Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
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8	
9	
TOTAL	

AQA

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Mathematics MPC2

Unit Pure Core 2

Thursday 22 May 2014 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.

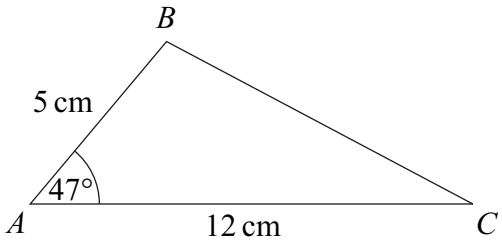
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

Answer **all** questions.

Answer each question in the space provided for that question.

1 The diagram shows a triangle ABC.



The size of angle BAC is $47°$ and the lengths of AB and AC are $5\,\text{cm}$ and $12\,\text{cm}$ respectively.

(a) Calculate the area of the triangle ABC, giving your answer to the nearest cm^2.

[2 marks]

(b) Calculate the length of BC, giving your answer, in cm, to one decimal place.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 1

Do not write outside the box

QUESTION PART REFERENCE

Answer space for question 1

2 (a) Find $\int\left(1+3x^{\frac{1}{2}}+x^{\frac{3}{2}}\right)\mathrm{d}x$.

[3 marks]

(b) (i) The expression $(1+y)^3$ can be written in the form $1+3y+ny^2+y^3$.
Write down the value of the constant n.

[1 mark]

(ii) Hence, or otherwise, expand $(1+\sqrt{x})^3$.

[1 mark]

(c) Hence find the exact value of $\int_0^1(1+\sqrt{x})^3\,\mathrm{d}x$.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 2

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QUESTION PART REFERENCE

Answer space for question 2



3 The first term of a geometric series is 54 and the common ratio of the series is $\frac{8}{9}$.

(a) Find the sum to infinity of the series.

[2 marks]

(b) Find the second term of the series.

[1 mark]

(c) Show that the 12th term of the series can be written in the form $\frac{2^p}{3^q}$, where p and q are integers.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 3

QUESTION PART REFERENCE

Answer space for question 3



4 A curve has equation $y = \frac{1}{x^2} + 4x$.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

[3 marks]

(b) The point $P(-1, -3)$ lies on the curve. Find an equation of the normal to the curve at the point P.

[3 marks]

(c) Find an equation of the tangent to the curve that is parallel to the line $y = -12x$.

[5 marks]

QUESTION PART REFERENCE

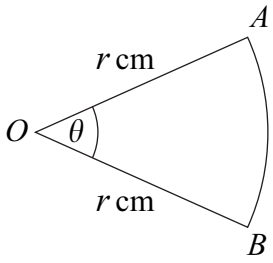
Answer space for question 4

QUESTION PART REFERENCE

Answer space for question 4



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



The angle AOB is θ radians.

The area of the sector is $12\,\text{cm}^2$.

The perimeter of the sector is four times the length of the arc AB.

Find the value of r.

[6 marks]

QUESTION PART REFERENCE

Answer space for question 5

QUESTION PART REFERENCE

Answer space for question 5

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6 (a) Sketch, on the axes given below, the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

[2 marks]

(b) Describe the geometrical transformation that maps the graph of $y = \sin x$ onto the graph of $y = \sin 5x$.

[2 marks]

