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| Centre Number | | | | | | Candidate Number | | | | |
| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |



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.

| | |
|---------------------|------|
| For Examiner's Use | |
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| TOTAL | |

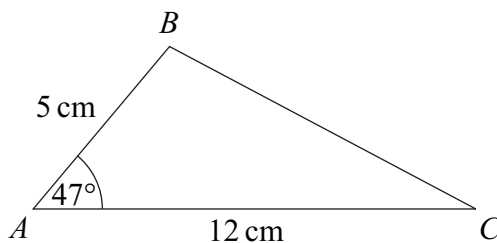


J U N 1 4 M P C 2 0 1

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 cm and 12 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



QUESTION
PART
REFERENCE

Answer space for question 1

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Turn over ►



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

[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 $\int_0^1 (1 + \sqrt{x})^3 dx$.

[3 marks]

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- 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
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QUESTION
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Answer space for question 3

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

(a) Find $\frac{dy}{dx}$.

[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]

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QUESTION
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Answer space for question 4

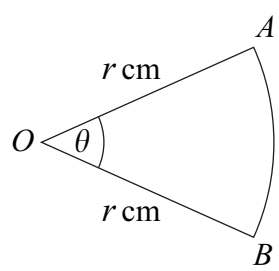
A large rectangular area containing 30 horizontal dotted lines for writing the answer to question 4.

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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 cm^2 .

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

Find the value of r .

[6 marks]

QUESTION
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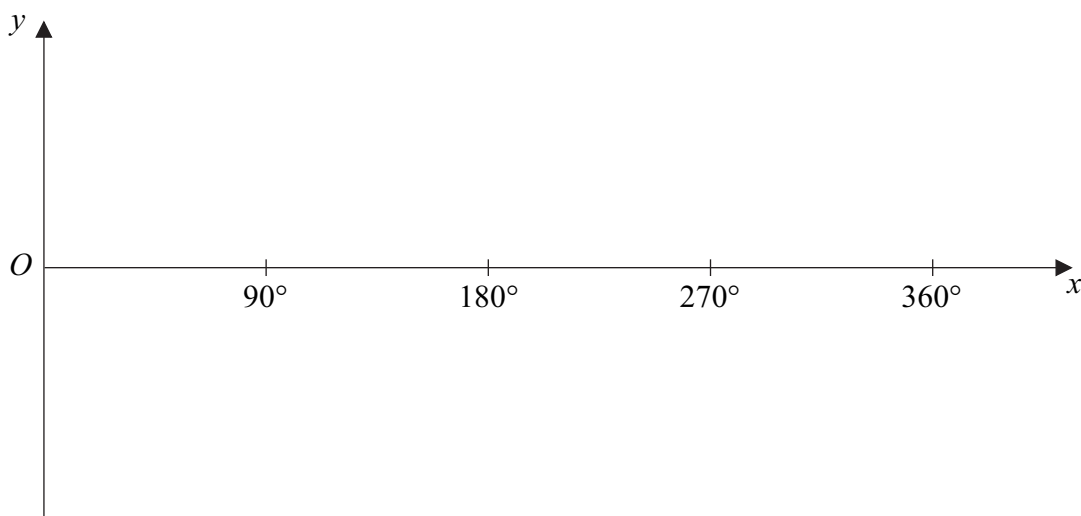


- 6 (a)** Sketch, on the axes given below, the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$. **[2 marks]**
- (b)** Describe the geometrical transformation that maps the graph of $y = \sin x$ onto the graph of $y = \sin 5x$. **[2 marks]**
- (c)** Describe the single geometrical transformation that maps the graph of $y = \sin 5x$ onto the graph of $y = \sin(5x + 10^\circ)$. **[2 marks]**

QUESTION
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Answer space for question 6

(a)



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

[3 marks]

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

[4 marks]

QUESTION
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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 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]**

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- 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 $\int_0^{1.5} 3 \times 12^x \, dx$, 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 $y = f(x)$. Given that the curve $y = f(x)$ 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 $\frac{2 - \log_2 3}{q + \log_2 3}$, where q is an integer. State the value of q . **[5 marks]**

QUESTION
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QUESTION
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REFERENCE

Answer space for question 9

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Turn over ▶



QUESTION
PART
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Answer space for question 9

Dotted lines for writing the answer.

END OF QUESTIONS

