

GCE Examinations  
Advanced Subsidiary

## **Core Mathematics C2**

Paper L

### **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.

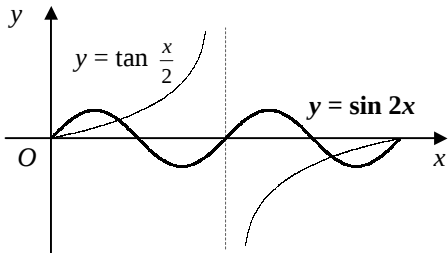


*Written by Shaun Armstrong*

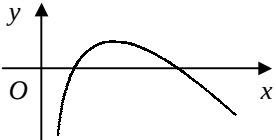
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## C2 Paper L – Marking Guide

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         |     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----|
| 1. | (a) $r = \frac{-15}{75} = -\frac{1}{5}$                                                                                                                                                                                                                                                                                                                                                                                                       | M1 A1                                   |     |
|    | (b) $= \frac{75}{1 - (-\frac{1}{5})} = 62\frac{1}{2}$                                                                                                                                                                                                                                                                                                                                                                                         | M1 A1                                   | (4) |
| 2. | (a) $(x+4)^2 - 16 + (y-2)^2 - 4 + k = 0$<br>$\therefore$ centre $(-4, 2)$                                                                                                                                                                                                                                                                                                                                                                     | M1<br>A1                                |     |
|    | (b) for x-axis to be tangent, radius must be 2<br>$(x+4)^2 + (y-2)^2 = 20 - k$<br>$\therefore 20 - k = 2^2$<br>$k = 16$                                                                                                                                                                                                                                                                                                                       | B1<br><br>M1<br>A1                      | (5) |
| 3. | area of segment $= (\frac{1}{2} \times r^2 \times \frac{\pi}{3}) - (\frac{1}{2} \times r^2 \times \sin \frac{\pi}{3})$<br>$= \frac{1}{6} r^2 \pi - \frac{1}{4} r^2 \sqrt{3}$<br>shaded area $= \frac{1}{6} r^2 \pi - 2(\frac{1}{6} r^2 \pi - \frac{1}{4} r^2 \sqrt{3})$<br>$= \frac{1}{6} r^2 \pi - \frac{1}{3} r^2 \pi + \frac{1}{2} r^2 \sqrt{3}$<br>$= \frac{1}{2} r^2 \sqrt{3} - \frac{1}{6} r^2 \pi = \frac{1}{6} r^2 (3\sqrt{3} - \pi)$ | B1 M2<br><br>A1<br><br>M1<br><br><br>A1 | (6) |
| 4. | (a)                                                                                                                                                                                                                                                                                                                                                         | B2<br><br>B2                            |     |
|    | (b) 4 solutions<br>the graphs intersect at 4 points                                                                                                                                                                                                                                                                                                                                                                                           | B1<br>B1                                | (6) |
| 5. | (a) $\log_a 27 - \log_a 8 = 3$<br>$\log_a \frac{27}{8} = 3$<br>$a^3 = \frac{27}{8}, a = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$                                                                                                                                                                                                                                                                                                                 | M1<br><br>M1 A1                         |     |
|    | (b) $(x+3) \lg 2 = (x-1) \lg 6$<br>$x(\lg 6 - \lg 2) = 3 \lg 2 + \lg 6$<br>$x = \frac{3 \lg 2 + \lg 6}{\lg 6 - \lg 2} = 3.52$                                                                                                                                                                                                                                                                                                                 | M1<br>M1<br>M1 A1                       | (7) |
| 6. | (a) $= 2^4 + 4(2^3)(x) + 6(2^2)(x^2) + 4(2)(x^3) + x^4$<br>$= 16 + 32x + 24x^2 + 8x^3 + x^4$                                                                                                                                                                                                                                                                                                                                                  | M1 A1<br>B1 A1                          |     |
|    | (b) $(2-x)^4 = 16 - 32x + 24x^2 - 8x^3 + x^4$<br>$(2+x)^4 + (2-x)^4 = 32 + 48x^2 + 2x^4, A = 32, B = 48, C = 2$                                                                                                                                                                                                                                                                                                                               | M1<br>A1                                |     |
|    | (c) $32 + 48x^2 + 2x^4 = 136$<br>$x^4 + 24x^2 - 52 = 0$<br>$(x^2 + 26)(x^2 - 2) = 0$<br>$x^2 = -26$ (no real solutions) or 2<br>$x = \pm \sqrt{2}$                                                                                                                                                                                                                                                                                            | M1<br>A1<br>A1                          | (9) |

