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# FURTHER MATHEMATICS PAPER 2 0775

**JUNE 2020** 

### CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

## **\***Edukamer

ADVANCED LEVEL

Subject Title	Further Mathematics
Paper No.	Paper 2
Subject Code No.	0775

**\***Edukamer

#### **THREE Hours**

Answer ALL 10 questions.

For your guidance, the approximate mark allocation for parts of each question is indicated.

Mathematical formulae and tables published by the Board, and noiseless non-programmable electronic calculators are allowed.

In calculations, you are advised to show all the steps in your working, giving your answer at each stage.

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1. Use the substitution $y = vx$ , where v is a function of x, to transform the differential eq	uation
$x^2 \frac{dy}{dt} = x^2 + xy + y^2$	
dx	(3 marks)
Hence find the solution of this differential equation $f(x)$	(*
given that $y = 1$ when $x = 1$ .	(5 marks)
2. Solve for real $x$ , the equation	
$3\cosh 2x = 3 + \sinh 2x \; .$	(6 marks)
6. Given that $I_n = \int_0^1 x (1-x)^n dx,$	
where $n$ is a positive integer,	
show that $(n+2)L = nL = n \ge 1$	(5 marks)
$(n+2)I_n = nI_{n-1}, n \ge 1$ .	(o marks)
Hence, evaluate $\int_{0}^{5} x (1-x)^{5} dx$ .	(3 marks)
4. Find the cartesian equation of the curve with polar equation	
$r = \cos^2 \theta$ .	(3 marks)
Hence, show that the equation of the tangent to the curve at the point $\left(\frac{1}{2}, \frac{\pi}{4}\right)$ is	
1	
$r = \frac{1}{\sqrt{2}(3\sin\theta - \cos\theta)}.$	(4 marks)
5. Show that the equation of the normal to the hyperbola $xy = 4$	
at the point $P\left(2t,\frac{2}{t}\right)$ , $t \neq 0$ is	
$t^{3}x - ty - 2t^{4} + 2 = 0.$	(3 marks)
This normal cuts the hyperbola again at the point $Q$ .	
(i) Find the coordinates of $Q$ .	(2 marks)
(ii) Prove that the locus of the midpoint of the origin and $Q$ is another hyperbola.	
	(3 marks)
6. Given that $z = \cos\theta + i\sin\theta$ , (i) Show that	-
$z + \frac{1}{z} = 2\cos\theta .$	(2 marks)
(ii) Find in a similar manner, an expression for $z^2 + \frac{1}{z}$ .	(1 mark)
(iii) Show that $z^2$	
$z^2 - z + 2 - \frac{1}{2} + \frac{1}{2} = 4\cos^2\theta - 2\cos heta$ .	(2 marks)
$z = z^2$ Hence, solve the equation	. ,
$z^4 - z^3 + 2z^2 - z + 1 = 0,$	
giving the roots in the form $a + bi$ .	(3 marks)

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7.	(a) Given that S is a similarity transformation (similitude) defined by $r_{1} = (1 + i) r_{2} = 0 + 0i$	
	$z^{2} = (1+i)z - 2 + 3i$ ,	
	(i) the scale factor	(1 mark)
	(ii) the invariant point (centre) and	(2 marks)
	(iii) the angle of rotation of this transformation.	(2 marks)
	(b) A linear transformation, $T$ , is defined as follows	
	$T:\mathbb{R}^2 o\mathbb{R}^2$	
	$(x,y)\mapsto (2x+y, x-y).$	
	Determine the kernel of $T$ .	(3 marks)
8.	Solve in $\mathbb{N}$ , the system of equations	
	$3x \equiv 1 \pmod{5}$	
	$5x \equiv 2 \pmod{7}$	(8 marks)
9	A sequence $(u)$ is defined recursively by	
1.	A sequence, $(u_n)$ , is defined recursively by $u_n = 1$ , $u_n = 3$ and $u_n = 3u_n \pm 4u_n$	
	(i) Find $u_0 = 1$ , $u_1 = 3$ and $u_{n+1} = 3u_n + 4u_{n-1}$ .	(2 marks)
	(i) Find $u_2$ :	(3 marks)
	(11) Show that $u_{n+1} - 4u_n = (-1) (u_1 - 4u_0)$ .	(1 mark)
	(iii) Hence express $u_{n+1}$ in terms of $u_n$ .	(1 mark)
	Show that	(2 marks)
	(iv) $u_n$ is divergent.	(3 marks)
	(v) $u_n \ge 1$ , $\forall n \in \mathbb{N}$ .	(2 marks)
	$(v_1) = u_n$ is increasing. The other economics $(u_1)$ and $(u_2)$ are defined as	(,
	Two other sequences $(v_n)$ and $(w_n)$ are defined as	
	$v_n = u_n + u_{n-1}$ and $w_n = u_n - 4u_{n-1}, n \ge 1$ .	(3 marks)
	(vii) Show that $v_n$ and $w_n$ are geometric sequences.	(7 marks)
	(viii) Express $v_n$ and $w_n$ each in terms of $n$ .	(2  marks)
	Hence, or otherwise, express $u_n$ in terms of $n$ .	(2 marks)
 1	0. (a) A function, f, is defined by	
	$f(x)=\sqrt{x^2-3x+2}$ .	
	(i) Find the domain of $f$ .	(3 marks)
	(ii) Show that	
	$f(x) = \sqrt{\left(x - \frac{3}{2}\right)^2 - \frac{1}{4}}$ and that as $x \to +\infty$ , $f(x) \to x - \frac{3}{2}$ .	
	Find a similar expression for $f(x)$ as $x \to -\infty$ .	(4 marks)
	(iii) Hence, state the oblique asymptotes of $f$ .	(1 mark)
	(iv) Sketch the graph of $y = f(x)$ , showing clearly the asymptotes.	(3 marks)

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(b) Given that $g($	$x) = \frac{x^2}{2m-1}$ , defined on	]1,+ $\infty$ [, and the sequence $\left( u_{_{n}} ight)$ defined	
recursively b	2x - 1	고려 가 가려면서 해외 방다는 사람에서 가 가 가지 않는 것이 가지. 	
	$\int u_0 = 2$		1.5.0
Analise 11	$\left\{u_{n+1}=g\left(u_{n}\right)\right.$		fet in the
(i) Show that	$\forall x > 1$ , $g(x) > 1$ .	ika na konstanski stadi ostora	(3 marks
Given the se	quences $(v_n)$ and $(w_n)$ s	such that	(11) .
	$u_n = \frac{u_n - 1}{2}$ and $u_n = \frac{u_n - 1}{2}$	land a strategy and and and a	
	$u_n = u_n$	······································	
. For the Co			
show that			
(ii) $w_n$ is a	geometric sequence.		(4 marks
(iii) $v_n = 2^{-2}$	n •		(2 marks
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	a n fil a shi.	$f_{\rm eff} = \frac{1}{2} \left[ \frac{1}{2} \left[ \frac{1}{2} - \frac{1}{2} \right] \right] = \frac{1}{2} \left[ \frac{1}{2} \left[ \frac{1}{2} - \frac{1}{2} \right] \right]$	
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