Solomon Practice Paper

Pure Mathematics 2B

Time allowed: 90 **minutes**

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	6	
2	7	
3	8	
4	9	
5	10	
6	10	
7	11	
8	14	
Total:	75	

How I can achieve better:

-
-
-

Last updated: July 14, 2025

1. (a) Sketch the graph of $y = |3x + 2|$ showing the coordinates of any points where the graph meets the coordinate axes. [3]

   (b) Solve the equation $|3x + 2| = 2 - x$ [3]

   Total: 6

2. (a) Prove using the laws of indices that for all values of x [4]

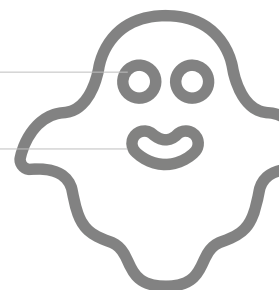$$\log_a \left(x^k \right) \equiv k \log_a(x).$$
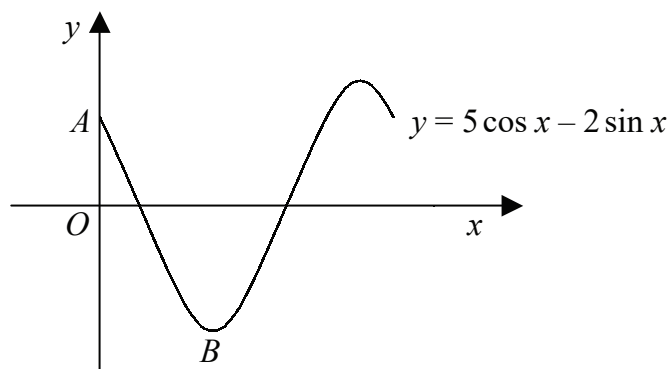
(b) Express [3]

$$\ln(9) - 3 \ln \sqrt{3} + \ln(81)$$

in the form $k \ln(3)$, where k is an exact fraction.

Total: 7

3. Figure shows the curve $y = 5\cos(x) - 2\sin(x)$ for $0 \leq x \leq 360°$.

(a) Find the values of R and α, correct to 3 significant figures, for which   [5]
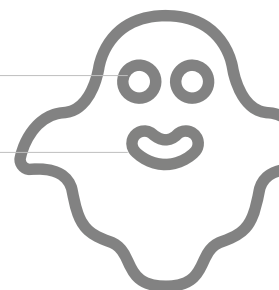
$$5\cos(x) - 2\sin(x) \equiv R\cos(x + \alpha)$$

where x is measured in degrees and $0 < \alpha < 90°$.
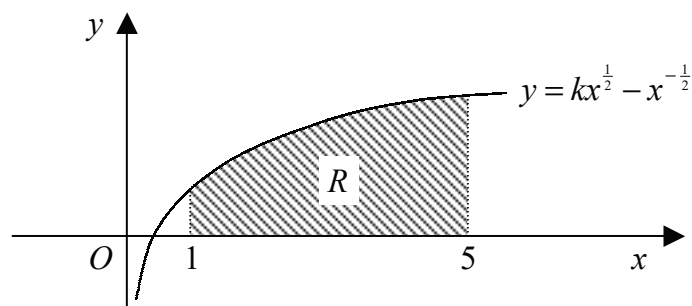
(b) Find the coordinates of   [3]

    i. the point A, where the curve meets the y-axis,

    ii. the point B, the first minimum on the curve for $x > 0$.

Total: 8

4. Figure shows part of the curve $y = kx^{\frac{1}{2}} - x^{-\frac{1}{2}}$.

Given that the point with coordinates $\left(3, \frac{5}{3}\sqrt{3}\right)$ lies on the curve,
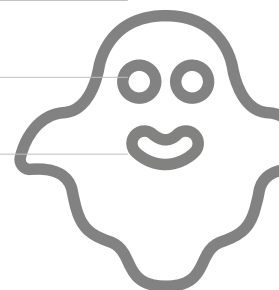
(a) show that $k = 2$. [3]

The shaded region, R, is bounded by the curve, the x-axis and the ordinates $x = 1$ and $x = 5$.

