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	

AQA

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

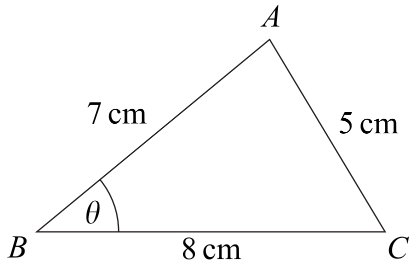
Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer the questions in the space provided. 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.

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 $\theta = 38.2°$, correct to the nearest $0.1°$. *(3 marks)*

(b) Calculate the area of triangle ABC, giving your answer, in cm^2, to three significant figures. *(2 marks)*

QUESTION PART REFERENCE

2 (a) Write down the value of n given that $\frac{1}{x^4} = x^n$. *(1 mark)*

(b) Expand $\left(1 + \frac{3}{x^2}\right)^2$. *(2 marks)*

(c) Hence find $\int \left(1 + \frac{3}{x^2}\right)^2 \mathrm{d}x$. *(3 marks)*

(d) Hence find the exact value of $\int_1^3 \left(1 + \frac{3}{x^2}\right)^2 \mathrm{d}x$. *(2 marks)*

QUESTION PART REFERENCE

3 The nth 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

$$u_1 = 16 \qquad u_2 = 24$$

(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)*

QUESTION PART REFERENCE

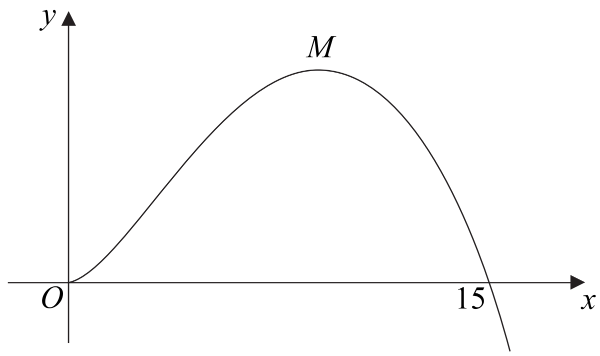
Do not write outside the box

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)*

QUESTION PART REFERENCE

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 $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. *(3 marks)*

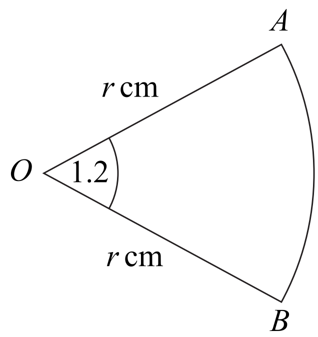
(b) Hence find the coordinates of the maximum point M. *(4 marks)*

(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)*

QUESTION PART REFERENCE

6 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)*

QUESTION PART REFERENCE

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 nth term of the series is u_n . Find the value of $\sum_{n=6}^{\infty} u_n$. *(4 marks)*

QUESTION PART REFERENCE

8 (a) Given that $\dfrac{\sin\theta - \cos\theta}{\cos\theta} = 4$, 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 $0° \leqslant x \leqslant 360°$. *(5 marks)*

QUESTION PART REFERENCE

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)*

QUESTION PART REFERENCE