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Mark Scheme (Results)

June 2011

GCE Core Mathematics C3 (6665) Paper 1

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EDEXCEL GCE MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

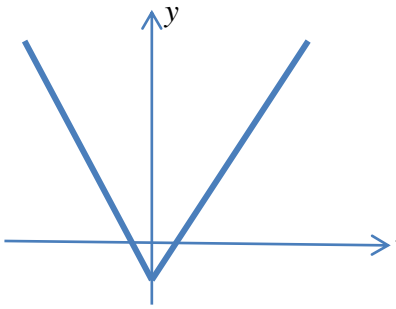
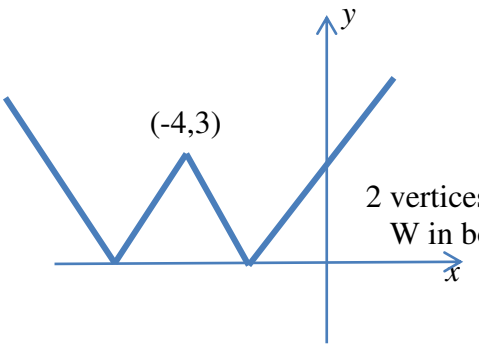
   - **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
   - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - **B** marks are unconditional accuracy marks (independent of M marks)
   - Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN.

   - bod – benefit of doubt
   - ft – follow through
   - the symbol $\hat{}$ will be used for correct ft
   - cao – correct answer only
   - cso - correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC: special case
   - oe – or equivalent (and appropriate)
   - dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - * The answer is printed on the paper
   - ⌊ The second mark is dependent on gaining the first mark

Question Number	Scheme	Marks
1 (a)	$\frac{1}{(x^2+3x+5)} \times \ldots . , = \frac{2x+3}{(x^2+3x+5)}$	M1,A1 (2)
(b)	Applying $\frac{vu'-uv'}{v^2}$	M1,
	$\frac{x^2\times-\sin x-\cos x\times 2x}{(x^2)^2} = \frac{-x^2\sin x-2x\cos x}{x^4} = \frac{-x\sin x-2\cos x}{x^3}$ oe	A2,1,0 (3)
		5 Marks
2 (a)	f(0.75)= -0.18… f(0.85) = 0.17…..	M1
	Change of sign, hence root between x=0.75 and x=0.85	A1 (2)
(b)	Sub x_0=0.8 into $x_{n+1} = [\arcsin(1-0.5x_n)]^{\frac{1}{2}}$ to obtain x_1	M1
	Awrt x_1=0.80219 and x_2=0.80133	A1
	Awrt x_3 = 0.80167	A1 (3)
(c)	f(0.801565) = -2.7…..×10^{-5} f(0.801575) = +8.6….×10^{-6}	M1A1
	Change of sign and conclusion	A1 (3)
	See Notes for continued iteration method	
		8 Marks

Question Number	Scheme	Marks
3 (a)	 V shape vertex on y axis &both branches of graph cross x axis 'y' co-ordinate of R is -6 (0,-6)	B1 B1 B1 (3)
(b)	 W shape 2 vertices on the negative x axis. W in both quad 1 & quad 2. R'=(-4,3)	B1 B1dep B1 (3) 6 Marks
4 (a)	$y = 4 - \ln(x+2)$ $\ln(x+2) = 4 - y$ $x + 2 = e^{4-y}$ $x = e^{4-y} - 2$ $f^{-1}(x) = e^{4-x} - 2$ oe	M1 M1A1 (3)
(b)	$x \leq 4$	B1 (1)
(c)	$fg(x) = 4 - \ln(e^{x^2} - 2 + 2)$ $fg(x) = 4 - x^2$	M1 dM1A1 (3)
(d)	$fg(x) \leq 4$	B1ft (1) 8 Marks

Question Number	Scheme	Marks
5 (a)	p=7.5	B1 (1)
(b)	$2.5 = 7.5e^{-4k}$	M1
	$e^{-4k} = \frac{1}{3}$	M1
	$-4k = \ln(\frac{1}{3})$	dM1
	$-4k = -\ln(3)$	
	$k = \frac{1}{4}\ln(3)$	A1*
	See notes for additional correct solutions and the last A1	(4)
(c)	$\frac{dm}{dt} = -kpe^{-kt}$ ft on their p and k	M1A1ft
	$-\frac{1}{4}ln3 \times 7.5e^{-\frac{1}{4}(ln3)t} = -0.6ln3$	
	$e^{-\frac{1}{4}(ln3)t} = \frac{2.4}{7.5} = (0.32)$	M1A1
	$-\frac{1}{4}(ln3)t = \ln(0.32)$	dM1
	t=4.1486…. 4.15 or awrt 4.1	A1
		(6)
		11Marks