(b) Find the volume generated when R is rotated through $360°$ about the x-axis, giving your answer in the form $\pi(a + b\ln(5))$. [6]

Total: 9

5. The function f is given by
$$\mathrm{f}\colon x \mapsto \frac{x}{x+3}, \quad x \in \mathbb{R}, \quad x \neq -3.$$

   (a) Define $\mathrm{f}^{-1}(x)$, stating its domain clearly. [5]

   The function g is given by
   $$\mathrm{g}\colon x \mapsto \frac{4}{x}, \quad x \in \mathbb{R}, \quad x \neq 0.$$

   (b) Express $\mathrm{fg}(\sqrt{2})$ in the form $a + b\sqrt{2}$, where a and b are integers. [5]

   Total: 10

6. A sequence is defined as follows

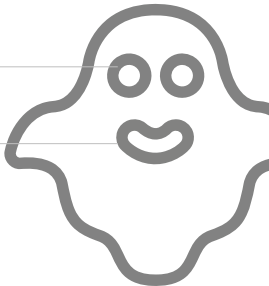$$u_{n+1} = ku_n - 2, \quad n \geq 1, \quad u_1 = 3.$$

(a) Find expressions in terms of k for u_2 and u_3.   [3]
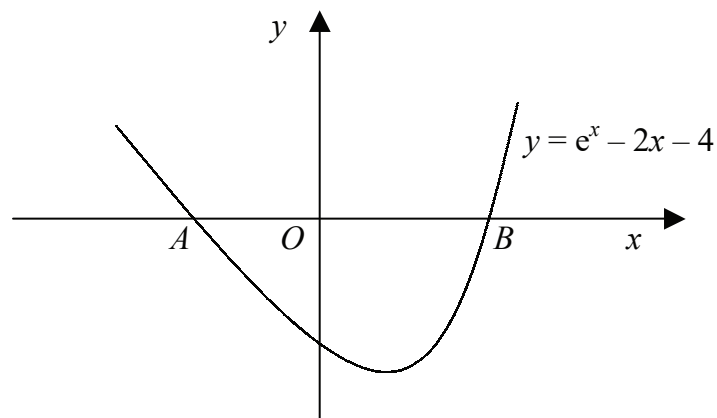
Given that $u_2 + u_3 = 0$,

(b) show that one possible value of k is 1 and find the other possible value,   [4]

(c) find the value of u_4 corresponding to each possible value of k.   [3]

Total: 10

7. Figure shows part of the curve with equation $y = e^x - 2x - 4$.

(a) Find in exact form the coordinates of the turning point of the curve. [5]

The curve intersects the x-axis at the points $A(a, 0)$ and $B(b, 0)$ where $a < b$.
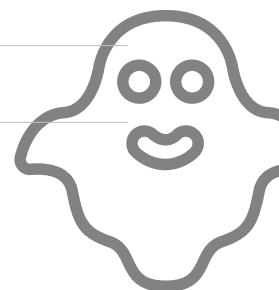
(b) Show that $-2 < a < -1$. [2]

(c) Use an iteration of the form [4]

$$x_{n+1} = \ln(px_n + q)$$

with a starting value of $x_0 = 2$ to find b correct to 3 significant figures.

Total: 11

8.

$$f(x) \equiv 2x^2 + 4x + \ln(x), \quad x \in \mathbb{R}, \quad x > 0.$$

(a) Sketch the curves $y = 4x + 2x^2$ and $y = -\ln(x)$, for $x > 0$, on the same diagram. Hence show that the equation $f(x) = 0$ has exactly one solution. [3]

(b) Express $f'(x)$ in the form [6]
$$\frac{(ax + b)^2}{x},$$
and hence prove that $f(x)$ is increasing throughout its domain.

(c) Find $f''(x)$ and hence find the set of values of x for which the gradient of $f(x)$ is increasing. [5]

Total: 14