FOR OCR

GCE Examinations
Advanced / Advanced Subsidiary

Core Mathematics C3

Paper A

MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks could be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for using a valid method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.

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C3 Paper A – Marking Guide

1.	$= [\frac{3}{4}(2x-3)^{\frac{2}{3}}]_2^{15}$	M1 A1	
	$= \frac{3}{4}(27^{\frac{2}{3}} - 1)$	M1	
	$= \frac{3}{4}(9 - 1) = 6$	M1 A1	**(5)**
2.	$= \pi\int_1^3 \frac{(3x+1)^2}{x}\ dx$	M1	
	$= \pi\int_1^3 \frac{9x^2+6x+1}{x}\ dx = \int_1^3 (9x + 6 + \frac{1}{x})\ dx$	A1	
	$= \pi[\frac{9}{2}x^2 + 6x + \ln\lvert x\rvert]_1^3$	M1 A1	
	$= \pi\{(\frac{81}{2} + 18 + \ln 3) - (\frac{9}{2} + 6 + 0)\}$	M1	
	$= \pi(48 + \ln 3)$	A1	**(6)**
3.	*(i)* $\frac{dy}{dx} = 3(3x-5)^2 \times 3 = 9(3x-5)^2$	M1	
	grad = 9	A1	
	$\therefore\ y - 1 = 9(x - 2)$ $[\ y = 9x - 17\ ]$	M1 A1	
	(ii) $9(3x-5)^2 = 9,\quad 3x - 5 = \pm 1$	M1	
	$x = 2$ (at P), $\frac{4}{3}$ $\therefore\ Q\ (\frac{4}{3}, -1)$	A2	**(7)**
4.	$e^{2y} - x + 2 = 0 \Rightarrow e^{2y} = x - 2$		
	$2y = \ln(x - 2)$	M1	
	sub. $\Rightarrow \ln(x + 3) - \ln(x - 2) - 1 = 0$	A1	
	$\ln\frac{x+3}{x-2} = 1$	M1	
	$\frac{x+3}{x-2} = e$	A1	
	$x + 3 = e(x - 2),\quad 3 + 2e = x(e - 1)$	M1	
	$x = \frac{2e+3}{e-1} = 4.91$ (2dp), $y = \frac{1}{2}\ln(\frac{2e+3}{e-1} - 2) = 0.53$ (2dp)	A2	**(7)**
5.	*(i)* $\tan^{-1}(x - 2) = -\frac{\pi}{3}$	M1	
	$x - 2 = \tan(-\frac{\pi}{3}) = -\sqrt{3}$	M1	
	$x = 2 - \sqrt{3}$	A1	
	(ii) $1 - 2\sin^2\theta - \sin\theta - 1 = 0$	M1	
	$2\sin^2\theta + \sin\theta = 0,\quad \sin\theta(2\sin\theta + 1) = 0$	M1	
	$\sin\theta = 0$ or $-\frac{1}{2}$	A1	
	$\theta = 0$ or $-\frac{\pi}{6}, -\pi + \frac{\pi}{6}$		
	$\theta = -\frac{5\pi}{6}, -\frac{\pi}{6}, 0$	A2	**(8)**
6.	*(i)* $= f(\frac{1}{2}) = -\frac{5}{2}$	M1 A1	
	(ii) $gf(x) = \frac{2}{(3x-4)+3} = \frac{2}{3x-1}$	M1 A1	
	$\therefore\ \frac{2}{3x-1} = 6,\quad 2 = 6(3x - 1)$	M1	
	$x = \frac{4}{9}$	A1	
	(iii) $y = \frac{2}{x+3},\quad x + 3 = \frac{2}{y},\quad x = \frac{2}{y} - 3$	M1	
	$\therefore\ g^{-1}(x) = \frac{2}{x} - 3$	A1	**(8)**

