

GCE Examinations  
Advanced Subsidiary

## **Core Mathematics C2**

Paper F

### 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.



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## C2 Paper F – Marking Guide

- |                   |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
|-------------------|-----|---|-------------------------|--------|-----|---|-----|---|-------------------|---|-----|-----|--------|-----|----------------------|--|
| 1.                | (a) | $\angle BAC = 180 - (107 + 31) = 42$<br>$\frac{BC}{\sin 42} = \frac{12.6}{\sin 31}$<br>$BC = \frac{12.6 \sin 42}{\sin 31} = 16.4 \text{ cm (3sf)}$  | B1<br>M1<br>A1          |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
|                   | (b) | $= \frac{1}{2} \times 12.6 \times 16.37 \times \sin 107 = 98.6 \text{ cm}^2 \text{ (3sf)}$  | M1 A1                   | (5)    |     |   |     |   |                   |   |     |     |        |     |                      |  |
| <hr/>             |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
| 2.                |     | $\int_2^3 (6\sqrt{x} - \frac{4}{\sqrt{x}}) dx = [4x^{\frac{3}{2}} - 8x^{\frac{1}{2}}]_2^3$<br>$= [4(3\sqrt{3}) - 8\sqrt{3}] - [4(2\sqrt{2}) - 8\sqrt{2}]$<br>$= (12\sqrt{3} - 8\sqrt{3}) - (8\sqrt{2} - 8\sqrt{2})$<br>$= 4\sqrt{3} \quad [k = 4]$  | M1 A2<br>M1 B1<br>A1    | (6)    |     |   |     |   |                   |   |     |     |        |     |                      |  |
| <hr/>             |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
| 3.                | (a) | <table style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="padding-right: 10px;"><math>x</math></td> <td style="padding-right: 10px;">0</td> <td style="padding-right: 10px;">0.5</td> <td style="padding-right: 10px;">1</td> <td style="padding-right: 10px;">1.5</td> <td style="padding-right: 10px;">2</td> </tr> <tr> <td><math>\frac{1}{x^2+1}</math></td> <td>1</td> <td>0.8</td> <td>0.5</td> <td>0.3077</td> <td>0.2</td> </tr> </table> $\text{area} \approx \frac{1}{2} \times 0.5 \times [1 + 0.2 + 2(0.8 + 0.5 + 0.3077)]$<br>$= 1.10 \text{ (3sf)}$ | $x$                     | 0      | 0.5 | 1 | 1.5 | 2 | $\frac{1}{x^2+1}$ | 1 | 0.8 | 0.5 | 0.3077 | 0.2 | M1 A1<br>B1 M1<br>A1 |  |
| $x$               | 0   | 0.5   | 1                       | 1.5    | 2   |   |     |   |                   |   |     |     |        |     |                      |  |
| $\frac{1}{x^2+1}$ | 1   | 0.8   | 0.5                     | 0.3077 | 0.2 |   |     |   |                   |   |     |     |        |     |                      |  |
|                   | (b) | $\text{area} = 8^2 \times 1.10385 = 70.6464$<br>$\text{volume} = 2 \times 70.6464 = 141 \text{ cm}^3 \text{ (3sf)}$   | M1<br>A1                | (7)    |     |   |     |   |                   |   |     |     |        |     |                      |  |
| <hr/>             |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
| 4.                | (a) | $= 2^6 + 6(2^5)y + \binom{6}{2}(2^4)(y^2) + \binom{6}{3}(2^3)(y^3) + \dots$<br>$= 64 + 192y + 240y^2 + 160y^3 + \dots$  | M1 A1<br>B1 A1          |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
|                   | (b) | $\text{let } y = x - x^2$<br>$(2 + x - x^2)^6 = 64 + 192(x - x^2) + 240(x - x^2)^2 + 160(x - x^2)^3 + \dots$<br>$= 64 + 192(x - x^2) + 240(x^2 - 2x^3 + \dots) + 160(x^3 + \dots) + \dots$<br>$= 64 + 192x + 48x^2 - 320x^3 + \dots$  | M1<br>M1<br>A1          | (7)    |     |   |     |   |                   |   |     |     |        |     |                      |  |
| <hr/>             |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
| 5.                | (a) | $\frac{8 \sin x}{\cos x} - 3 \cos x = 0$<br>$8 \sin x - 3 \cos^2 x = 0$<br>$8 \sin x - 3(1 - \sin^2 x) = 0$<br>$3 \sin^2 x + 8 \sin x - 3 = 0$  | M1<br>M1<br>A1          |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
|                   | (b) | $(3 \sin x - 1)(\sin x + 3) = 0$<br>$\sin x = -3 \text{ (no solutions) or } \frac{1}{3}$<br>$x = 0.34, \pi - 0.3398$<br>$x = 0.34, 2.80 \text{ (2dp)}$  | M1<br>A1<br>B1 M1<br>A1 | (8)    |     |   |     |   |                   |   |     |     |        |     |                      |  |
| <hr/>             |     |   |                         |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
| 6.                | (a) | <p>(i) <math>= 3^1 \times 3^x = 3y</math></p> <p>(ii) <math>= 3^{-1} \times (3^x)^2 = \frac{1}{3}y^2</math></p>   | M1 A1<br>M1 A1          |        |     |   |     |   |                   |   |     |     |        |     |                      |  |
|                   | (b) | $3y - \frac{1}{3}y^2 = 6$<br>$y^2 - 9y + 18 = 0$<br>$(y - 3)(y - 6) = 0$<br>$y = 3, 6$<br>$3^x = 3, 6$<br>$x = 1, \frac{\lg 6}{\lg 3}$<br>$x = 1, 1.63 \text{ (2dp)}$   | M1<br>A1<br>B1 M1<br>A1 | (9)    |     |   |     |   |                   |   |     |     |        |     |                      |  |

