

Solomon Press
Core Mathematics C2
Paper J
(Mark Scheme)

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GCE Examinations
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 knowing and using a method.

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

(B) marks are independent of method marks.



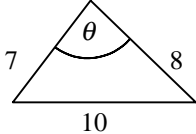
Written by Shaun Armstrong

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C2 Paper J – Marking Guide

1. (a) 11 a.m. $\therefore t = 3$
 $N = 20\,000 \times (1.06)^3 = 23820$ (nearest unit) M1 A1
- (b) $40\,000 = 20\,000 \times (1.06)^t$
 $(1.06)^t = 2$ 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)
-

2.  $10^2 = 7^2 + 8^2 - (2 \times 7 \times 8 \times \cos \theta)$ M1 A1
 $\cos \theta = \frac{49 + 64 - 100}{112} = \frac{13}{112}$
 $\theta = 83.335$ M1 A1
 $\text{area} = \frac{1}{2} \times 7 \times 8 \times \sin 83.335$ M1
 $= 27.8 \text{ cm}^2$ (3sf) A1 (6)
-

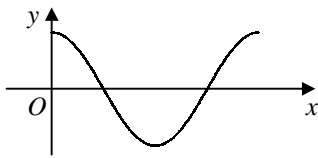
3. (a)

x	0	0.25	0.5	0.75	1	
$\frac{4x}{(x+1)^2}$	0	0.64	0.8889	0.9796	1	

M1
 $\text{area} \approx \frac{1}{2} \times 0.25 \times [0 + 1 + 2(0.64 + 0.8889 + 0.9796)]$ A1
 $= 0.752$ (3sf) B1 M1
 (b) under-estimate A1
 the curve passes above the top edge of each trapezium B1 (7)
-

4. (a) $(x + \frac{k}{x^2})^{15} = x^{15} + 15(x^{14})(\frac{k}{x^2}) + \binom{15}{2}(x^{13})(\frac{k}{x^2})^2 + \dots$ M1 A1
 $\therefore 15k = 30$ M1
 $k = 2$ A1
 $A = \frac{15 \times 14}{2} \times k^2 = 420$ A1
- (b) $(x + \frac{2}{x^2})^{15} = \dots + \binom{15}{5}(x^{10})(\frac{2}{x^2})^5 + \dots$ M1 A1
 term indep. of $x = \frac{15 \times 14 \times 13 \times 12 \times 11}{5 \times 4 \times 3 \times 2} \times 32 = 96\,096$ A1 (8)
-

5. (a) $4x^{\frac{1}{3}} - x = 0$
 $x^{\frac{1}{3}}(4 - x^{\frac{2}{3}}) = 0$ M1
 $x^{\frac{1}{3}} = 0$ (at O) or $x^{\frac{2}{3}} = 4$ M1
 $x \geq 0 \therefore x = (\sqrt[3]{4})^3 = 8, a = 8$ A1
- (b) $= \int_0^8 (4x^{\frac{1}{3}} - x) dx$
 $= [3x^{\frac{4}{3}} - \frac{1}{2}x^2]_0^8$ M1 A2
 $= (48 - 32) - (0) = 16$ M1 A1 (8)
-

6. (a) 
- (b) $(0, 1), (\frac{\pi}{4}, 0), (\frac{3\pi}{4}, 0)$
- (c) $\cos 2x = 0.5$
 $2x = \frac{\pi}{3}, 2\pi - \frac{\pi}{3}$
 $2x = \frac{\pi}{3}, \frac{5\pi}{3}$
 $x = \frac{\pi}{6}, \frac{5\pi}{6}$

B2

B3

B1 M1

M1 A1 (9)

7. (a) $= (\frac{-2+4}{2}, \frac{6-1}{2}) = (1, \frac{5}{2})$
- (b) radius = dist. $(-2, 6)$ to $(1, \frac{5}{2}) = \sqrt{9 + \frac{49}{4}} = \sqrt{\frac{85}{4}}$
 $\therefore (x-1)^2 + (y - \frac{5}{2})^2 = (\sqrt{\frac{85}{4}})^2$
 $x^2 - 2x + 1 + y^2 - 5y + \frac{25}{4} = \frac{85}{4}$
 $x^2 + y^2 - 2x - 5y - 14 = 0$
- (c) $(2, 7)$, LHS = $4 + 49 - 4 - 35 - 14 = 0 \therefore R$ lies on circle
 $\angle PRQ = 90^\circ$

M1 A1

M1 A1

M1 A1

A1

B1

B1 (9)

8. (a) $r = \frac{\log_3 16}{\log_3 4} = \frac{\log_3 4^2}{\log_3 4} = \frac{2 \log_3 4}{\log_3 4} = 2$
- (b) $ar = \log_3 4$
 $a = \frac{\log_3 4}{2} = \frac{\log_3 2^2}{2} = \frac{2 \log_3 2}{2} = \log_3 2$
- (c) $S_6 = \frac{(2^6 - 1) \log_3 2}{2 - 1} = 63 \log_3 2$
 $= 63 \times \frac{\lg 2}{\lg 3} = 39.7$

M2 A1

M1 A1

M1 A1

M1 A1 (9)

9. (a) $f(3) = 27 - 36 - 9 + 18 = 0 \therefore (x-3)$ is a factor
- (b)
$$\begin{array}{r} x^2 - x - 6 \\ x-3 \overline{) x^3 - 4x^2 - 3x + 18} \\ \underline{x^3 - 3x^2} \\ -x^2 - 3x \\ \underline{-x^2 + 3x} \\ -6x + 18 \\ \underline{-6x + 18} \\ 0 \end{array}$$
- $f(x) = (x-3)(x^2 - x - 6)$
 $f(x) = (x-3)(x+2)(x-3) = (x+2)(x-3)^2$
- (c) $(3, 0)$
 $(x-3)$ is a repeated factor of $f(x) \therefore x$ -axis is tangent where $x = 3$
- (d) $f'(x) = 3x^2 - 8x - 3$
for SP, $3x^2 - 8x - 3 = 0$
 $(3x+1)(x-3) = 0$
 $x = -\frac{1}{3}, 3 \therefore x = -\frac{1}{3}$

M1 A1

M1 A1

M1 A1

B1

B1

M1 A1

M1

M1

A1 (13)

Total (75)