AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS MATHEMATICS

Unit Pure Core 2

Wednesday 23 May 2018 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

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	
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4	
5	
6	
7	
8	
9	
TOTAL	

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Answer **all** questions.

Answer each question in the space provided for that question.

1 (a) Use the trapezium rule with four ordinates (three strips) to find an approximate value for $\int_0^{\frac{3}{4}} \sqrt{9 - 16x^3}\,\mathrm{d}x$. Give your answer to three significant figures.

[4 marks]

(b) State how you could obtain a better approximation to the value of the integral using the trapezium rule.

[1 mark]

QUESTION PART REFERENCE

Answer space for question 1

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QUESTION PART REFERENCE	**Answer space for question 1**

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2 A curve is defined for $x > 0$ by the equation

$$y = 3x + x^{\frac{3}{2}} - 7$$

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

[2 marks]

(b) The point $P(4, k)$ lies on the curve.

(i) Find the value of the integer k.

[1 mark]

(ii) Find an equation of the normal to the curve at the point P.

[3 marks]

(iii) The normal to the curve at P intersects the x-axis at the point Q. Find the x-coordinate of Q.

[2 marks]

QUESTION PART REFERENCE

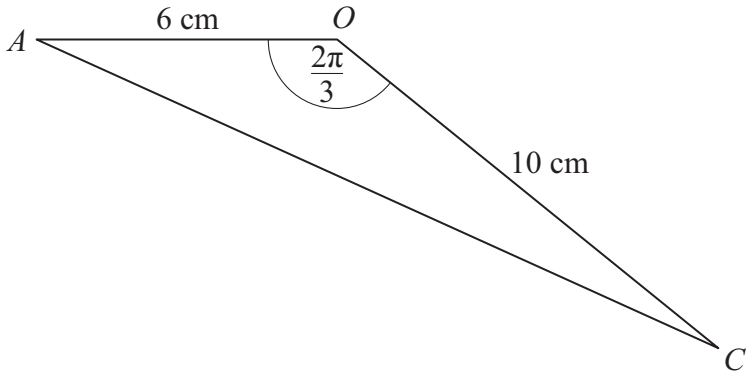
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QUESTION PART REFERENCE	**Answer space for question 2**

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3 The diagram shows a triangle AOC.



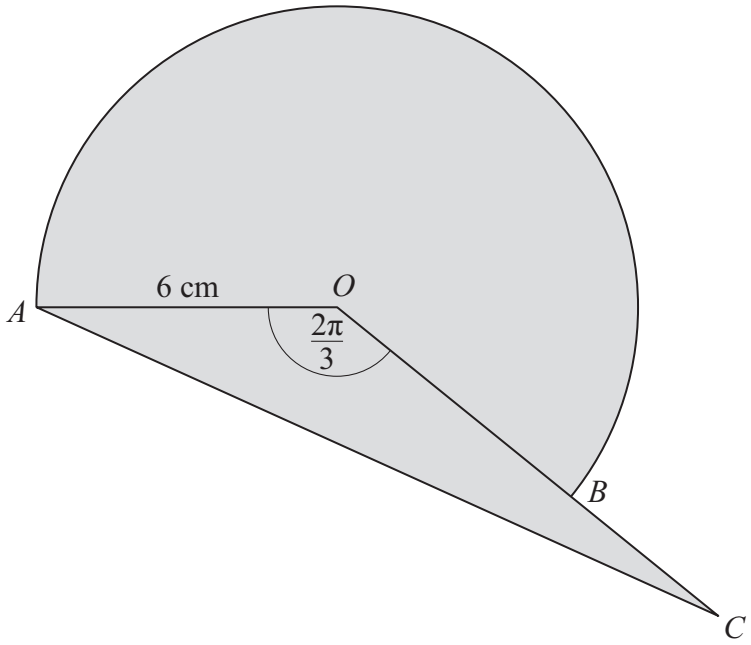
The lengths of AO and OC are $6\,\text{cm}$ and $10\,\text{cm}$ respectively.

