Solomon Practice Paper

Pure Mathematics 2E

Time allowed: 90 minutes

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	6	
2	7	
3	7	
4	9	
5	9	
6	11	
7	12	
8	14	
Total:	75	

How I can achieve better:

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Last updated: July 14, 2025

1. Given that [6]

$$\frac{1}{x+2} = \frac{3x}{y-4} - \frac{3x+5}{x+2},$$

express y in terms of x as simply as possible.

2. (a) Given that $y = 3^x$, express 3^{2x+1} as a function of y. [2]

   (b) Hence, or otherwise, find correct to 3 significant figures the values of x for which [5]

$$3^{2x+1} - 14(3^x) + 8 = 0.$$

Total: 7

3. Evaluate [7]

$$\int_1^9 \frac{3 - 4\sqrt{x}}{2x}\,\mathrm{d}x,$$

giving your answer in the form $a + b\ln(3)$, where a and b are integers.

4. (a) Given that [4]

$$(1 + k\sqrt{3})^4 \equiv A + B\sqrt{3},$$

show that $A = (1 + 18k^2 + 9k^4)$ and find an expression for B in terms of k.

(b) Hence, find the value of k for which [5]

$$(1 + k\sqrt{3})^4 \equiv 217 - 104\sqrt{3}.$$

Total: 9

5. The function f is an even function defined for all real values of x.

   Given that

   $$f(x) \equiv 3x^{\frac{1}{2}}, \quad x \geq 0,$$

   sketch each of the following curves on separate diagrams. Your sketches should show the coordinates of any points where each curve meets the coordinate axes.

   (a) $y = f(x)$, [2]

   (b) $y = 2f(x+1)$, [3]

   (c) $y = 2 - f(x)$. [4]

Total: 9

6. (a) Using the identities [4]

$$\cos(A+B) \equiv \cos(A)\cos(B) - \sin(A)\sin(B),$$

and

$$\cos(A-B) \equiv \cos(A)\cos(B) + \sin(A)\sin(B),$$

prove the identity

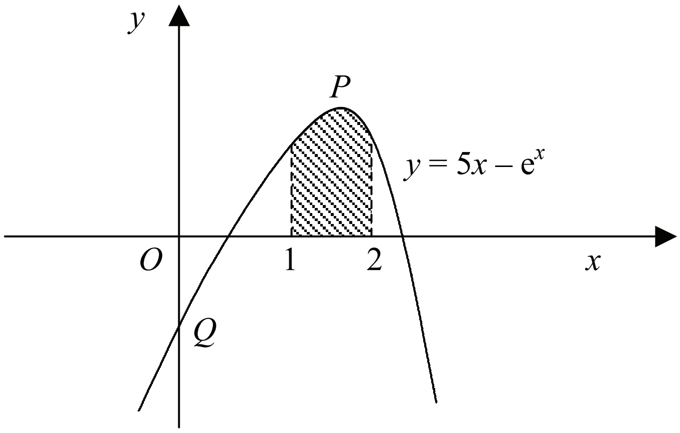
$$\cos(A) + \cos(B) \equiv 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right).$$

(b) Find in terms of π the values of θ in the interval $0 \leq \theta \leq \pi$ for which [7]

$$\cos(5\theta) + \cos(\theta) = \cos(3\theta).$$

Total: 11

7. Figure shows part of the curve with equation $y = 5x - e^x$.



(a) Find in exact form the coordinates of P, the stationary point on the curve. [4]

The curve meets the y-axis at the point Q.

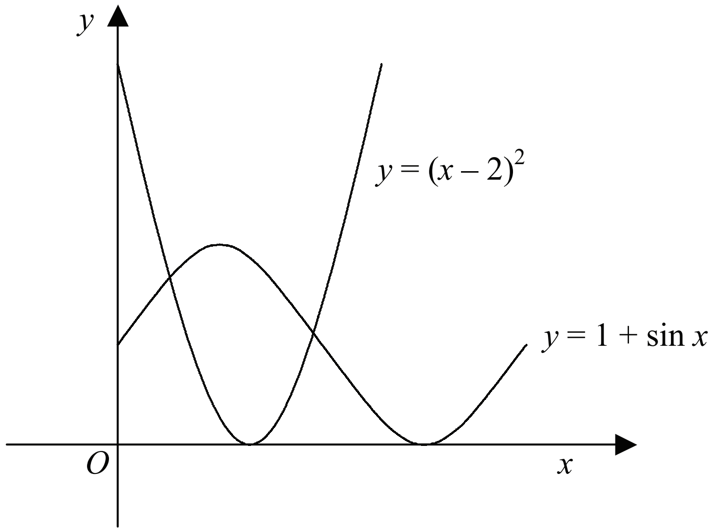
(b) Find an equation of the tangent to the curve at Q. [4]

The shaded region is enclosed by the curve, the x-axis and the ordinates $x = 1$ and $x = 2$.

(c) Show that the area of the shaded region is $\left(\frac{15}{2} + e - e^2\right)$. [4]

Total: 12

8. Figure shows the curves with equations $y = (x-2)^2$ and $y = 1 + \sin(x)$ where x is measured in radians.



(a) i. State, with a reason, how many solutions there will be to the equation $(x-2)^2 = 1 + \sin(x)$. [4]

ii. Show that one solution to the equation lies in the interval $[0.5, 1]$.

(b) Using the iteration [3]

$$x_{n+1} = \frac{1}{4}\left(x_n^2 + 3 - \sin(x_n)\right)$$

with a starting value of $x_1 = 0.75$, find x_4 correct to 3 significant figures.

(c) Show that your answer to part (b) is correct to 3 significant figures as a solution to the equation $(x-2)^2 = 1 + \sin(x)$. [2]

(d) Using an iteration of the form [5]

$$x_{n+1} = a + \frac{\sin(x_n) - b}{x_n},$$

with a starting value of $x_1 = 3$, find another solution of the equation $(x-2)^2 = 1 + \sin(x)$ correct to 3 significant figures.

Total: 14