Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

AS MATHEMATICS

Unit Pure Core 2

Wednesday 24 May 2017 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.

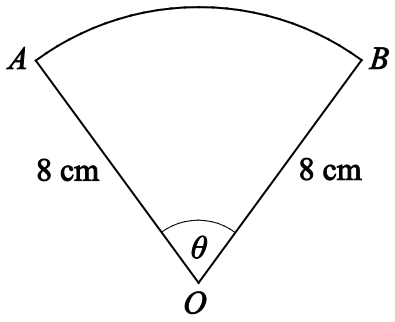
For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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 sector OAB of a circle with centre O and radius 8 cm.



The angle AOB is θ radians and the **perimeter** of the sector is 22 cm.

(a) Find the value of θ.

[2 marks]

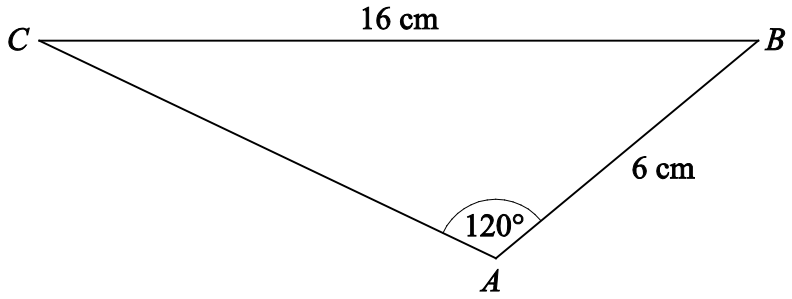
(b) Find the area of the sector.

[2 marks]

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

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

2 The diagram shows a triangle ABC.



The size of angle BAC is $120°$ and the lengths of AB and BC are 6 cm and 16 cm respectively.

(a) Show that angle ACB is $19°$, correct to the nearest degree.

[3 marks]

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

[3 marks]

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

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

3 (a) Express $\frac{\sqrt{27^x}}{3^{2x-1}}$ in the form 3^p, where p is an expression in terms of x.

[3 marks]

(b) **Hence** solve the equation $\frac{\sqrt{27^x}}{3^{2x-1}} = \sqrt[3]{81}$.

[2 marks]

QUESTION PART REFERENCE	**Answer space for question 3**

QUESTION PART REFERENCE	**Answer space for question 3**

4 The nth term of a geometric series is u_n, where $u_n = 162\left(\frac{2}{3}\right)^n$.

(a) Find the value of u_1 and the value of u_2.

[2 marks]

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

[3 marks]

(c) Find the smallest value of k for which $\sum_{n=k}^{\infty} u_n < 2.5$.

[3 marks]

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

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

5 A curve is defined for $x > 0$. The gradient of the curve at the point (x, y) is given by

$$\frac{\mathrm{d}y}{\mathrm{d}x} = x^{\frac{3}{2}} - 2x$$

(a) Show that there is a single value of x for which the curve has a stationary point.

[2 marks]

(b) Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ and hence show that the curve has a minimum point.

[3 marks]

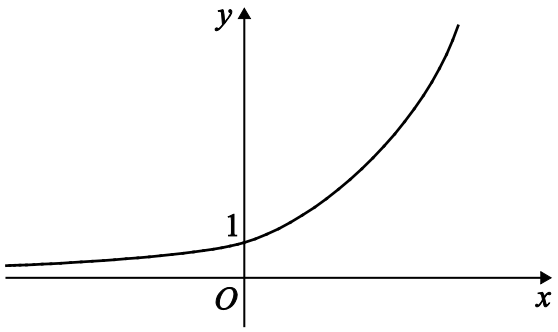
(c) The line with equation $y = 2$ is a tangent to the curve. Find the equation of the curve.

[4 marks]

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

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

6 The diagram shows a sketch of the curve $y = 2^{3x}$.



(a) (i) Use the trapezium rule with five ordinates (four strips) to find an approximate value for $\int_0^1 2^{3x}\,\mathrm{d}x$. Give your answer to two decimal places.

[4 marks]

(ii) State how you could obtain a better approximation to the value of $\int_0^1 2^{3x}\,\mathrm{d}x$ using the trapezium rule.

[1 mark]

(iii) The point $P(1,\ k)$ lies on the curve $y = 2^{3x}$. Use your answer to part **(a)(i)** to find an approximate value for the area of the region bounded by the curve, the line $x = 0$ and the line $y = k$. Give your answer to two decimal places.

[3 marks]

(b) The graph of $y = 2^{3x}$ can be mapped onto the graph of $y = 2^{3x-4}$ either by a translation or by a stretch.

(i) Describe the translation.

[2 marks]

(ii) Describe the stretch.

[2 marks]

(c) Use logarithms to solve the equation $2^{3x-4} = 7$, giving your value of x to three significant figures.

[2 marks]

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

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

7 (a) The region bounded by the curve $y = 7x + 6 - \frac{1}{x^2}$, the x-axis and the lines $x = 1$ and $x = 2$ lies above the x-axis. Show that the area of this region is 16.

[5 marks]

(b) The point Q lies on the curve $y = 7x + 6 - \frac{1}{x^2}$. The normal to this curve at Q is parallel to the line $2y + 8x = 3$. Find an equation of this normal at Q.

[6 marks]

QUESTION PART REFERENCE	**Answer space for question 7**

QUESTION PART REFERENCE	**Answer space for question 7**

8 (a) Solve the equation $\cos\theta = \frac{2}{3}$, giving all values of θ to the nearest degree in the interval $0° \leqslant \theta \leqslant 360°$.

[2 marks]

(b) (i) Given that $4\tan\theta\sin\theta = 4 - \cos\theta$, show that $3\cos^2\theta + 4\cos\theta - 4 = 0$.

[3 marks]

(ii) By solving the quadratic equation in part **(b)(i)**, explain why $\cos\theta$ can only take one value.

[2 marks]

(c) Hence solve the equation $4\tan 4x\sin 4x = 4 - \cos 4x$, giving all values of x to the nearest degree in the interval $0° \leqslant x \leqslant 180°$.

[4 marks]

QUESTION PART REFERENCE	**Answer space for question 8**

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9 Given that $3\log_2(c+2) - \log_2\left(\frac{c^3}{2} + k\right) = 1$, express $(c+1)^2$ in terms of k.

[7 marks]

QUESTION PART REFERENCE

Answer space for question 9

QUESTION PART REFERENCE	**Answer space for question 9**

QUESTION PART REFERENCE	**Answer space for question 9**

END OF QUESTIONS

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