Rewarding Learning

ADVANCED
General Certificate of Education
2018

Centre Number

Candidate Number

Mathematics

Assessment Unit C3
assessing
Module C3:
Core Mathematics 3

AMC31

[AMC31]
THURSDAY 31 MAY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer **all eight** questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen**.
Questions which require drawing or sketching should be completed using an H.B. pencil.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions. **Answers without working may not gain full credit**.
Answers should be given to three significant figures unless otherwise stated.
You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A copy of the **Mathematical Formulae and Tables booklet** is provided.
Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$

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1 **(a)** Solve

$$|4x - 1| > 5$$ [4]

[Turn over

(b) Write in partial fractions

$$\frac{7x + 18}{x^2 + 3x - 4}$$

[5]

2 Use Simpson's rule with four strips to find an approximate value for

$$\int_0^{\frac{\pi}{2}} x \cos x \, dx \qquad [5]$$

3 **(a)** **(i)** Using the binomial theorem, expand

$$(1 - 2x)^{-4}$$

in ascending powers of x, up to and including the term in x^3 [4]

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(ii) State the range of values of x for which this expansion is valid. [1]

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(b) The number of bacteria in a Petri dish can be modelled by the equation

$$N = N_0 e^{kt}$$

where N is the number of bacteria present after t seconds and N_0 is the initial number of bacteria.

(i) If it takes 10 seconds for the number of bacteria to double, find the value of k. [4]

(ii) Given that at $t = 0$, $N_0 = 3000$, find the number of bacteria that will be present after two minutes. [1]

4 **(i)** Differentiate $\cot^3 x$ [3]

(ii) Differentiate x^2e^{-3x} [4]

(iii) Differentiate $\frac{2x}{\ln x}$ [3]

5 **(a)** Find a Cartesian equation for the curve given parametrically by

$x = \sin\theta + 3$ $\qquad$ $y = 2\cos\theta$ [4]

[Turn over

(b) Solve

$$\operatorname{cosec} x + \frac{2}{\tan^2 x} = 1$$

for $180° \leqslant x \leqslant 360°$ [8]

6 **(a)** Integrate

$$4x^3 - e^x - \frac{1}{2x^2}$$

[3]

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(b) Find the exact value of

$$\int_1^9 \sqrt{x} + \frac{x}{x^2+5}\,dx$$

[5]

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7 **(a)** Show that

$$\frac{\mathrm{d}}{\mathrm{d}x}(\tan x) = \sec^2 x \qquad [5]$$

[Turn over

(b) Part of a metal sculpture can be modelled as the area bounded by the curve $y = \sec^2 2x$ and the lines $x = \frac{\pi}{6}$ and $y = 1$ as shown shaded in **Fig. 1** below.

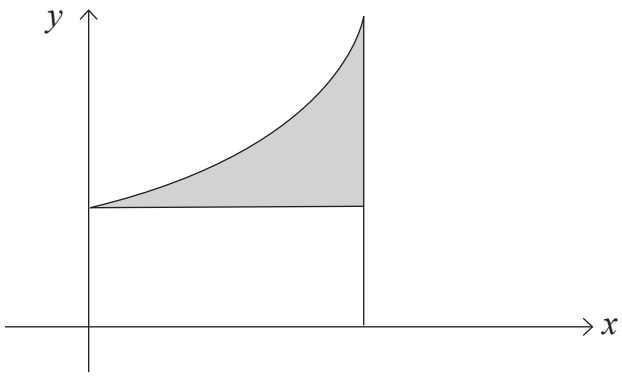


Fig. 1

Using calculus, find the area of metal required. [5]

[Turn over

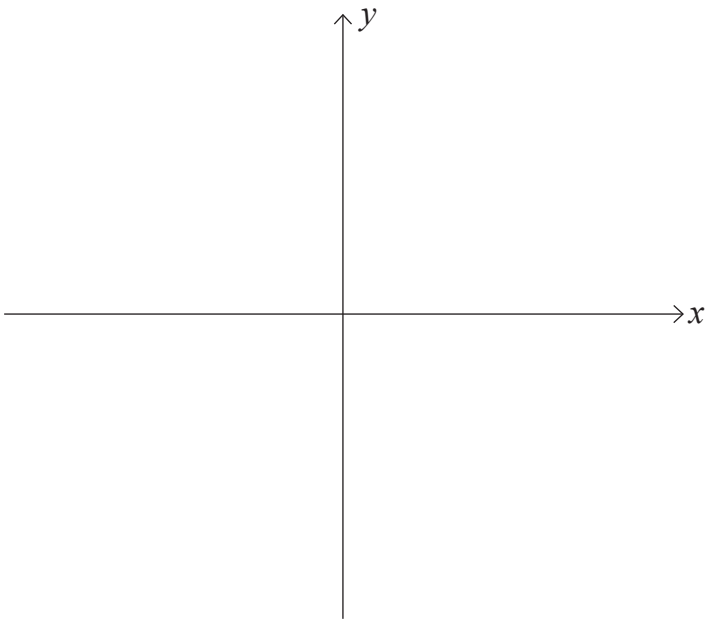
8 **(a)** **(i)** A curve has equation

$$y = \ln(1 - \cos^2 x)$$

Show that the gradient of this curve at any point (x, y) is $2\cot x$. [4]

(ii) Hence find the exact equation of the normal to the curve at the point where $x = \frac{\pi}{3}$ [4]

(b) On the axes below sketch the graph of $y = \ln|x - 1|$ [3]



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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Examiner Number