

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



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.

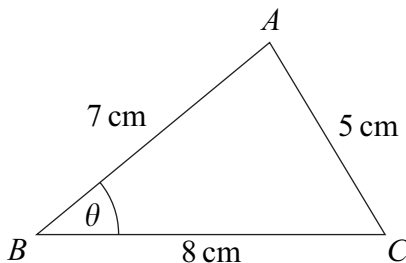
### Advice

- 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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TOTAL	

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

- 1** The triangle  $ABC$ , shown in the diagram, is such that  $AB = 7$  cm,  $AC = 5$  cm,  $BC = 8$  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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**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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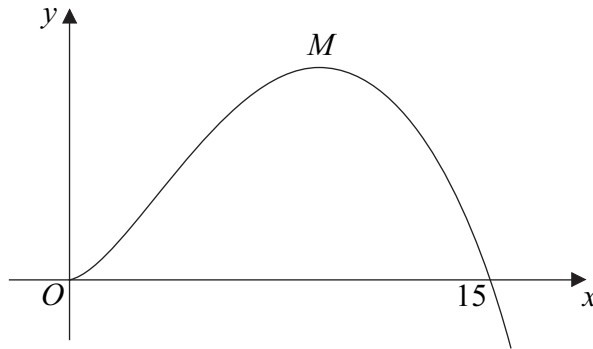
- 4 (a)** Use the trapezium rule with four ordinates (three strips) to find an approximate value for  $\int_0^6 \sqrt{x^3 + 1} dx$ , giving your answer to four significant figures. *(4 marks)*
- (b)** The curve with equation  $y = \sqrt{x^3 + 1}$  is stretched parallel to the  $x$ -axis with scale factor  $\frac{1}{2}$  to give the curve with equation  $y = f(x)$ . Write down an expression for  $f(x)$ . *(2 marks)*

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



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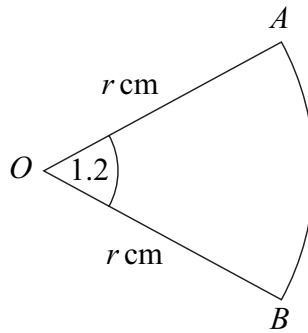
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The diagram shows a sector  $OAB$  of a circle with centre  $O$  and radius  $r$  cm.



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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Area with horizontal dotted lines for writing the answer.



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

$$2 \sin^2 x + \sin x - 1 = 0 \quad (2 \text{ marks})$$

**(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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