7.	(a)	$= 2 \times \sqrt{4+1} = 2\sqrt{5}$	M1 A1	
	(b)	$(x-5)^2 + (y-2)^2 = (\sqrt{5})^2$ $(x-5)^2 + (y-2)^2 = 5$	M1 A1	
	(c)	sub. $y = 2x - 3$ into eqn of C: $(x-5)^2 + [(2x-3)-2]^2 = 5$ $(x-5)^2 + (2x-5)^2 = 5$ $x^2 - 6x + 9 = 0$ $(x-3)^2 = 0$ repeated root $\therefore$ tangent point of contact (3, 3)	M1 A1 M1 A1 A1 A1	(9)

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8.	(a)	$\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - 16x^{-3}$	M1 A2	
		for minimum, $\frac{1}{2}x^{-\frac{1}{2}} - 16x^{-3} = 0$	M1	
		$\frac{1}{2}x^{-3}(x^{\frac{5}{2}} - 32) = 0$		
		$x^{\frac{5}{2}} = 32$	A1	
		$x = (\sqrt[5]{32})^2 = 4$	M1	
		$\therefore (4, \frac{5}{2})$	A1	
	(b)	$= \int_1^9 (\sqrt{x} + \frac{8}{x^2}) dx$ $= [\frac{2}{3}x^{\frac{3}{2}} - 8x^{-1}]_1^9$ $= (18 - \frac{8}{9}) - (\frac{2}{3} - 8)$ $= 24\frac{4}{9}$	M1 A2 M1 A1	(12)

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9.	(a)	$r = \frac{x+6}{x-2} = \frac{x^2}{x+6}$	M1	
		$(x+6)^2 = x^2(x-2)$	M1	
		$x^2 + 12x + 36 = x^3 - 2x^2$ , $x^3 - 3x^2 - 12x - 36 = 0$	A1	
	(b)	when $x = 6$ , LHS = $216 - 108 - 72 - 36 = 0 \therefore x = 6$ is a solution	B1	
		$  \begin{array}{r}  x^2 + 3x + 6 \\  x-6 \overline{) x^3 - 3x^2 - 12x - 36} \\  \underline{x^3 - 6x^2} \phantom{- 12x - 36} \\  3x^2 - 12x \phantom{- 36} \\  \underline{3x^2 - 18x} \phantom{- 36} \\  6x - 36 \\  \underline{6x - 36} \\  0  \end{array}  $	M1 A1	
		$\therefore (x-6)(x^2 + 3x + 6) = 0$ $x = 6$ or $x^2 + 3x + 6 = 0$ $b^2 - 4ac = 3^2 - (4 \times 1 \times 6) = -15$ $b^2 - 4ac < 0 \therefore$ no real solutions to quadratic	M1 A1	
		$\therefore$ no other solutions	A1	
	(c)	$r = \frac{6+6}{6-2} = 3$	B1	
	(d)	$a = 6 - 2 = 4$ $S_8 = \frac{4(3^8 - 1)}{3 - 1} = 13\,120$	M1 A1	(12)

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Total (75)

