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Mark Scheme (Pre-Standardisation)

Summer 2007

GCE

GCE Mathematics (6663/01)

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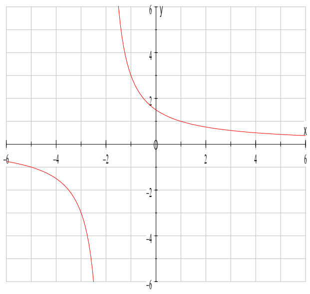
June 2007
6663 Core Mathematics C1
Mark Scheme

Question number	Scheme	Marks
1.	$9-5$ or $3^2+3\sqrt{5}-3\sqrt{5}-\sqrt{5}\times\sqrt{5}$ or $3^2-\sqrt{5}\times\sqrt{5}$ $=\underline{4}$	M1 A1 (2) **2**
	M1 for any correct, unsimplified expression $\left(\sqrt{5}\right)^2$ instead of 5 is OK Expansion of $\left(3+\sqrt{5}\right)\left(3+\sqrt{5}\right)$ is M0A0	

Question number	Scheme		Marks	
2.	(a) Attempt $\sqrt[3]{8}$ or $\sqrt[3]{(8^4)}$		M1	
	$= \underline{16}$		A1	(2)
	(b) $\underline{5x^{\frac{1}{3}}}$	$5,\ x^{\frac{1}{3}}$	B1, B1	(2)
				4
(a)	M1 for: 2 or $\sqrt[3]{8}$ or $\left(\sqrt[3]{8}\right)^4$ or 2^4 or $\sqrt[3]{8^4}$ or $\sqrt[3]{4096}$			
	A1 for 16 only			
SC	If they get $\sqrt[3]{8} = \alpha$ and then attempt $\alpha^4,\ \alpha \neq 2,$ this scores M1A0			
(b)	1st B1 for 5			
	2nd B1 for $x^{\frac{1}{3}}$			

Question number	Scheme	Marks
3.	(a) $\left(\frac{dy}{dx}\right) = 6x + \frac{4}{2}x^{-\frac{1}{2}}$ or $\left(6x + 2x^{-\frac{1}{2}}\right)$	M1 A1 (2)
	(b) $6 - x^{-\frac{3}{2}}$	M1 A1ft (2)
	(c) $x^3 + \frac{4x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)} + C$ A1: x^3 or $\frac{4x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)}$ A1: both and + C	M1 A1 A1 (3)
		7
(a)	M1 for <u>some</u> attempt to differentiate: $x^n \to x^{n-1}$ Condone missing $\frac{dy}{dx}$ or $y = \ldots$ A1 for both terms correct, as written or better.	
(b)	M1 for some attempt to differentiate again. Follow through their $\frac{dy}{dx}$ A1f.t. as written or better, follow through must have 2 terms and simplify e.g. $\frac{4}{4} = 1$	
(c)	M1 for some attempt to integrate: $x^n \to x^{n+1}$ 1st A1 for either x^3 or $\frac{4x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)}$ (or better) 2nd A1 for <u>both</u> x^3 and $\frac{4x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)}$ <u>and</u> $+C$. Obviously $\frac{8}{3}x^{\frac{3}{2}}$ or $\frac{8}{3}x\sqrt{x}$ etc is acceptable (but not <u>required</u>)for either A1.	

Question number	Scheme	Marks
4.	(a) Identify a = 5 and d = 2 (May be implied)	B1
	$(u_{200} =) a + 199d$ (= 5 + 199×2)	M1
	= <u>403</u>(p) or (£) <u>4.03</u>	A1 (3)
	(b) $(S_{200} =)\frac{200}{2}[2a+199d]$ or $\frac{200}{2}(a+\text{"their 403"})$	M1
	$= \frac{200}{2}[10+199\times 2]$ or $\frac{200}{2}(5+\text{"their 403"})$	A1
	= <u>40 800</u> or <u>£408</u>	A1 (3)
		6
(a)	M1 for use of nth term formula with n = 200. Follow through their a and d. Must be 199 not 200. A1 for 403 or 4.03 (i.e. condone missing £ sign here)	
N.B.	a = 3, d = 2 is B0 and a + 200d is M0 <u>BUT</u> $3+200\times 2$ is B1M1 and A1 if it leads to 403. Answer only of 403 (or 4.03) scores 3/3.	
(b)	M1 for use of correct sum formula with n = 200. Follow through their a and d and their 403. 1st A1 for any correct expression (i.e. must have a = 5 and d = 2) but can f.t. their 403 still. 2nd A1 for 40800 or £408 (i.e. the £ sign is required before we accept 408 this time).	

