

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2012

Mathematics

MPC2

Unit Pure Core 2

Wednesday 16 May 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 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	
3	
4	
5	
6	
7	
8	
9	
TOTAL	



J U N 1 2 M P C 2 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

1 The arithmetic series

$$23 + 32 + 41 + 50 + \dots + 2534$$

has 280 terms.

- (a) Write down the common difference of the series. (1 mark)
- (b) Find the 100th term of the series. (2 marks)
- (c) Find the sum of the 280 terms of the series. (2 marks)

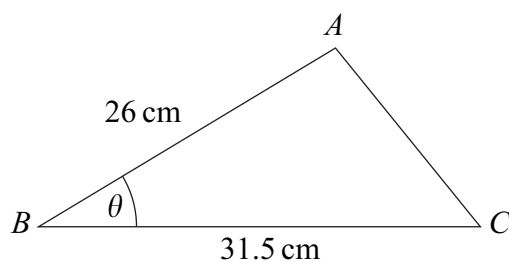
QUESTION
PART
REFERENCE

Answer space for question 1



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

- 2** The triangle ABC , shown in the diagram, is such that $AB = 26$ cm and $BC = 31.5$ cm.



The acute angle ABC is θ , where $\sin \theta = \frac{5}{13}$.

- (a) Calculate the area of triangle ABC . (2 marks)
- (b) Find the exact value of $\cos \theta$. (1 mark)
- (c) Calculate the length of AC . (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



QUESTION
PART
REFERENCE

Answer space for question 2

Handwriting practice area with horizontal dotted lines.

Turn over ►



3 (a) Expand $\left(x^{\frac{3}{2}} - 1\right)^2$. (2 marks)

(b) Hence find $\int \left(x^{\frac{3}{2}} - 1\right)^2 dx$. (3 marks)

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

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE**Answer space for question 3**

- 4** The n th term of a geometric series is u_n , where $u_n = 48\left(\frac{1}{4}\right)^n$.
- (a) Find the value of u_1 and the value of u_2 . (2 marks)
- (b) Find the value of the common ratio of the series. (1 mark)
- (c) Find the sum to infinity of the series. (2 marks)
- (d) Find the value of $\sum_{n=4}^{\infty} u_n$. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 4



QUESTION
PART
REFERENCE

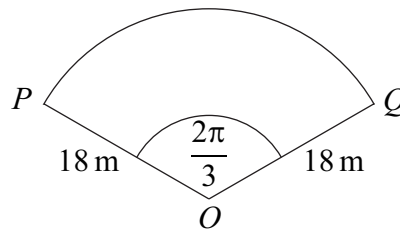
Answer space for question 4

Handwriting practice area with horizontal dotted lines.

Turn over ►

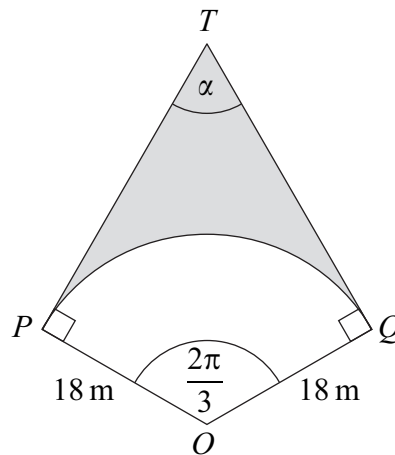


- 5 The diagram shows a sector OPQ of a circle with centre O .



The radius of the circle is 18 m and the angle POQ is $\frac{2\pi}{3}$ radians.

- (a) Find the length of the arc PQ , giving your answer as a multiple of π . (2 marks)
- (b) The tangents to the circle at the points P and Q meet at the point T , and the angles TPO and TQO are both right angles, as shown in the diagram below.



- (i) Angle $PTQ = \alpha$ radians. Find α in terms of π . (1 mark)
- (ii) Find the area of the shaded region bounded by the arc PQ and the tangents TP and TQ , giving your answer to three significant figures. (6 marks)

QUESTION
PART
REFERENCE

Answer space for question 5



Answer space for question 5

[illegible]

Answer space for question 5

[illegible]

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

- 6** At the point (x, y) , where $x > 0$, the gradient of a curve is given by

$$\frac{dy}{dx} = 3x^2 - \frac{4}{x^2} - 11$$

The point $P(2, 1)$ lies on the curve.

- (a) (i)** Verify that $\frac{dy}{dx} = 0$ when $x = 2$. (1 mark)

- (ii)** Find the value of $\frac{d^2y}{dx^2}$ when $x = 2$. (4 marks)

- (iii)** Hence state whether P is a maximum point or a minimum point, giving a reason for your answer. (1 mark)

- (b)** Find the equation of the curve. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 6



Answer space for question 6

[illegible]

7 It is given that $(\tan \theta + 1)(\sin^2 \theta - 3 \cos^2 \theta) = 0$.

(a) Find the possible values of $\tan \theta$. (4 marks)

(b) Hence solve the equation $(\tan \theta + 1)(\sin^2 \theta - 3 \cos^2 \theta) = 0$, giving all solutions for θ , in degrees, in the interval $0^\circ \leq \theta \leq 180^\circ$. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 7



Answer space for question 7

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height in handwriting practice. There are no other markings or text on the page.

- 8 (a)** Sketch the curve with equation $y = 7^x$, indicating the coordinates of any point where the curve intersects the coordinate axes. (2 marks)
- (b)** The curve C_1 has equation $y = 7^x$.
The curve C_2 has equation $y = 7^{2x} - 12$.
- (i)** By forming and solving a quadratic equation, prove that the curves C_1 and C_2 intersect at exactly one point. State the y -coordinate of this point. (4 marks)
- (ii)** Use logarithms to find the x -coordinate of the point of intersection of C_1 and C_2 , giving your answer to three significant figures. (2 marks)

QUESTION
PART
REFERENCE

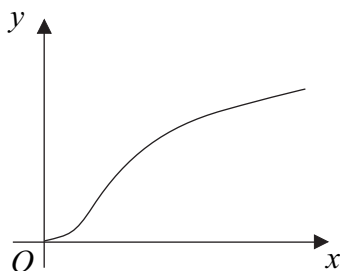
Answer space for question 8



Answer space for question 8

[illegible]

- 9 The diagram shows part of a curve whose equation is $y = \log_{10}(x^2 + 1)$.



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

$$\int_0^1 \log_{10}(x^2 + 1) \, dx$$

giving your answer to three significant figures. (4 marks)

- (b) The graph of $y = 2 \log_{10} x$ can be transformed into the graph of $y = 1 + 2 \log_{10} x$ by means of a translation. Write down the vector of the translation. (1 mark)

- (c) (i) Show that $\log_{10}(10x^2) = 1 + 2 \log_{10} x$. (2 marks)

- (ii) Show that the graph of $y = 2 \log_{10} x$ can also be transformed into the graph of $y = 1 + 2 \log_{10} x$ by means of a **stretch**, and describe the stretch. (4 marks)

- (iii) The curve with equation $y = 1 + 2 \log_{10} x$ intersects the curve $y = \log_{10}(x^2 + 1)$ at the point P . Given that the x -coordinate of P is positive, find the gradient of the line OP , where O is the origin. Give your answer in the form $\log_{10}\left(\frac{a}{b}\right)$, where a and b are integers. (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 9



Answer space for question 9

This image shows a blank sheet of white paper designed for handwriting practice. It features a solid black vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced, horizontal dashed lines for writing. There are no other markings, text, or illustrations on the page.

Answer space for question 9

[illegible]

Answer space for question 9

END OF QUESTIONS



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

