arithmetic series has first term a and common difference d .

The sum of the first 25 terms of the series is 3500.

(a) Show that $a + 12d = 140$. (3 marks)

(b) The fifth term of this series is 100.

Find the value of d and the value of a . (4 marks)

(c) The n th term of this series is u_n . Given that

$$33 \left(\sum_{n=1}^{25} u_n - \sum_{n=1}^k u_n \right) = 67 \sum_{n=1}^k u_n$$

find the value of $\sum_{n=1}^k u_n$. (3 marks)

QUESTION
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7 (a) Sketch the graph of $y = \frac{1}{2^x}$, indicating the value of the intercept on the y -axis. (2 marks)

(b) Use logarithms to solve the equation $\frac{1}{2^x} = \frac{5}{4}$, giving your answer to three significant figures. (3 marks)

(c) Given that

$$\log_a(b^2) + 3 \log_a y = 3 + 2 \log_a \left(\frac{y}{a} \right)$$

express y in terms of a and b .

Give your answer in a form not involving logarithms. (5 marks)

QUESTION
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8 (a) Given that $2 \sin \theta = 7 \cos \theta$, find the value of $\tan \theta$. (2 marks)

(b) (i) Use an appropriate identity to show that the equation

$$6 \sin^2 x = 4 + \cos x$$

can be written as

$$6 \cos^2 x + \cos x - 2 = 0 \qquad (2 \text{ marks})$$

(ii) Hence solve the equation $6 \sin^2 x = 4 + \cos x$ in the interval $0^\circ < x < 360^\circ$, giving your answers to the nearest degree. (6 marks)

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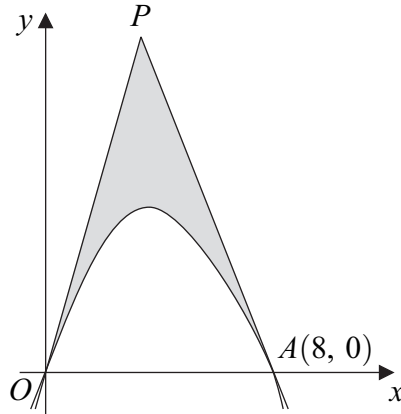
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The diagram shows part of a curve crossing the x -axis at the origin O and at the point $A(8, 0)$. Tangents to the curve at O and A meet at the point P , as shown in the diagram.



The curve has equation

$$y = 12x - 3x^{\frac{5}{3}}$$

- (a) Find $\frac{dy}{dx}$. (2 marks)
- (b) (i) Find the value of $\frac{dy}{dx}$ at the point O and hence write down an equation of the tangent at O . (2 marks)
- (ii) Show that the equation of the tangent at $A(8, 0)$ is $y + 8x = 64$. (3 marks)
- (c) Find $\int (12x - 3x^{\frac{5}{3}}) dx$. (3 marks)
- (d) Calculate the area of the shaded region bounded by the curve from O to A and the tangents OP and AP . (7 marks)

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QUESTION
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QUESTION
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Area with horizontal dotted lines for writing.

END OF QUESTIONS

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