Question number	Scheme	Marks	
5.	(a) 		
	Translation parallel to x-axis	M1	
	Top branch intersects +ve y-axis Lower branch has no intersections No obvious overlap	A1	
	$\left(0, \frac{3}{2}\right)$ or $\frac{3}{2}$ marked on y- axis	B1	(3)
	(b) $x = -2, \quad y = 0$	B1, B1	(2)
S.C.	[Allow ft on first B1 for $x = 2$ when translated "the wrong way" but must be compatible with their sketch.]		
			5
(a)	M1 for a horizontal translation – one branch should cut y – axis		
	A1 for a horizontal translation to left. Ignore any figures on axes for this mark.		
	B1 for correct intersection on positive y-axis. More than 1 intersection is B0.		
(b)	1^{st} B1 for $x = -2$. Can accept $x = +2$ if this is compatible with their sketch. Usually they will have M1A0 in part (a) (and usually B0 too)		
	2^{nd} B1 for $y = 0$.		

Question number	Scheme	Marks
6.	(a) $2x^2 - x(x-4) = 8$	M1
	$x^2 + 4x - 8 = 0$ (*)	A1cso (2)
	(b) $x = \dfrac{-4 \pm \sqrt{4^2 - (4\times1\times-8)}}{2}$ or $(x+2)^2 \pm 4 - 8 = 0$	M1
	$x = - 2 \underline{+} \ldots$	A1
	$\sqrt{48} = \sqrt{16}\sqrt{3} = 4\sqrt{3}$	B1
	$y = \left(-2 \pm 2\sqrt{3}\right) - 4$ M: Attempt at least one y value	M1
	$\underline{x = -2 + 2\sqrt{3},\quad y = -6 + 2\sqrt{3}}$ $\underline{x = -2 - 2\sqrt{3},\quad y = -6 - 2\sqrt{3}}$	A1 (5)
		7
(a)	M1 for correct attempt to form an equation in x only. Condone sign errors/slips A1cso for correctly simplifying to printed form. No incorrect working seen.	
(b)	1st M1 for use of correct formula. If formula is not quoted then a fully correct substitution is required. Condone missing x = for M1. For completing the square must have as printed or better. 1st A1 for x = -2 $\underline{+}$ any correct expression B1 for simplifying the surd e.g. $\sqrt{48} = 4\sqrt{3}$. Must reduce to $b\sqrt{3}$ 2nd M1 for attempting to find at least one y value. 2nd A1 for both correct pairs of answers	

Question number	Scheme	Marks
7.	(a) Attempt to use discriminant b^2-4ac	M1
	$k^2-4(k+3)>0 \;\Rightarrow\; k^2-4k-12>0$ (*)	A1cso (2)
	(b) $k^2-4k-12=0 \;\Rightarrow$	
	$(k\pm a)(k\pm b)$, with $ab=12$ or $(k=)\dfrac{4\pm\sqrt{4^2--4\times12}}{2}$ or $(k-2)^2\pm2^2-12$	M1
	$k=-2$ and 6	A1
	$\underline{k<-2,\quad k>6}$ M: choosing "outside"	M1 A1ft (4)
		6

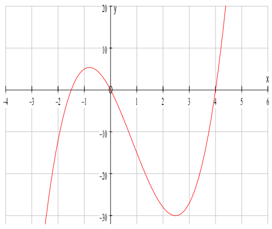
(a) M1 for use of b^2-4ac , one of b or c must be correct.
Or full attempt using completing the square that leads to a 3TQ in k
e.g. $\left(\left[x+\dfrac{k}{2}\right]^2=\right)\dfrac{k^2}{4}-(k+3)$

A1cso Correct argument to printed result. Need to state (or imply) that $b^2-4ac>0$ and no incorrect working seen.

(b)
1st M1 for attempting to find critical regions. Factors, formula or completing the square.
1st A1 for $k=6$ or -2 only
2nd M1 for choosing the outside regions
2nd A1f.t. as printed or f.t. their (non identical) critical values

$6<k<-2$ is M1A0 but ignore if it follows a correct version
$-2<k<6$ is M0A0 whatever their diagram looks like

Question number	Scheme	Marks	
8.	(a) $(a_2 =)\underline{3k+5}$	B1	(1)
	(b) $(a_3 =)3(3k+5)+5$	M1	
	$= \underline{9k + 20}$ (*)	A1cso	(2)
	(c)(i) $a_4 = 3(9k+20)+5 \quad (= 27k+65)$	M1	
	$\sum_{r=1}^{4} a_r = k + (3k+5) + (9k+20) + (27k+65)$	M1	
	(ii) $= 40k + 90$	A1	
	$= \underline{10(4k + 9)}$ (or explain why divisible by 10)	A1ft	(4) **7**
(b)	M1 for attempting to find a_3, follow through their $a_2 \neq k$. A1cso for simplifying to printed result with no incorrect working seen.		
(c)	1st M1 for attempting to find a_4 2nd M1 for attempting sum of 4 relevant terms 1st A1 for simplifying to $40k + 90$ or better 2nd A1ft for taking out a factor of 10 or an explanation in words. Follow through their sum of 4 terms provided that both Ms are scored and their sum <u>is</u> divisible by 10.		

