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Mark Scheme (Pre-standardisation)

June 2013

GCE Core Mathematics C3 (6665/01)

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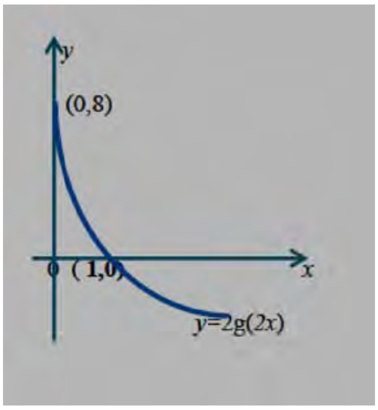
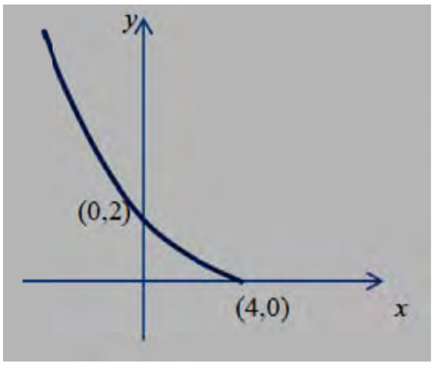
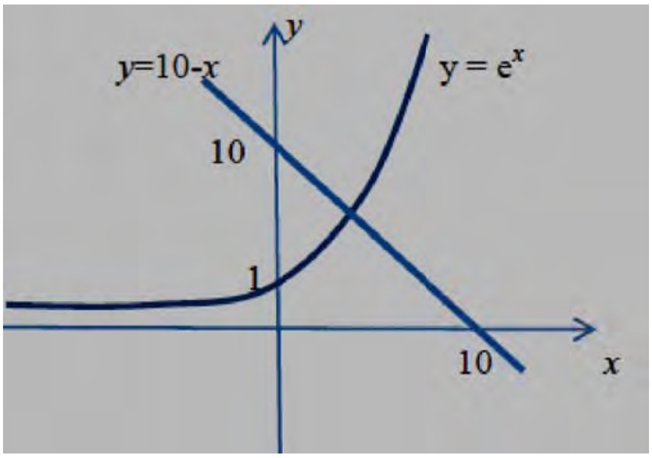
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Scheme	Marks
1.	(a) $x^2+3x+2=(x+2)(x+1)$	B1
	Attempt as a single fraction $\dfrac{6x+12-2(x^2+3x+2)}{x^2+3x+2}$ or $\dfrac{6-2(x+1)}{x+1}$	M1
	$=\dfrac{4-2x}{x+1}$	A1
		(3)
	(b)(i) 	
	Same shape	B1
	intercept at (0,8)	B1
	x intercept at (1,0)	B1
		(3)
	(b)(ii) 	
	Correct shape in quadrants 1& 2	B1
	Both (0,2) and (4,0)	B1
		(2)
		(8 marks)

Question Number	Scheme	Marks
2.	(a) $\cot 40^0 = \dfrac{1}{\tan 40^0} = \dfrac{1}{p}$	B1
		(1)
	(b) Attempts to use $1 + \tan^2 40^0 = \sec^2 40^0$	M1
	$\Rightarrow \sec 40^0 = \sqrt{(1 + p^2)}$	A1
		(2)
	(c) Attempts to use $\tan 85^0 = \tan(45^0 + 40^0) = \dfrac{\tan 45^0 + \tan 40^0}{1 - \tan 45^0 \tan 40^0}$	M1
	$\Rightarrow \tan 85^0 = \dfrac{1+p}{1-p}$	A1
		(2)
		(5 marks)

Question Number	Scheme	Marks
3.	(a) (2.5,0) (0,-5)	B1B1
		(2)
	(b) $2x-5=3-x \Rightarrow x=\frac{8}{3}$ oe.	B1
	$-2x-5=3-x \Rightarrow x=-8$	M1,A1
		(3)
		(5 marks)

Question Number	Scheme		Marks
4	(a)		
		Shape for $y = 10 - x$	B1
		Shape for $y = e^x$	B1
		co- ordinates correct (0,10),(10,0) and (0,1)	B1
			(3)
	(b) One solution as there is one point of intersection		B1√
			(1)
	(c) Sub x=2 and x=3 into $f(x) = e^x - 10 + x$		
	f(2)=-0.61, f(3)=(+)13.1		M1
	Both correct to 1sf, reason (change of sign) and conclusion (hence root)		A1
			(2)
	(d) Substitutes $x_1 = 2$ into $x_{n+1} = \ln(10 - x_n)$		M1
	$x_2 = 2.0794, \quad x_3 = 2.0695 \quad x_4 = 2.0707$		A1,A1
			(3)
			(9 marks)

