FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C3

Paper G

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 G – Marking Guide

1. *(i)* $\ln(2+\cos a)=0,\quad 2+\cos a=1,\quad \cos a=-1,\quad a=\pi$ — M1 A1

(ii)

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π
y	1.0986	0.9959	0.6931	0.2569	0

M1

area $\approx \frac{1}{3}\times\frac{\pi}{4}\times[1.0986+0+4(0.9959+0.2569)+2(0.6931)]$ — M1

$=1.96$ (3sf) — A1 **(5)**

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2. *(i)* $=f(2)=-2$ — M1 A1

(ii) $gf(x)=g(2-x^2)=\frac{3(2-x^2)}{2(2-x^2)-1}=\frac{6-3x^2}{3-2x^2}$ — M1 A1

$\therefore\ \frac{6-3x^2}{3-2x^2}=\frac{1}{2},\qquad 2(6-3x^2)=3-2x^2$

$x^2=\frac{9}{4}$ — M1

$x=\pm\frac{3}{2}$ — A1 **(6)**

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3. $\frac{dy}{dx}=\frac{1\times(x^2-2x+5)-(x-1)(2x-2)}{(x^2-2x+5)^2}=\frac{-x^2+2x+3}{(x^2-2x+5)^2}$ — M1 A2

SP: $\frac{-x^2+2x+3}{(x^2-2x+5)^2}=0,\qquad -x^2+2x+3=0$

$-(x+1)(x-3)=0$ — M1

$x=-1,\ 3$ — A1

$\therefore\ (-1,\ -\frac{1}{4}),\ (3,\ \frac{1}{4})$ — A1 **(6)**

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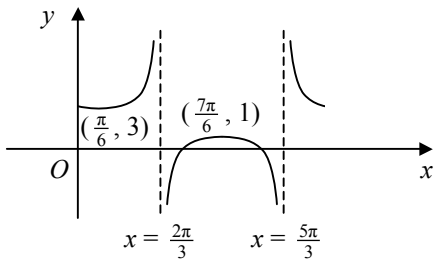
4. *(i)*



M2 A2

(ii) $2+\sec(x-\frac{\pi}{6})=0$

$\sec(x-\frac{\pi}{6})=-2,\qquad \cos(x-\frac{\pi}{6})=-\frac{1}{2}$ — M1

$x-\frac{\pi}{6}=\pi-\frac{\pi}{3},\ \pi+\frac{\pi}{3}=\frac{2\pi}{3},\ \frac{4\pi}{3}$ — M1

$x=\frac{5\pi}{6},\ \frac{3\pi}{2}$ — A2 **(8)**

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5. *(i)* $x=3,\ y=\sqrt{20}=2\sqrt{5}$ — B1

$\frac{dy}{dx}=\frac{1}{2}(3x+11)^{-\frac{1}{2}}\times 3=\frac{3}{2}(3x+11)^{-\frac{1}{2}}$ — M1

grad $=\frac{3}{4\sqrt{5}}$ — A1

$\therefore\ y-2\sqrt{5}=\frac{3}{4\sqrt{5}}(x-3)$ — M1

$4\sqrt{5}\,y-40=3x-9$

$3x-4\sqrt{5}\,y+31=0$ — A1

(ii) normal: $y-2\sqrt{5}=-\frac{4\sqrt{5}}{3}(x-3)$ — M1

at Q, $x=0\ \therefore\ y-2\sqrt{5}=4\sqrt{5}$ — M1

$y=6\sqrt{5}$ — A1 **(8)**

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6. *(i)* $3\cos x + \sin x = R\cos x\cos\alpha + R\sin x\sin\alpha$

