

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)                   |        |     |   |     |   |                   |   |     |     |        |     |                      |
| 2.                |     | $\int_2^3 (6\sqrt{x} - \frac{4}{\sqrt{x}}) \text{ dx} = [4x^{\frac{3}{2}} - 8x^{\frac{1}{2}}]_2^3$<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)    |        |     |   |     |   |                   |   |     |     |        |     |                      |
| 3.                | (a) | <table><tr><th>x</th><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td></tr><tr><th><math>\frac{1}{x^2+1}</math></th><td>1</td><td>0.8</td><td>0.5</td><td>0.3077</td><td>0.2</td></tr></table><br>$\text{area} \approx \frac{1}{2} \times 0.5 \times [1 + 0.2 + 2(0.8 + 0.5 + 0.3077)]$<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)                |        |     |   |     |   |                   |   |     |     |        |     |                      |
| 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) | 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)          |        |     |   |     |   |                   |   |     |     |        |     |                      |
| 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) |        |     |   |     |   |                   |   |     |     |        |     |                      |
| 6.                | (a) | (i) $= 3^1 \times 3^x = 3y$<br>(ii) $= 3^{-1} \times (3^x)^2 = \frac{1}{3}y^2$                                                                                                                                                                                                                                         | 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) | $(x-5)^2 + (y-2)^2 = (\sqrt{5})^2$<br>$(x-5)^2 + (y-2)^2 = 5$                                                                                                                                                                                                   | M1<br>A1                         |      |
|    | (c) | sub. $y = 2x - 3$ into eqn of C:<br>$(x-5)^2 + [(2x-3)-2]^2 = 5$<br>$(x-5)^2 + (2x-5)^2 = 5$<br>$x^2 - 6x + 9 = 0$<br>$(x-3)^2 = 0$<br>repeated root $\therefore$ tangent<br>point of contact (3, 3)                                                            | M1<br>A1<br>A1<br>M1<br>A1<br>A1 | (9)  |
| 8. | (a) | $\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - 16x^{-3}$<br>for minimum, $\frac{1}{2}x^{-\frac{1}{2}} - 16x^{-3} = 0$<br>$\frac{1}{2}x^{-3}(x^{\frac{5}{2}} - 32) = 0$<br>$x^{\frac{5}{2}} = 32$<br>$x = (\sqrt[5]{32})^2 = 4$<br>$\therefore (4, \frac{5}{2})$ | M1 A2<br>M1<br>A1<br>M1<br>A1    |      |
|    | (b) | $= \int_1^9 (\sqrt{x} + \frac{8}{x^2}) dx$<br>$= [\frac{2}{3}x^{\frac{3}{2}} - 8x^{-1}]_1^9$<br>$= (18 - \frac{8}{9}) - (\frac{2}{3} - 8)$<br>$= 24\frac{4}{9}$                                                                                                 | M1 A2<br>M1<br>A1                | (12) |
| 9. | (a) | $r = \frac{x+6}{x-2} = \frac{x^2}{x+6}$<br>$(x+6)^2 = x^2(x-2)$<br>$x^2 + 12x + 36 = x^3 - 2x^2$ , $x^3 - 3x^2 - 12x - 36 = 0$                                                                                                                                  | M1<br>M1<br>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                            |      |
|    |     | $\therefore (x-6)(x^2 + 3x + 6) = 0$<br>$x = 6$ or $x^2 + 3x + 6 = 0$<br>$b^2 - 4ac = 3^2 - (4 \times 1 \times 6) = -15$<br>$b^2 - 4ac < 0 \therefore$ no real solutions to quadratic<br>$\therefore$ no other solutions                                        | M1 A1<br>A1                      |      |
|    | (c) | $r = \frac{6+6}{6-2} = 3$                                                                                                                                                                                                                                       | B1                               |      |
|    | (d) | $a = 6 - 2 = 4$<br>$S_8 = \frac{4(3^8 - 1)}{3 - 1} = 13\,120$                                                                                                                                                                                                   | M1 A1                            | (12) |

Total (75)

