Solomon Practice Paper

Core Mathematics 4L

Time allowed: 90 minutes

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	8	
2	8	
3	10	
4	11	
5	12	
6	12	
7	14	
Total:	75	

How I can achieve better:

- •





1. The number of people, n, in a queue at a Post Office t minutes after it opens is modelled by the differential equation

$$\frac{\mathrm{d}n}{\mathrm{d}t} = \mathrm{e}^{0.5t} - 5, \qquad t \ge 0.$$

- (a) Find, to the nearest second, the time when the model predicts that there will be the least [3] number of people in the queue.
- (b) Given that there are 20 people in the queue when the Post Office opens, solve the differential [4] equation.
- (c) Explain why this model would not be appropriate for large values of t.

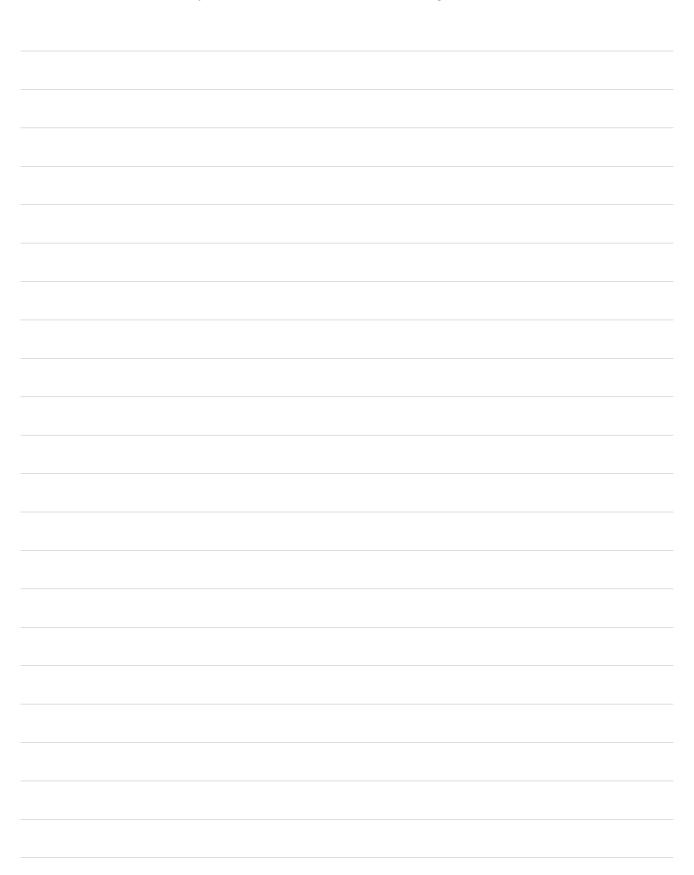
Total: 8

[1]

2. A curve has the equation

 $3x^2 + xy - 2y^2 + 25 = 0.$

Find an equation for the normal to the curve at the point with coordinates (1, 4), giving your answer in the form ax + by + c = 0, where a, b and c are integers.



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3. (a) Use the substitution $u = 2 - x^2$ to find

$$\int \frac{x}{2-x^2} \,\mathrm{d}x.$$

Total: 10

$$\int_0^{\frac{\pi}{4}} \sin(3x) \cos(x) \,\mathrm{d}x.$$

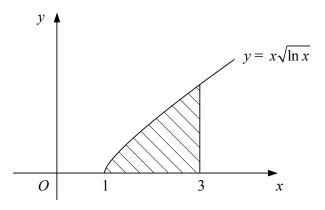
Last updated: June 17, 2025

[4]

[6]

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4. Figure shows the curve with equation $y = x\sqrt{\ln(x)}, x \ge 1$.



The shaded region is bounded by the curve, the x-axis and the line x = 3.

(a) Using the trapezium rule with two intervals of equal width, estimate the area of the shaded [4] region.

The shaded region is rotated through 360° about the *x*-axis.

(b) Find the exact volume of the solid formed.

[7]

Total: 11

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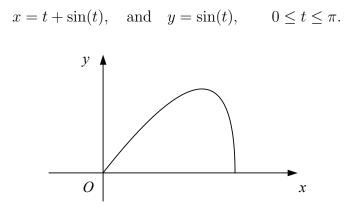
5.

$$f(x) = \frac{5 - 8x}{(1 + 2x)(1 - x)^2}.$$

- (a) Express f(x) in partial fractions. [5](b) Find the series expansion of f(x) in ascending powers of x up to and including the term in [6] x^3 , simplifying each coefficient. [1]
- (c) State the set of values of x for which your expansion is valid.

Total: 12

6. Figure shows the curve with parametric equations



(a)	Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of t .	[3]
(b)	Find, in exact form, the coordinates of the point where the tangent to the curve is parallel	[3]
	to the <i>x</i> -axis.	

(c) Show that the region bounded by the curve and the x-axis has area 2.

Total: 12

[6]

7. The line l_1 passes through the points A and B with position vectors $(3\mathbf{i} + 6\mathbf{j} - 8\mathbf{k})$ and $(8\mathbf{j} - 6\mathbf{k})$ respectively, relative to a fixed origin.	
(a) Find a vector equation for l_1 .	[2]
The line l_2 has vector equation	
$\mathbf{r} = (-2\mathbf{i} + 10\mathbf{j} + 6\mathbf{k}) + \mu(7\mathbf{i} - 4\mathbf{j} + 6\mathbf{k}),$	
where μ is a scalar parameter.	
(b) Show that lines l_1 and l_2 intersect.	[4]
(c) Find the coordinates of the point where l_1 and l_2 intersect.	[2]
The point C lies on l_2 and is such that AC is perpendicular to AB.	
(d) Find the position vector of C .	[6]

Total: 14