Question Number	Scheme	Marks
5.	(a) (i) Applies $vu'+uv'$ to $x^{\frac{1}{2}}\ln x$	M1
	$=\ln x\times\frac{1}{2}x^{-\frac{1}{2}}+x^{\frac{1}{2}}\times\frac{1}{x}$	A1
	$=\frac{\ln x}{2\sqrt{x}}+\frac{1}{\sqrt{x}}$	A1*
		(3)
	(ii) Sets $\frac{\ln x}{2\sqrt{x}}+\frac{1}{\sqrt{x}}=0$	M1
	Multiplies (or factorises) by $\sqrt{x}$, with correct *ln* work leading to *x*=	M1
	$P=(e^{-2},-2e^{-1})$ oe.	A1,A1
		(4)
	(b) Applies $\frac{vu'-uv'}{v^2}$ to $y=\frac{x-k}{x+k}$ with $u=x-k$ and $v=x+k$	M1
	$\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{(x+k)\times1-(x-k)\times1}{(x+k)^2}$	A1
	$\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{2k}{(x+k)^2}$	A1
	As $k>0\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}>0\Rightarrow C$ has no turning points	B1
		(4)
		(11 marks)

Question Number	Scheme	Marks
6.	(a) $\mathrm{f}(x) \geq -3$	B1
		(1)
	(b) $\mathrm{f}(0) = 5$ or attempts to put their f(0) into $\mathrm{e}^{2x-8} - 4$	M1
	Correct answer ff(0)= $\mathrm{e}^{2} - 4$	A1
		(2)
	(c) Either $5 - 2x = 21 \Rightarrow x = -8$	M1A1
	Or $\mathrm{e}^{2x-8} - 4 = 21$	M1
	Correct order and ln work $\Rightarrow x = \dfrac{\ln 25 + 8}{2}$ oe. $\ln 5 + 4$	M1A1
		(5)
	(d) f does not have an inverse as it is a 'many to one' function	
	Accept f does not have an inverse as it is not a 'one to one' function	B1
		(1)
		(9 marks)

Question Number	Scheme	Marks
7.	(a) $\dfrac{\cos x}{1-\sin x}+\dfrac{1-\sin x}{\cos x}=\dfrac{\cos x\cos x+(1-\sin x)(1-\sin x)}{(1-\sin x)\cos x}$	M1A1
	$=\dfrac{\cos^2 x+\sin^2 x+1-2\sin x}{(1-\sin x)\cos x}$	
	$=\dfrac{2-2\sin x}{(1-\sin x)\cos x}$	M1
	$=\dfrac{2\cancel{(1-\sin x)}}{\cancel{(1-\sin x)}\cos x}$	
	$=\dfrac{2}{\cos x}=2\sec x$	A1*
		(4)
	(b) $\dfrac{\cos x}{1-\sin x}+\dfrac{1-\sin x}{\cos x}=8\sin x$	
	$2\sec x=8\sin x$	
	$1=4\sin x\cos x$ $a\sin x\cos x=b$	M1
	$\sin 2x=\dfrac{1}{2}$ $\sin 2x=2\sin x\cos x$	M1
	$x=\dfrac{1}{2}\arcsin(\dfrac{1}{2})=\dfrac{\pi}{12}$	M1,A1
		(4)
		(8 marks)

Question Number	Scheme	Marks
8.	(a) $9\cos\theta - 2\sin\theta = R\cos(\theta+\alpha)$	
	$R = \sqrt{(9^2+2^2} = \sqrt{85}$	B1
	$\alpha = \arctan(\frac{2}{9}) = 0.21866... = \text{awrt } 0.2187$	M1A1
		(3)
	(b) (i) $\sqrt{85}$	B1√
	(ii) $\theta+\alpha = 2\pi \Rightarrow \theta = \text{awrt } 6.06 \text{ 2dp}$	M1A1
		(3)
	(c) Seeing (or implied by their working)	
	$H = 10 - R\cos(\frac{\pi t}{5}+\alpha)$ for their R and α	M1
	$H_{\max} = 10 + \textit{their } R = 10+\sqrt{85}$ $(=19.22\text{m})$	A1√
	Maximum occurs when $\cos(\frac{\pi t}{5}+\alpha) = -1$ or $(\frac{\pi t}{5}+\alpha) = \pi$	M1
	t= awrt 4.65	A1
		(4)
	(d) Setting and solving $\frac{\pi t}{5} = 2\pi$ (for 1 cycle) or $\frac{\pi t}{5} = 4\pi$ (for 2 cycles)	M1
	Two revolutions = 20 minutes	A1
		(2)
		(12 marks)

Question Number	Scheme	Marks
9.	(a) $x=3$ or $(3,0)$	B1
		(1)
	(b) $\frac{dx}{dy}=\frac{1}{2}(9+16y-2y^2)^{-\frac{1}{2}}(16-4y)$ oe	M1M1A1
		(3)
	(c) Substitute $y=0$ into their $\frac{dx}{dy}$ or $\frac{dy}{dx}$	M1
	$\Rightarrow \frac{dx}{dy}=\frac{8}{3}$ or $\frac{dy}{dx}=\frac{3}{8}$	A1
	Uses their numerical $\frac{dy}{dx}$ and their 3 from (3,0) to find equation of tangent	
	$\frac{y-0}{x-3}=\frac{3}{8}$ or $y-0=\frac{3}{8}(x-3)$	M1A1
		(4)
		(8 marks)