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Surname										
Other Names										
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General Certificate of Education  
Advanced Subsidiary Examination  
June 2009

# Mathematics

# MPC2

## Unit Pure Core 2

**Specimen paper for examinations in June 2010 onwards**

**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 space 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.

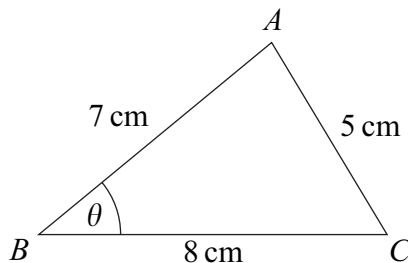
- Information**
- The marks for questions are shown in brackets.
  - The maximum mark for this paper is 75.

- Advice**
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

For Examiner's Use	
Examiner's Initials	
Question	Mark
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Answer **all** questions in the spaces provided.

- 1** The triangle  $ABC$ , shown in the diagram, is such that  $AB = 7\text{ cm}$ ,  $AC = 5\text{ cm}$ ,  $BC = 8\text{ cm}$  and angle  $ABC = \theta$ .



- (a) Show that  $\theta = 38.2^\circ$ , correct to the nearest  $0.1^\circ$ . (3 marks)
- (b) Calculate the area of triangle  $ABC$ , giving your answer, in  $\text{cm}^2$ , to three significant figures. (2 marks)

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QUESTION  
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**3** The  $n$ th term of a sequence is  $u_n$ .

The sequence is defined by

$$u_{n+1} = ku_n + 12$$

where  $k$  is a constant.

The first two terms of the sequence are given by

$$u_1 = 16 \quad u_2 = 24$$

- (a) Show that  $k = 0.75$ . (2 marks)
- (b) Find the value of  $u_3$  and the value of  $u_4$ . (2 marks)
- (c) The limit of  $u_n$  as  $n$  tends to infinity is  $L$ .
- (i) Write down an equation for  $L$ . (1 mark)
- (ii) Hence find the value of  $L$ . (2 marks)

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- 4 (a)** Use the trapezium rule with four ordinates (three strips) to find an approximate value for  $\int_0^6 \sqrt{x^3 + 1} \, dx$ , giving your answer to four significant figures. *(4 marks)*
- (b)** The curve with equation  $y = \sqrt{x^3 + 1}$  is stretched parallel to the  $x$ -axis with scale factor  $\frac{1}{2}$  to give the curve with equation  $y = f(x)$ . Write down an expression for  $f(x)$ . *(2 marks)*

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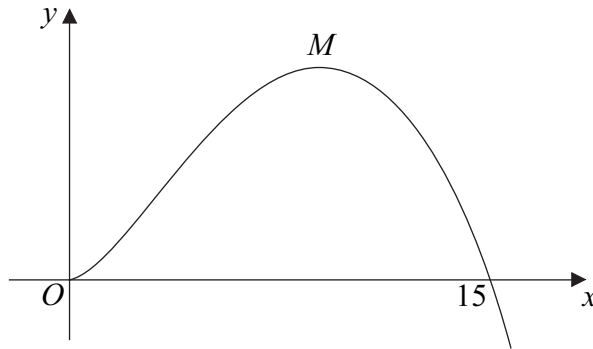
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5 The diagram shows part of a curve with a maximum point  $M$ .



The equation of the curve is

$$y = 15x^{\frac{3}{2}} - x^{\frac{5}{2}}$$

- (a) Find  $\frac{dy}{dx}$ . (3 marks)
- (b) Hence find the coordinates of the maximum point  $M$ . (4 marks)
- (c) The point  $P(1, 14)$  lies on the curve. Show that the equation of the tangent to the curve at  $P$  is  $y = 20x - 6$ . (3 marks)
- (d) The tangents to the curve at the points  $P$  and  $M$  intersect at the point  $R$ . Find the length of  $RM$ . (3 marks)

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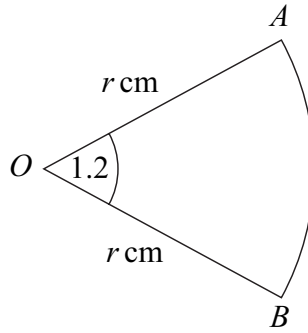
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The diagram shows a sector  $OAB$  of a circle with centre  $O$  and radius  $r$  cm.



The angle  $AOB$  is  $1.2$  radians. The area of the sector is  $33.75 \text{ cm}^2$ .

Find the perimeter of the sector.

(6 marks)

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- 7** A geometric series has second term 375 and fifth term 81.
- (a) (i) Show that the common ratio of the series is 0.6. (3 marks)
- (ii) Find the first term of the series. (2 marks)
- (b) Find the sum to infinity of the series. (2 marks)
- (c) The  $n$ th term of the series is  $u_n$ . Find the value of  $\sum_{n=6}^{\infty} u_n$ . (4 marks)

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**8 (a)** Given that  $\frac{\sin \theta - \cos \theta}{\cos \theta} = 4$ , prove that  $\tan \theta = 5$ . (2 marks)

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

$$2 \cos^2 x - \sin x = 1$$

can be written as

$$2 \sin^2 x + \sin x - 1 = 0$$
 (2 marks)

**(ii)** Hence solve the equation

$$2 \cos^2 x - \sin x = 1$$

giving all solutions in the interval  $0^\circ \leq x \leq 360^\circ$ . (5 marks)

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9 (a) (i) Find the value of  $p$  for which  $\sqrt{125} = 5^p$ . (2 marks)

(ii) Hence solve the equation  $5^{2x} = \sqrt{125}$ . (1 mark)

(b) Use logarithms to solve the equation  $3^{2x-1} = 0.05$ , giving your value of  $x$  to four decimal places. (3 marks)

(c) It is given that

$$\log_a x = 2(\log_a 3 + \log_a 2) - 1$$

Express  $x$  in terms of  $a$ , giving your answer in a form not involving logarithms. (4 marks)

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**END OF QUESTIONS**



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ANSWER IN THE SPACES PROVIDED**