7. *(i)* $2 \sin x - 3 \cos x = R \sin x \cos \alpha - R \cos x \sin \alpha$

$R \cos \alpha = 2,\ R \sin \alpha = 3$ — M1

$\therefore\ R = \sqrt{2^2 + 3^2} = \sqrt{13}$ — A1

$\tan \alpha = \frac{3}{2},\ \alpha = 56.3$ (3sf) — A1

$\therefore\ 2 \sin x° - 3 \cos x° = \sqrt{13} \sin (x - 56.3)°$

(ii) $\operatorname{cosec} x° + 3 \cot x° = 2 \ \Rightarrow\ \frac{1}{\sin x} + \frac{3\cos x}{\sin x} = 2$

$\Rightarrow\ 1 + 3 \cos x = 2 \sin x$

$\Rightarrow\ 2 \sin x° - 3 \cos x° = 1$ — B1

(iii) $\sqrt{13} \sin (x - 56.31) = 1$

$\sin (x - 56.31) = \frac{1}{\sqrt{13}}$ — M1

$x - 56.31 = 16.10,\ 180 - 16.10 = 16.10,\ 163.90$ — M1

$x = 72.4,\ 220.2$ (1dp) — A2 — **(8)**

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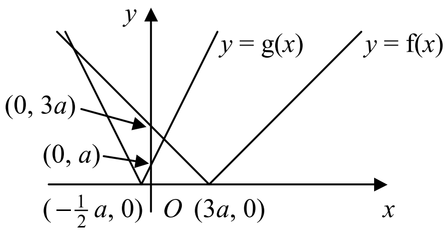
8. *(i)* $= \mathrm{f}(3a) = 0$ — M1 A1

(ii)



B4

(iii) $(x - 3a)^2 = (2x + a)^2$ — M1

$3x^2 + 10ax - 8a^2 = 0$ — A1

$(3x - 2a)(x + 4a) = 0$ — M1

$x = -4a,\ \frac{2}{3}a$ — A1 — **(10)**

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9. *(i)* $\frac{\mathrm{d}y}{\mathrm{d}x} = 2 - \frac{3}{2x+5} \times 2 = 2 - \frac{6}{2x+5}$ — M1

grad $= -4$, grad of normal $= \frac{1}{4}$ — A1

$\therefore\ y + 4 = \frac{1}{4}(x + 2) \qquad [\ y = \frac{1}{4}x - \frac{7}{2}\ ]$ — M1 A1

(ii) $\frac{1}{4}x - \frac{7}{2} = 2x - 3 \ln (2x + 5)$ — M1

$\frac{7}{4}x + \frac{7}{2} - 3 \ln (2x + 5) = 0$

let $\mathrm{f}(x) = \frac{7}{4}x + \frac{7}{2} - 3 \ln (2x + 5)$

$\mathrm{f}(1) = -0.59,\ \mathrm{f}(2) = 0.41$ — M1

sign change, f(x) continuous $\therefore$ root — A1

(iii) $\frac{7}{4}x + \frac{7}{2} - 3 \ln (2x + 5) = 0$

$7x + 14 - 12 \ln (2x + 5) = 0$

$7x = 12 \ln (2x + 5) - 14$ — M1

$x = \frac{12}{7} \ln (2x + 5) - 2$ — A1

(iv) $x_{n+1} = \frac{12}{7} \ln (2x_n + 5) - 2,\ x_0 = 1.5$

$x_1 = 1.5648,\ x_2 = 1.5923,\ x_3 = 1.6039,\ x_4 = 1.6087,\ x_5 = 1.6107$ — M1

$q = 1.61$ (3sf) — A1

$\mathrm{f}(1.605) = -0.0073,\ \mathrm{f}(1.615) = 0.0029$ — M1

sign change, f(x) continuous $\therefore$ root $\therefore\ q = 1.61$ (3sf) — A1 — **(13)**

Total **(72)**

Performance Record – C3 Paper A

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	Total
Topic(s)	integration	integration	differentiation	exponentials and logarithms	trigonometry	functions	trigonometry	functions	differentiation, numerical methods	
Marks	5	6	7	7	8	8	8	10	13	72
Student										