Question number	Scheme	Marks	
9.	(a) $\mathrm{f}(x) = \frac{6x^3}{3} - \frac{10x^2}{2} - 12x \ (+C)$	M1 A1	
	$x = 5$: $250 - 125 - 60 + C = 65$ $C = 0$	M1 A1	(4)
	(b) $x(2x^2 - 5x - 12)$ or $(2x^2 + 3x)(x - 4)$ or $(2x + 3)(x^2 - 4x)$	M1	
	$= x(2x + 3)(x - 4)$ (*)	A1cso	(2)
	(c)  Shape	B1	
	Through origin	B1	
	$\left(-\frac{3}{2}, 0\right)$ and (4,0)	B1	(3)
			9
(a)	1^{st} M1 for attempting to integrate, $x^n \to x^{n+1}$ 1^{st} A1 for all x terms correct, need not be simplified. Ignore + C here. 2^{nd} M1 for some use of $x = 5$ and f(5)=65 to form an equation in C. No +C is M0. 2^{nd} A1 for $C = 0$. This mark cannot be scored unless a suitable equation is seen.		
(b)	M1 for attempting to take out a correct factor. Allow usual errors on signs. A1cso for proceeding to printed answer with no incorrect working seen.		
(c)	1^{st} B1 for positive x^3 shaped curve (with a max and a min) positioned anywhere. 2^{nd} B1 for any curve that passes through the origin 3^{rd} B1 for the two points given or values marked in appropriate places on x axis.		

Question number	Scheme	Marks
10.	(a) $x=1:\ y=-5+4=\underline{-1}$, $\quad x=2:\ y=-16+2=\underline{-14}$	B1, B1
	$PQ=\sqrt{(2-1)^2+(-14-(-1))^2}=\sqrt{170}$ (*)	M1 A1cso (4)
	(b) $y=x^3-6x^2+4x^{-1}$	M1
	$\frac{dy}{dx}=3x^2-12x-4x^{-2}$	M1 A1
	$x=1:\ \frac{dy}{dx}=3-12-4=-13$ M: Evaluate at one of the points	M1
	$x=2:\ \frac{dy}{dx}=12-24-1=-13$ $\therefore$ Parallel A: Both correct + conclusion	A1 (5)
	(c) Finding gradient of normal $\left(m=\frac{1}{13}\right)$	M1
	$y--1=\frac{1}{13}(x-1)$	M1 A1ft
	$\underline{x-13y-14=0}$ o.e.	A1 (4)
		13
(a)	M1 for attempting PQ or PQ^2 using their P and their Q. A1cso for proceeding to the correct answer with no incorrect working seen.	
(b)	1st M1 for multiplying by x^2, the x^3 or $-6x^2$ must be correct. 2nd M1 for some correct differentiation, at least one term must be correct as printed. 1st A1 for a fully correct derivative. 3rd M1 for attempting to substitute x = 1 or x = 2 in their derivative. Substituting in y is M0. 2nd A1 for -13 from both substitutions <u>and</u> a brief comment.	
(c)	1st M1 for use of the perpendicular gradient rule. Follow through their – 13. 2nd M1 for full method to find the equation of the normal. If formula is quoted allow slips in substitution, otherwise a correct substitution is required. 1st A1ft for a correct expression. Follow through their – 1 and their m if different from – 13. 2nd A1 for a correct equation with = 0 and integer coefficients.	

Question number	Scheme	Marks
11.	(a) $y=-\frac{3}{2}x(+4)$ Gradient = $-\frac{3}{2}$	M1 A1 (2)
	(b) $3x+2=-\frac{3}{2}x+4$ $x=\ldots,\ \underline{\frac{4}{9}}$	M1, A1
	$y=3\left(\frac{4}{9}\right)+2=\underline{\frac{10}{3}}\ \left(=3\frac{1}{3}\right)$	A1 (3)
	(c) Where y = 1, $l_1: x_A=-\frac{1}{3}$ $l_2: x_B=2$ M: Attempt one of these	M1 A1
	Area = $\frac{1}{2}(x_B-x_A)(y_P-1)$	M1
	$=\frac{1}{2}\times\frac{7}{3}\times\frac{7}{3}=\underline{\frac{49}{18}=2\frac{13}{18}}$	A1 (4)
		9
(a)	M1 for an attempt to write in the form $y = mx + c$ or a full method that leads to m = , e.g find 2 points, and attempt gradient using $\frac{y_2-y_1}{x_2-x_1}$ A1 for $m=-\frac{3}{2}$ (can ignore the $+c$)	
(b)	M1 for forming a suitable equation in one variable and attempting to solve leading to x =… 1st A1 for any exact correct value for x 2nd A1 for any exact correct value for y	
(c)	1st M1 for attempting the x coordinate of A or B 1st A1 for $x_A=-\frac{1}{3}$ and $x_B=2$ 2nd M1 for a full method for the area of the triangle e.g. determinant approach $\frac{1}{2}\begin{vmatrix}2 & -\frac{1}{3} & \frac{4}{9} & 2\\ 1 & 1 & \frac{10}{3} & 1\end{vmatrix}=\frac{1}{2}\left\|2-\ldots-(-\frac{1}{3}\ldots)\right\|$ 2nd A1 for $\frac{49}{18}$ or an exact equivalent.	