Angle AOC is $\frac{2\pi}{3}$ radians.

(a) Find the length of AC.

[3 marks]

(b) A circular arc, centre O and radius $6\,\text{cm}$, is drawn from the point A to meet the line OC at the point B as shown in the diagram below.



(i) Show that the length of the arc AB, shown in the diagram, is $25.1\,\text{cm}$, correct to three significant figures.

[3 marks]

(ii) Find the area of the shaded region bounded by the arc AB and the lines BC and CA. Give your answer to the nearest cm^2.

[4 marks]

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QUESTION PART REFERENCE

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4 (a) The arithmetic series $23 + 32 + 41 + 50 + ... + 2714$ has 300 terms.

The nth term of the series is u_n.

(i) Write down the common difference of the series.

[1 mark]

(ii) Find the value of u_{100}.

[2 marks]

(iii) Find the value of $\sum_{n=100}^{300} u_n$.

[3 marks]

(b) A geometric series has first term 24. The first term and the fourth term of this series have a sum equal to -57.

(i) Find the common ratio of the series.

[2 marks]

(ii) State whether the series has a sum to infinity. Give a reason to justify your answer.

[1 mark]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE	**Answer space for question 4**

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5 (a) The expression $(3 + 2x^2)^3$ can be written in the form

$$27 + ax^2 + bx^4 + cx^6$$

By using the binomial expansion, or otherwise, find the values of the coefficients a, b and c.

[3 marks]

(b) Given that $\frac{1}{x^4} = x^n$, write down the value of n.

[1 mark]

(c) (i) Find $\int \frac{(3 + 2x^2)^3}{x^4}\,\mathrm{d}x$.

[4 marks]

(ii) Hence find the value of $\int_1^3 \frac{(3 + 2x^2)^3}{x^4}\,\mathrm{d}x$.

[2 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE	**Answer space for question 5**

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6 The nth term of a sequence is u_n.

The sequence is defined by $u_{n+1} = pu_n + q$, where p and q are constants.

The second term of the sequence is 121. The third term of the sequence is 100.

The limit of u_n as n tends to infinity is 16.

Find the value of the fourth term of the sequence.

[5 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE	**Answer space for question 6**

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7 (a) (i) Express $\log_b(6x) - \log_b 18$ as a single term.

[1 mark]

(ii) Solve the equation

$$\log_b(x+4) = \log_b(6x) - \log_b 18 + \log_b(x-1)$$

where b is a positive constant.

[4 marks]

(b) (i) Given that $\log_m n = k$, express n in terms of m and k.

[1 mark]

(ii) Given that $p \log_8 x^2 = \log_2(x^2\sqrt{x})$, find the value of the constant p.

[4 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

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8 (a) Given that

$$9\sin^2\theta - 2\sin\theta\cos\theta = 8$$

show that

$$(\tan\theta - 4)(\tan\theta + 2) = 0$$

[3 marks]

(b) **Hence** solve the equation

$$9\sin^2 2x - 2\sin 2x\cos 2x = 8$$

in the interval $0° \leqslant x \leqslant 180°$, giving your values of x to the nearest degree.

[4 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

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9 (a) (i) Describe the geometrical transformation that maps the graph of $y = 2^x$ onto the graph of $y = 2^{2x}$.

[2 marks]

(ii) Describe the single geometrical transformation that maps the graph of $y = 2^x - 15$ onto the graph of $y = 2^{x+3} - 15$.

[2 marks]

(b) The curve C_1 has equation $y = 2^{2x}$. The curve C_2 has equation $y = 2^{x+3} - 15$.

The curves C_1 and C_2 intersect at the points A and B.

(i) Given that $u = 2^x$, express 2^{x+3} in terms of u.

[1 mark]

(ii) Find the gradient of the line AB, giving your answer in the form $\dfrac{p}{\log_2 q}$.

[6 marks]

QUESTION PART REFERENCE

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