Question Number	Scheme	Marks
6 (a)	$\frac{1}{\sin 2\theta} - \frac{\cos 2\theta}{\sin 2\theta} = \frac{1-\cos 2\theta}{\sin 2\theta}$	M1
	$= \frac{2\sin^2\theta}{2\sin\theta\cos\theta}$	M1A1
	$= \frac{\sin\theta}{\cos\theta} = \tan\theta$ cso	A1* (4)
(b)(i)	$\tan 15° = \frac{1}{\sin 30°} - \frac{\cos 30°}{sin 30°}$	M1
	$\tan 15° = \frac{1}{\frac{1}{2}} - \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = 2 - \sqrt{3}$ cso	dM1 A1* (3)
(b)(ii)	$\tan 2x = 1$	M1
	$2x = 45°$	A1
	$2x = 45° + 180°$	M1
	$x = 22.5°, 112.5°, 202.5°, 292.5°$	A1(any two) A1 (5)
	Alt for (b)(i) $\tan 15° = \tan(60° - 45°)$ *or* $\tan(45° - 30°)$	12 Marks
	$\tan 15° = \frac{\tan 60 - \tan 45}{1 + \tan 60 tan 45}$ *or* $\frac{\tan 45 - \tan 30}{1 + \tan 45 \tan 30}$	M1
	$\tan 15° = \frac{\sqrt{3}-1}{1+\sqrt{3}}$ *or* $\frac{1-\frac{\sqrt{3}}{3}}{1+\frac{\sqrt{3}}{3}}$	M1
	Rationalises to produce $\tan 15° = 2 - \sqrt{3}$	A1*

Question Number	Scheme	Marks
7 (a)	$x^2 - 9 = (x+3)(x-3)$	B1
	$\frac{4x-5}{(2x+1)(x-3)} - \frac{2x}{(x+3)(x-3)}$	
	$= \frac{(4x-5)(x+3)}{(2x+1)(x-3)(x+3)} - \frac{2x(2x+1)}{(2x+1)(x+3)(x-3)}$	M1
	$= \frac{5x-15}{(2x+1)(x-3)(x+3)}$	M1A1
	$= \frac{5(x-3)}{(2x+1)(x-3)(x+3)} = \frac{5}{(2x+1)(x+3)}$	A1*
		(5)
(b)	$f(x) = \frac{5}{2x^2+7x+3}$	
	$f'(x) = \frac{-5(\mathbf{4x}+\mathbf{7})}{(2x^2+7x+3)^2}$	M1**M1**A1
	$f'(-1) = -\frac{15}{4}$	M1A1
	Uses m_1m_2=-1 to give gradient of normal=$\frac{4}{15}$	M1
	$\frac{y-(-\frac{5}{2})}{(x--1)} = their\ \frac{4}{15}$	M1
	$y+\frac{5}{2} = \frac{4}{15}(x+1)$ or any equivalent form	A1
		(8)
		13 Marks

Question Number	Scheme	Marks
8		
(a)	$R^2 = 2^2 + 3^2$	M1
	$R = \sqrt{13}$ or 3.61 ….	A1
	$\tan\alpha = \frac{3}{2}$	M1
	$\alpha = 0.983$ …	A1
		(4)
(b)	$f'(x) = 2e^{2x}\cos 3x - 3e^{2x}\sin 3x$	M1A1A1
	$= e^{2x}(2\cos 3x - 3\sin 3x)$	M1
	$= e^{2x}(R\cos(3x + \alpha)$	
	$= Re^{2x}\cos(3x + \alpha)$	A1* cso
		(5)
(c)	$f'(x) = 0 \Rightarrow \cos(3x + \alpha) = 0$	M1
	$3x + \alpha = \frac{\pi}{2}$	M1
	x=0.196… awrt 0.20	A1
		(3)
		12 Marks
	Alternative to part (c)⇒	
	$f'(x) = 0 \Rightarrow 2\cos 3x - 3\sin 3x = 0$	M1
	$\tan 3x = \frac{2}{3}$	M1
	x=0.196… awrt 0.20	A1
		(3)

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