|    |     |                                                                                                                                                                                                                                                     |         |
|----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 7. | (a) | $f(2) = 16 - 20 + 2 + 2 = 0 \therefore (x - 2)$ is a factor                                                                                                                                                                                         | M1 A1   |
|    | (b) | $  \begin{array}{r}  2x^2 - x - 1 \\  x-2 \overline{) 2x^3 - 5x^2 + x + 2} \\  \underline{2x^3 - 4x^2} \phantom{+ x + 2} \\  -x^2 + x \phantom{+ 2} \\  \underline{-x^2 + 2x} \phantom{+ 2} \\  -x + 2 \\  \underline{-x + 2} \\  0  \end{array}  $ | M1 A1   |
|    |     | $f(x) = (x - 2)(2x^2 - x - 1) = (x - 2)(2x + 1)(x - 1)$                                                                                                                                                                                             | M1 A1   |
|    | (c) | $x = -\frac{1}{2}, 1, 2$                                                                                                                                                                                                                            | B1      |
|    | (d) | $\sin \theta = 2$ (no solutions), $-\frac{1}{2}$ or $1$                                                                                                                                                                                             |         |
|    |     | $\theta = \pi + \frac{\pi}{6}, 2\pi - \frac{\pi}{6}$ or $\frac{\pi}{2}$                                                                                                                                                                             | M1 B1   |
|    |     | $\theta = \frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$                                                                                                                                                                                           | A2 (11) |

|    |     |                                                                                                                                                                                                                                                                      |                      |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 8. | (a) | $3 - x^{\frac{1}{2}} - 2x^{-\frac{1}{2}} = 0, \quad 3x^{\frac{1}{2}} - x - 2 = 0$<br>$x - 3x^{\frac{1}{2}} + 2 = 0, \quad (x^{\frac{1}{2}} - 1)(x^{\frac{1}{2}} - 2) = 0$<br>$x^{\frac{1}{2}} = 1, 2$<br>$x = 1, 4 \therefore (1, 0), (4, 0)$                        | M1<br>M1<br>A1<br>A1 |
|    | (b) | $\frac{dy}{dx} = -\frac{1}{2}x^{-\frac{1}{2}} + x^{-\frac{3}{2}}$<br>for minimum, $-\frac{1}{2}x^{-\frac{1}{2}} + x^{-\frac{3}{2}} = 0$<br>$-\frac{1}{2}x^{-\frac{3}{2}}(x - 2) = 0$<br>$x = 2, y = 3 - \sqrt{2} - \frac{2}{\sqrt{2}} \therefore (2, 3 - 2\sqrt{2})$ | M1 A1<br>M1<br>A2    |
|    | (c) | $\frac{d^2y}{dx^2} = \frac{1}{4}x^{-\frac{3}{2}} - \frac{3}{2}x^{-\frac{5}{2}}$<br>when $x = 2, \frac{d^2y}{dx^2} = \frac{1}{8\sqrt{2}} - \frac{3}{8\sqrt{2}} = -\frac{1}{4\sqrt{2}}, \frac{d^2y}{dx^2} < 0 \therefore$ maximum                                      | M1<br>A1             |
|    | (d) |                                                                                                                                                                                   | B2 (13)              |

|    |     |                                                                                                                                                                                                                                                                                                                                              |                                       |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 9. | (a) | $x = 4 \therefore y = 12 - 8 + 2 = 6$<br>$\frac{dy}{dx} = 3 - 2x^{-\frac{1}{2}}$<br>grad $= 3 - 1 = 2$<br>$\therefore y - 6 = 2(x - 4)$<br>$y = 2x - 2$                                                                                                                                                                                      | B1<br>M1 A1<br>M1<br>M1<br>A1         |
|    | (b) | area under curve $= \int_0^4 (3x - 4\sqrt{x} + 2) dx$<br>$= [\frac{3}{2}x^2 - \frac{8}{3}x^{\frac{3}{2}} + 2x]_0^4$<br>$= (24 - \frac{64}{3} + 8) - (0) = 10\frac{2}{3}$<br>tangent meets x-axis when $y = 0 \Rightarrow x = 1$<br>area of triangle $= \frac{1}{2} \times 3 \times 6 = 9$<br>shaded area $= 10\frac{2}{3} - 9 = \frac{5}{3}$ | M1 A2<br>M1<br>M1<br>A1<br>M1 A1 (14) |

Total (75)

## Performance Record – C2 Paper L

[illegible]