$R\cos\alpha = 3,\ R\sin\alpha = 1$ M1

$\therefore\ R = \sqrt{3^2+1^2} = \sqrt{10}$ A1

$\tan\alpha = \frac{1}{3},\ \alpha = 18.4$ (3sf) A1

$\therefore\ 3\cos x° + \sin x° = \sqrt{10}\cos(x - 18.4)°$

(ii) $6\cos^2 x + 2\sin x\cos x = 0$ M1

$2\cos x(3\cos x + \sin x) = 0$ M1

$\cos x = 0$ or $3\cos x + \sin x = \sqrt{10}\cos(x - 18.4) = 0$ A1

$x = 90, 270$ or $x - 18.4 = 90, 270$

$x = 90, 108.4$ (1dp), $270, 288.4$ (1dp) A2 **(8)**

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7. *(i)* $= \int_1^4 (x + \frac{2}{x})\ dx = [\frac{1}{2}x^2 + 2\ln|x|]_1^4$ M1 A1

$= (8 + 2\ln 4) - (\frac{1}{2} + 0) = 7\frac{1}{2} + 2\ln 4$ M1 A1

(ii) $= \pi\int_1^4 (x + \frac{2}{x})^2\ dx = \pi\int_1^4 (x^2 + 4 + 4x^{-2})\ dx$ M1

$= \pi[\frac{1}{3}x^3 + 4x - 4x^{-1}]_1^4$ M1 A1

$= \pi[(\frac{64}{3} + 16 - 1) - (\frac{1}{3} + 4 - 4)] = 36\pi$ M1 A1 **(9)**

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8. *(i)* $P = 30 + 50e^{0.002\times 30} = 83.1$ M1

$\therefore$ population $= 83\,100$ (3sf) A1

(ii) $30 + 50e^{0.002t} > 84,\qquad e^{0.002t} > \frac{54}{50}$ M1

$t > \frac{1}{0.002}\ln\frac{54}{50},\ t > 38.5\ \therefore$ 2018 M1 A1

(iii) $30 + 50e^{0.002t} = 26 + 50e^{0.003t},\qquad 50e^{0.003t} - 50e^{0.002t} = 4$

$e^{0.003t} - e^{0.002t} = 0.08,\qquad e^{0.002t}(e^{0.001t} - 1) = 0.08$ M1

$e^{0.001t} - 1 = 0.08e^{-0.002t}$ M1

$0.001t = \ln(1 + 0.08e^{-0.002t})$

$t = 1000\ln(1 + 0.08e^{-0.002t})$ A1

(iv) $t_1 = 69.887,\ t_2 = 67.251,\ t_3 = 67.595$ M1 A1

$\therefore$ 2047 A1 **(11)**

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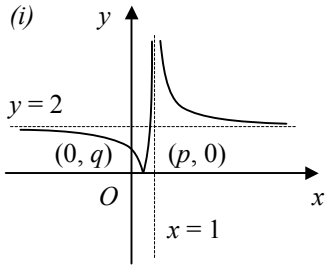
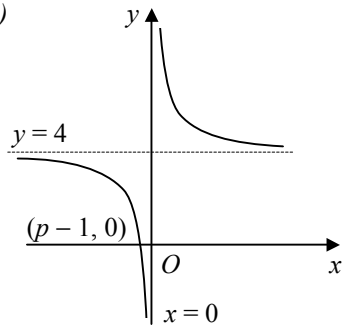
9. *(a)* *(i)*



(ii)



M1 A1

M2 A1

(b) $y = 0 \Rightarrow 2x - 1 = 0 \Rightarrow x = \frac{1}{2}\ \therefore p = \frac{1}{2}$ M1 A1

$x = 0 \Rightarrow y = 1\ \therefore q = 1$ B1

(c) $y = \frac{2x-1}{x-1},\qquad y(x-1) = 2x - 1,\qquad x(y-2) = y - 1$ M1

$x = \frac{y-1}{y-2}$

$\therefore\ f^{-1}(x) = \frac{x-1}{x-2}$ M1 A1 **(11)**

Total **(72)**

Performance Record – C3 Paper G

Question no.	1	2	3	4	5	6	7	8	9	Total
Topic(s)	Simpson's rule	functions	differentiation	trigonometry	differentiation	trigonometry	integration	exponentials and logarithms, numerical methods	functions	
Marks	5	6	6	8	8	8	9	11	11	72
Student										