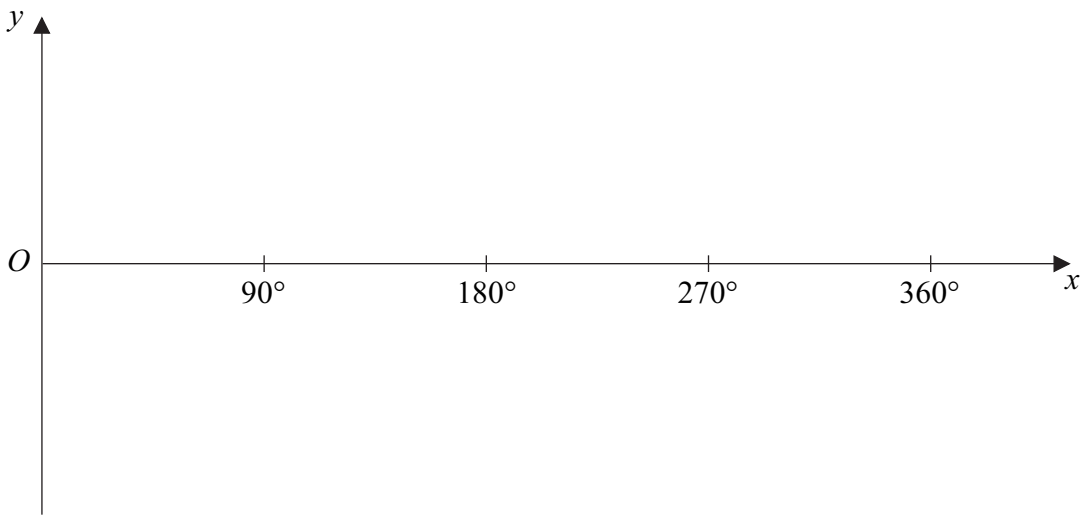
(c) Describe the single geometrical transformation that maps the graph of $y = \sin 5x$ onto the graph of $y = \sin(5x + 10°)$.

[2 marks]

QUESTION PART REFERENCE

(a)

Answer space for question 6



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QUESTION PART REFERENCE

Answer space for question 6

7 (a) Given that $\dfrac{\cos^2 x + 4\sin^2 x}{1 - \sin^2 x} = 7$, show that $\tan^2 x = \dfrac{3}{2}$.

[3 marks]

(b) **Hence** solve the equation $\dfrac{\cos^2 2\theta + 4\sin^2 2\theta}{1 - \sin^2 2\theta} = 7$ in the interval $0° < \theta < 180°$, giving your values of θ to the nearest degree.

[4 marks]

QUESTION PART REFERENCE

Answer space for question 7

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QUESTION PART REFERENCE

Answer space for question 7

8 An arithmetic series has first term a and common difference d.

The sum of the first 5 terms of the series is 575.

(a) Show that $a + 2d = 115$.

[3 marks]

(b) Given also that the 10th term of the series is 87, find the value of d.

[3 marks]

(c) The $n\text{th}$ term of the series is u_n. Given that $u_k > 0$ and $u_{k+1} < 0$, find the value of $\sum_{n=1}^{k} u_n$.

[5 marks]

QUESTION PART REFERENCE

Answer space for question 8

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QUESTION PART REFERENCE

Answer space for question 8

9 A curve has equation $y = 3 \times 12^x$.

(a) The point $(k, 6)$ lies on the curve $y = 3 \times 12^x$. Use logarithms to find the value of k, giving your answer to three significant figures.

[3 marks]

(b) Use the trapezium rule with four ordinates (three strips) to find an approximate value for $\int_0^{1.5} 3 \times 12^x \, \mathrm{d}x$, giving your answer to two significant figures.

[4 marks]

(c) The curve $y = 3 \times 12^x$ is translated by the vector $\begin{bmatrix} 1 \\ p \end{bmatrix}$ to give the curve $y = \mathrm{f}(x)$. Given that the curve $y = \mathrm{f}(x)$ passes through the origin $(0, 0)$, find the value of the constant p.

[3 marks]

(d) The curve with equation $y = 2^{2-x}$ intersects the curve $y = 3 \times 12^x$ at the point T. Show that the x-coordinate of T can be written in the form $\dfrac{2 - \log_2 3}{q + \log_2 3}$, where q is an integer. State the value of q.

[5 marks]

QUESTION PART REFERENCE

Answer space for question 9

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QUESTION PART REFERENCE

Answer space for question 9



QUESTION PART REFERENCE

Answer space for question 9

END OF QUESTIONS

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