FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C2

Paper J

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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C2 Paper J – Marking Guide

1. *(i)* $r = \frac{-15}{75} = -\frac{1}{5}$ M1 A1

(ii) $= \frac{75}{1-(-\frac{1}{5})} = 62\frac{1}{2}$ M1 A1 **(4)**

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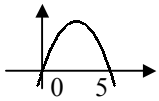
2. $5x - x^2 = 0$
$x(5 - x) = 0$
crosses x-axis at (0, 0) and (5, 0)



B1

area $= \int_0^5 (5x - x^2)\ dx$

$= [\frac{5}{2}x^2 - \frac{1}{3}x^3]_0^5$ M1 A2

$= (\frac{125}{2} - \frac{125}{3}) - (0)$ M1

$= 20\frac{5}{6}$ A1 **(6)**

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3. *(i)* 11 a.m. $\therefore t = 3$
$N = 20\,000 \times (1.06)^3 = 23820$ (nearest unit) M1 A1

(ii) $40\,000 = 20\,000 \times (1.06)^t$
$(1.06)^t = 2$ M1

$t = \frac{\lg 2}{\lg 1.06} = 11.8957$ M1 A1

11.8957 hours = 11 hours 54 mins $\therefore$ 7.54 p.m. A1 **(6)**

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4. *(i)*

x	2	3	4	5	6
y	2.89	6.36	11.55	18.50	27.27

B2

(ii) area $\approx \frac{1}{2} \times 1 \times [2.89 + 27.27 + 2(6.36 + 11.55 + 18.50)]$ B1 M1

$= 51.5$ (3sf) A1

(iii) over-estimate B1
the curve passes below the top edge of each trapezium B1 **(7)**

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5. *(i)* $\sin^2\theta = (2 - \sqrt{2})^2 = 4 - 4\sqrt{2} + 2 = 6 - 4\sqrt{2}$ M1

$\cos^2\theta = 1 - (6 - 4\sqrt{2}) = -5 + 4\sqrt{2}$ M1 A1

(ii) $3x = \frac{\pi}{6}, 2\pi - \frac{\pi}{6}, 2\pi + \frac{\pi}{6}$ B1 M1

$3x = \frac{\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}$ A1

$x = \frac{\pi}{18}, \frac{11\pi}{18}, \frac{13\pi}{18}$ M1 A1 **(8)**

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6. *(i)* isosceles $\therefore \angle AMB = 90°$

$BM = 4 \tan 30° = \frac{4}{\sqrt{3}}$ M1 A1

area $= \frac{1}{2} \times 8 \times \frac{4}{\sqrt{3}} = \frac{16}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{16}{3}\sqrt{3}$ cm^2 M1 A1

(ii) area of sector $= \frac{1}{2} \times 4^2 \times \frac{\pi}{6} = \frac{4}{3}\pi$ B1 M1

shaded area $= \frac{16}{3}\sqrt{3} - (2 \times \frac{4}{3}\pi)$ M1

$= \frac{16}{3}\sqrt{3} - \frac{8}{3}\pi = \frac{8}{3}(2\sqrt{3} - \pi)$ cm^2 A1 **(8)**

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7. *(i)* $= 2^4 + 4(2^3)(x) + 6(2^2)(x^2) + 4(2)(x^3) + x^4$ M1 A1
$= 16 + 32x + 24x^2 + 8x^3 + x^4$ B1 A1

(ii) $(2 - x)^4 = 16 - 32x + 24x^2 - 8x^3 + x^4$ M1
$(2 + x)^4 + (2 - x)^4 = 32 + 48x^2 + 2x^4$, $A = 32$, $B = 48$, $C = 2$ A1

(iii) $32 + 48x^2 + 2x^4 = 136$
$x^4 + 24x^2 - 52 = 0$
$(x^2 + 26)(x^2 - 2) = 0$ M1
$x^2 = -26$ (no real solutions) or 2 A1
$x = \pm\sqrt{2}$ A1 **(9)**

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8. *(i)* $y = \int (3 - \frac{2}{x^2})\ dx$
$y = 3x + 2x^{-1} + c$ M1 A2
(2, 6) $\therefore$ $6 = 6 + 1 + c$ M1
$c = -1$ A1
$\therefore$ $y = 3x + 2x^{-1} - 1$ A1

(ii) $\int_2^3 (6\sqrt{x} - \frac{4}{\sqrt{x}})\ dx = [4x^{\frac{3}{2}} - 8x^{\frac{1}{2}}]_2^3$ M1 A2
$= [4(3\sqrt{3}) - 8\sqrt{3}] - [4(2\sqrt{2}) - 8\sqrt{2}]$ M1 B1
$= (12\sqrt{3} - 8\sqrt{3}) - (8\sqrt{2} - 8\sqrt{2})$
$= 4\sqrt{3}$ $[k = 4]$ A1 **(12)**

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9. *(i)* f(−1) = r $\therefore$ $-1 + k + 7 - 15 = r$ M1
$k = r + 9$ A1
f(3) = $3r$ $\therefore$ $27 + 9k - 21 - 15 = 3r$ M1
$3k = r + 3$
subtracting, $2k = -6$ M1
$k = -3$ A1

(ii) $r = -3 - 9 = -12$ B1

(iii) $f(x) = x^3 - 3x^2 - 7x - 15$
$f(5) = 125 - 75 - 35 - 15 = 0$ $\therefore$ $(x - 5)$ is a factor M1 A1

(iv)

$$\begin{array}{r|l} x - 5 & x^2 + 2x + 3 \\ \hline & x^3 - 3x^2 - 7x - 15 \\ & x^3 - 5x^2 \\ \hline & \quad 2x^2 - 7x \\ & \quad 2x^2 - 10x \\ \hline & \quad\quad 3x - 15 \\ & \quad\quad 3x - 15 \\ \hline \end{array}$$

M1 A1

$\therefore$ $(x - 5)(x^2 + 2x + 3) = 0$
$x = 5$ or $x^2 + 2x + 3 = 0$
$b^2 - 4ac = 2^2 - (4 \times 1 \times 3) = -8$ M1
$b^2 - 4ac < 0$ $\therefore$ no real solutions to quadratic
$\therefore$ only one real solution A1 **(12)**

Total **(72)**

Performance Record – C2 Paper J

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	Total
Topic(s)	GP	area by integr.	logs	trapezium rule	trig. eqn	sector of a circle	binomial	integr.	remain. theorem, alg. div.	
Marks	4	6	6	7	8	8	9	12	12	72
Student										