

**Solomon Press**  
**Core Mathematics C2**  
**Paper L**  
**(Mark Scheme)**

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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.

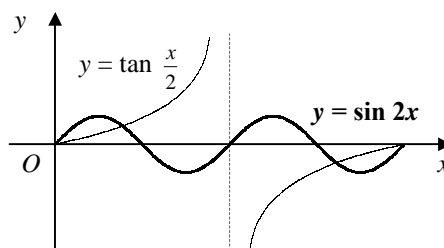


*Written by Shaun Armstrong*

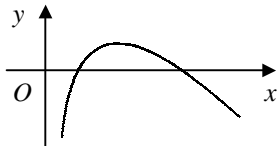
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## C2 Paper L – Marking Guide

- |       |   |  |     |
|-------|---|--|-----|
| 1.    | <p>(a) <math>r = \frac{-15}{75} = -\frac{1}{5}</math></p> <p>(b) <math>= \frac{75}{1 - (-\frac{1}{5})} = 62\frac{1}{2}</math></p>   | M1 A1  |     |
|       |   | M1 A1  | (4) |
| <hr/> |   |  |     |
| 2.    | <p>(a) <math>(x+4)^2 - 16 + (y-2)^2 - 4 + k = 0</math><br/> <math>\therefore</math> centre <math>(-4, 2)</math></p> <p>(b) for <math>x</math>-axis to be tangent, radius must be 2<br/> <math>(x+4)^2 + (y-2)^2 = 20 - k</math><br/> <math>\therefore 20 - k = 2^2</math><br/> <math>k = 16</math></p>  | M1<br>A1<br>B1<br>M1<br>A1                   | (5) |
| <hr/> |   |  |     |
| 3.    | <p>area of segment <math>= (\frac{1}{2} \times r^2 \times \frac{\pi}{3}) - (\frac{1}{2} \times r^2 \times \sin \frac{\pi}{3})</math><br/> <math>= \frac{1}{6} r^2 \pi - \frac{1}{4} r^2 \sqrt{3}</math></p> <p>shaded area <math>= \frac{1}{6} r^2 \pi - 2(\frac{1}{6} r^2 \pi - \frac{1}{4} r^2 \sqrt{3})</math><br/> <math>= \frac{1}{6} r^2 \pi - \frac{1}{3} r^2 \pi + \frac{1}{2} r^2 \sqrt{3}</math><br/> <math>= \frac{1}{2} r^2 \sqrt{3} - \frac{1}{6} r^2 \pi = \frac{1}{6} r^2 (3\sqrt{3} - \pi)</math></p> | B1 M2<br>A1<br>M1<br>A1                      | (6) |
| <hr/> |   |  |     |
| 4.    | <p>(a) </p> <p>(b) 4 solutions<br/>the graphs intersect at 4 points</p>   | B2<br>B2<br>B1<br>B1                         | (6) |
| <hr/> |   |  |     |
| 5.    | <p>(a) <math>\log_a 27 - \log_a 8 = 3</math><br/> <math>\log_a \frac{27}{8} = 3</math><br/> <math>a^3 = \frac{27}{8}, a = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}</math></p> <p>(b) <math>(x+3) \lg 2 = (x-1) \lg 6</math><br/> <math>x(\lg 6 - \lg 2) = 3 \lg 2 + \lg 6</math><br/> <math>x = \frac{3 \lg 2 + \lg 6}{\lg 6 - \lg 2} = 3.52</math></p>   | M1<br>M1 A1<br>M1<br>M1<br>M1 A1             | (7) |
| <hr/> |   |  |     |
| 6.    | <p>(a) <math>= 2^4 + 4(2^3)(x) + 6(2^2)(x^2) + 4(2)(x^3) + x^4</math><br/> <math>= 16 + 32x + 24x^2 + 8x^3 + x^4</math></p> <p>(b) <math>(2-x)^4 = 16 - 32x + 24x^2 - 8x^3 + x^4</math><br/> <math>(2+x)^4 + (2-x)^4 = 32 + 48x^2 + 2x^4, A = 32, B = 48, C = 2</math></p> <p>(c) <math>32 + 48x^2 + 2x^4 = 136</math><br/> <math>x^4 + 24x^2 - 52 = 0</math><br/> <math>(x^2 + 26)(x^2 - 2) = 0</math><br/> <math>x^2 = -26</math> (no real solutions) or 2<br/> <math>x = \pm \sqrt{2}</math></p>                   | M1 A1<br>B1 A1<br>M1<br>A1<br>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 M1 B1
- $\theta = \pi + \frac{\pi}{6}, 2\pi - \frac{\pi}{6}$  or  $\frac{\pi}{2}$  M1 B1
- $\theta = \frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$  A2 (11)

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

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

Total (75)