

ADVANCED General Certificate of Education 2018

Mathematics

Assessment Unit C4 assessing Module C4: Core Mathematics 4

Centre Number

Candidate Number

AMC41

[AMC41] WEDNESDAY 6 JUNE, 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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and the gradient of the curve when $t = 4$	[5]
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	$\mathbf{r}_1 = \begin{pmatrix} 1\\ -1 \end{pmatrix} + \lambda \begin{pmatrix} 1\\ 0 \end{pmatrix}$	
The	e line L_2 passes through the points (2, 3, -1) and (4, -1, 1).	
(i)	Find the vector equation of L_2	[3]

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(ii)	Show that L_1 and L_2 are perpendicular.	[4]
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The ful	icuons I and g are defin	ieu by
	$f(x) = \sqrt{2x+5}$	for $x \in \mathbb{R}$, $x \ge -2.5$
	$g(x) = \frac{1}{4x+1}$	for $x \in \mathbb{R}, x \neq -0.25$
(i) Sta	te the range of f.	
(ii) Fi	id the inverse function f	$f^{-1}(x)$ stating the domain of this function.
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$\sin 2x = \tan x$	for $0^{\circ} \leq x \leq 360^{\circ}$	I
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6	Ac	urve has the equation
		$y e^{-2x} = 2x + y^2$
	(i)	Show that the gradient function of this curve is given by
		$2 + 2y e^{-2x}$
		$e^{-2x} - 2y $ [7]
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;	Find the equation of the normal to this curve at the point P. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [
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- 7 Newton's law of cooling states that the rate at which the temperature of a liquid is falling is proportional to the difference between the temperature of the liquid and the temperature of its surroundings at that instant.

A mug of hot coffee is placed in a room which has a constant temperature of 20°C.

After t minutes the coffee has cooled to θ °C.

The rate at which the coffee is cooling can be modelled by the differential equation

$$\frac{\mathrm{d}\theta}{\mathrm{d}t} = -k(\theta - 20) \qquad \text{where } k \text{ is a constant.}$$

At time t = 0, the coffee has a temperature of 100°C. At t = 5, the coffee has a temperature of 68°C.

(i) Show that

$$\theta = 20 + 80e^{-\left(\frac{1}{5}\ln\frac{5}{3}\right)t}$$
[9]

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$\int x \cot^2 x dx$	[6

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$\frac{2}{x(2x-1)}$	[2]
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(ii) Use the substitution $x = u^2$, where *u* is positive, to show that

$$\int_{1}^{9} \frac{1}{x(2\sqrt{x}-1)} \, \mathrm{d}x = 2\ln\left(\frac{a}{b}\right)$$

viere <i>u</i> and <i>b</i> are integers to be found.	٢٥]
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For Examiner's use only	
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11211/4

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