

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	
8	
9	
TOTAL	



General Certificate of Education  
Advanced Subsidiary Examination  
January 2011

# Mathematics

# MPC2

Unit Pure Core 2

Monday 10 January 2011 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.

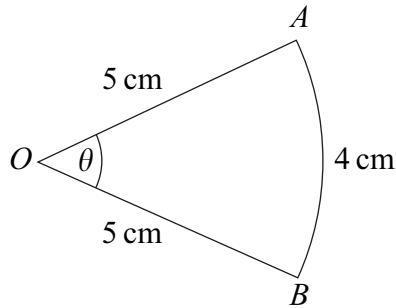
- Information**
- The marks for questions are shown in brackets.
  - The maximum mark for this paper is 75.

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



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

**1** The diagram shows a sector  $OAB$  of a circle with centre  $O$  and radius 5 cm.



The angle between the radii  $OA$  and  $OB$  is  $\theta$  radians.

The length of the arc  $AB$  is 4 cm.

- (a) Find the value of  $\theta$ . (2 marks)
- (b) Find the area of the sector  $OAB$ . (2 marks)

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**2 (a)** Write down the values of  $p$ ,  $q$  and  $r$  given that:

**(i)**  $8 = 2^p$ ; (1 mark)

**(ii)**  $\frac{1}{8} = 2^q$ ; (1 mark)

**(iii)**  $\sqrt{2} = 2^r$ . (1 mark)

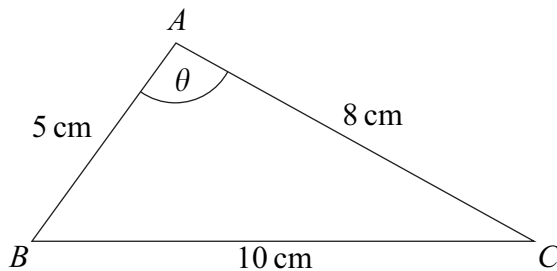
**(b)** Find the value of  $x$  for which  $\sqrt{2} \times 2^x = \frac{1}{8}$ . (2 marks)

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- 3** The triangle  $ABC$ , shown in the diagram, is such that  $AB = 5\text{ cm}$ ,  $AC = 8\text{ cm}$ ,  $BC = 10\text{ cm}$  and angle  $BAC = \theta$ .



- (a) Show that  $\theta = 97.9^\circ$ , correct to the nearest  $0.1^\circ$ . (3 marks)
- (b) (i) Calculate the area of triangle  $ABC$ , giving your answer, in  $\text{cm}^2$ , to three significant figures. (2 marks)
- (ii) The line through  $A$ , perpendicular to  $BC$ , meets  $BC$  at the point  $D$ . Calculate the length of  $AD$ , giving your answer, in  $\text{cm}$ , to three significant figures. (3 marks)

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**4 (a)** Use the trapezium rule with four ordinates (three strips) to find an approximate value for  $\int_0^{1.5} \sqrt{27x^3 + 4} dx$ , giving your answer to three significant figures. (4 marks)

**(b)** The curve with equation  $y = \sqrt{27x^3 + 4}$  is stretched parallel to the  $x$ -axis with scale factor 3 to give the curve with equation  $y = g(x)$ . Write down an expression for  $g(x)$ . (2 marks)

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**5 (a)** Using the binomial expansion, or otherwise, express  $(1 - x)^3$  in ascending powers of  $x$ . *(2 marks)*

**(b)** Show that the expansion of

$$(1 + y)^4 - (1 - y)^3$$

is

$$7y + py^2 + qy^3 + y^4$$

where  $p$  and  $q$  are constants to be found. *(4 marks)*

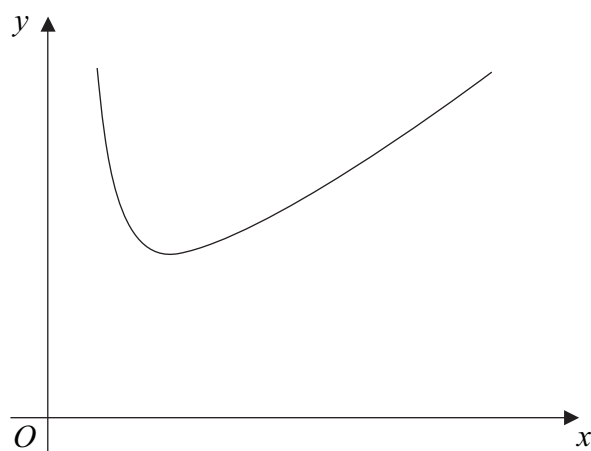
**(c)** Hence find  $\int \left[ (1 + \sqrt{x})^4 - (1 - \sqrt{x})^3 \right] dx$ , expressing each coefficient in its simplest form. *(4 marks)*

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7 A curve  $C$  is defined for  $x > 0$  by the equation  $y = x + 3 + \frac{8}{x^4}$  and is sketched below.



- (a) Given that  $y = x + 3 + \frac{8}{x^4}$ , find  $\frac{dy}{dx}$ . (3 marks)
- (b) Find an equation of the tangent at the point on the curve  $C$  where  $x = 1$ . (3 marks)
- (c) The curve  $C$  has a minimum point  $M$ . Find the coordinates of  $M$ . (4 marks)
- (d) (i) Find  $\int \left(x + 3 + \frac{8}{x^4}\right) dx$ . (3 marks)
- (ii) Hence find the area of the region bounded by the curve  $C$ , the  $x$ -axis and the lines  $x = 1$  and  $x = 2$ . (2 marks)
- (e) The curve  $C$  is translated by  $\begin{bmatrix} 0 \\ k \end{bmatrix}$  to give the curve  $y = f(x)$ . Given that the  $x$ -axis is a tangent to the curve  $y = f(x)$ , state the value of the constant  $k$ . (1 mark)

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- 8 (a)**    Given that  $2 \log_k x - \log_k 5 = 1$ , express  $k$  in terms of  $x$ . Give your answer in a form not involving logarithms. *(4 marks)*
  
- (b)**    Given that  $\log_a y = \frac{3}{2}$  and that  $\log_4 a = b + 2$ , show that  $y = 2^p$ , where  $p$  is an expression in terms of  $b$ . *(3 marks)*

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