

GCE Examinations
Advanced Subsidiary

Core Mathematics C2

Paper E

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.

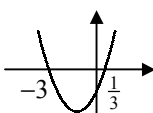


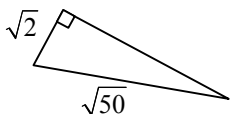
Written by Shaun Armstrong

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C2 Paper E – Marking Guide

1.	$= [2x + x^{-1}]_2^4$ $= (8 + \frac{1}{4}) - (4 + \frac{1}{2}) = 3\frac{3}{4}$	M1 A1 M1 A1 (4)								
2.	$f'(x) = 3x^2 + 8x - 3$ increasing when $3x^2 + 8x - 3 \geq 0$ $(3x - 1)(x + 3) \geq 0$ $x \leq -3$ or $x \geq \frac{1}{3}$ 	M1 A1 M1 M1 A1 (5)								
3.	(a) $= \log_2 (3^2 \times 5)$ $= 2 \log_2 3 + \log_2 5 = 2p + q$ (b) $= \log_2 \frac{3}{5 \times 2} = \log_2 3 - \log_2 5 - \log_2 2$ $= p - q - 1$	B1 M1 A1 M1 B1 A1 (6)								
4.	(a) $(1 + kx)^7 = \dots + \binom{7}{2}(kx)^2 + \dots$ $\therefore \frac{7 \times 6}{2} \times k^2 = 525$ $k^2 = \frac{525}{21} = 25$ $k > 0 \therefore k = 5$ (b) $(1 + 5x)^7 = \dots + \binom{7}{3}(5x)^3 + \dots$ $\therefore \text{coeff. of } x^3 = \frac{7 \times 6 \times 5}{3 \times 2} \times 125 = 4375$ (c) $(1 + 5x)^7 = 1 + 35x + 525x^2 + \dots$ $(2 - x)(1 + 5x)^7 = (2 - x)(1 + 35x + 525x^2 + \dots)$ $= 2 + 70x + 1050x^2 - x - 35x^2 + \dots$ $= 2 + 69x + 1015x^2 + \dots$	B1 M1 A1 M1 A1 B1 M1 A1 (8)								
5.	(a) $\frac{1}{2}\sqrt{3}$ (b) <table><tr><td>x</td><td>0</td><td>$\frac{\pi}{6}$</td><td>$\frac{\pi}{3}$</td></tr><tr><td>$\cos^2 x$</td><td>1</td><td>$\frac{3}{4}$</td><td>$\frac{1}{4}$</td></tr></table> $\text{area} \approx \frac{1}{2} \times \frac{\pi}{6} \times [1 + \frac{1}{4} + 2(\frac{3}{4})]$ $= 0.720 \text{ (3sf)}$ (c) $\text{area of } S = \int_0^{\frac{\pi}{3}} \sin^2 x \, dx = \int_0^{\frac{\pi}{3}} (1 - \cos^2 x) \, dx$ $= \frac{\pi}{3} - 0.71995 = 0.327 \text{ (3sf)}$	x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\cos^2 x$	1	$\frac{3}{4}$	$\frac{1}{4}$	B1 M1 A1 B1 M1 A1 M1 M1 A1 (9)
x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$							
$\cos^2 x$	1	$\frac{3}{4}$	$\frac{1}{4}$							
6.	(a) isosceles $\therefore \angle AMB = 90^\circ$ $BM = 4 \tan 30^\circ = \frac{4}{\sqrt{3}}$ $\text{area} = \frac{1}{2} \times 8 \times \frac{4}{\sqrt{3}} = \frac{16}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{16}{3}\sqrt{3} \text{ cm}^2$ (b) $\text{area of sector} = \frac{1}{2} \times 4^2 \times \frac{\pi}{6} = \frac{4}{3}\pi$ $\text{shaded area} = \frac{16}{3}\sqrt{3} - (2 \times \frac{4}{3}\pi)$ $= \frac{16}{3}\sqrt{3} - \frac{8}{3}\pi = \frac{8}{3}(2\sqrt{3} - \pi) \text{ cm}^2$	B1 M1 A1 M1 A1 B1 M1 M1 A1 (9)								

7.	(a)	$(-6, 5) \therefore 36 + 25 - 60 - 40 + k = 0$ $k = 39$	M1 A1	
	(b)	$(x+5)^2 - 25 + (y-4)^2 - 16 + 39 = 0$ $(x+5)^2 + (y-4)^2 = 2$ $\therefore$ centre $(-5, 4)$, radius $= \sqrt{2}$	M1 A2	
	(c)	 dist. $(2, 3)$ to centre $= \sqrt{49+1} = \sqrt{50}$ $\therefore AB^2 = (\sqrt{50})^2 - (\sqrt{2})^2 = 48$ $AB = \sqrt{48} = \sqrt{16 \times 3} = 4\sqrt{3}$	B1 M1 A1 M1 A1	(10)
8.	(a)	end of 1 st year: $500 \times 1.06 = 530$ start of 2 nd year: $530 + 500 = 1030$ interest at end of 2 nd year $= 0.06 \times 1030 = \text{£}61.80$	M1 M1 A1	
	(b)	end of 8 th year: $500 \times (1.06 + 1.06^2 + 1.06^3 + \dots + 1.06^8)$ $= 500 \times S_8$; GP, $a = 1.06, r = 1.06$ $= 500 \times \frac{1.06[(1.06)^8 - 1]}{1.06 - 1}$ $= 5245.66 \therefore \text{£}5246$ (nearest pound)	B1 M1 A1 A1	
	(c)	$(1.005)^{12} = 1.0617\dots$ end of 8 th year: $500 \times \frac{1.0617[(1.0617)^8 - 1]}{1.0617 - 1} = 5285.71$ $\therefore$ £40 more in account (nearest pound)	M1 A1 M1 A1 A1	(12)
9.	(a)	$f(-1) = r \therefore -1 + k + 7 - 15 = r$ $k = r + 9$ $f(3) = 3r \therefore 27 + 9k - 21 - 15 = 3r$ $3k = r + 3$ subtracting, $2k = -6$ $k = -3$	M1 A1 M1 M1 A1	
	(b)	$r = -3 - 9 = -12$	B1	
	(c)	$f(x) = x^3 - 3x^2 - 7x - 15$ $f(5) = 125 - 75 - 35 - 15 = 0 \therefore (x - 5)$ is a factor	M1 A1	
	(d)	$\begin{array}{r} x^2 + 2x + 3 \\ x-5 \overline{) x^3 - 3x^2 - 7x - 15} \\ \underline{x^3 - 5x^2} \\ 2x^2 - 7x \\ \underline{2x^2 - 10x} \\ 3x - 15 \\ \underline{3x - 15} \\ 0 \end{array}$ $\therefore (x-5)(x^2 + 2x + 3) = 0$ $x = 5$ or $x^2 + 2x + 3 = 0$ $b^2 - 4ac = 2^2 - (4 \times 1 \times 3) = -8$ $b^2 - 4ac < 0 \therefore$ no real solutions to quadratic $\therefore$ only one real solution	M1 A1 M1 A1	(12)
Total				(75)

