Solomon Practice Paper

Core Mathematics 4A

Time allowed: 90 minutes

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Name:

Teacher:

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

How I can achieve better:

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1. A curve has the equation

 $x^2(2+y) - y^2 = 0.$

Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of x and y.

2.

$$f(x) = \frac{3}{\sqrt{1-x}}, \quad |x| < 1.$$

- (a) Show that $f\left(\frac{1}{10}\right) = \sqrt{10}$.
- (b) Expand f(x) in ascending powers of x up to and including the term in x^3 , simplifying each [3] coefficient.
- (c) Use your expansion to find an approximate value for $\sqrt{10}$, giving your answer to 8 significant [1] figures.
- (d) Find, to 1 significant figure, the percentage error in your answer to part (c).

Total: 8

[2]

[2]



3. Relative to a fixed origin, O, the line l has the equation

$$\mathbf{r} = (\mathbf{i} + p\mathbf{j} - 5\mathbf{k}) + \lambda(3\mathbf{i} - \mathbf{j} + q\mathbf{k}),$$

where p and q are constants and λ is a scalar parameter.

Given that the point A with coordinates (-5, 9, -9) lies on l,

- (a) find the values of p and q,
- (b) show that the point B with coordinates (25, -1, 11) also lies on l.

The point C lies on l and is such that OC is perpendicular to l.

- (c) Find the coordinates of C.
- (d) Find the ratio AC: CB.

Total: 11

[3]

[2]

[4]

[2]



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4. During a chemical reaction, a compound is being made from two other substances. At time t hours after the start of the reaction, x g of the compound has been produced.

Assuming that x = 0 initially, and that

$$\frac{\mathrm{d}x}{\mathrm{d}t} = 2(x-6)(x-3),$$

- (a) show that it takes approximately 7 minutes to produce 2 g of the compound. [10]
- (b) Explain why it is not possible to produce 3 g of the compound.

Total: 12

[2]



5. Figure shows the curve with equation $y = 4x^{\frac{1}{2}}e^{-x}$.



- The shaded region is bounded by the curve, the x-axis and the line x = 2.
- (a) Use the trapezium rule with four intervals of equal width to estimate the area of the shaded [5] region.

The shaded region is rotated through 2π radians about the *x*-axis.

(b) Find, in terms of π and e, the exact volume of the solid formed.

[7] Total: 12

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6. (a) Find

$$\int 2\sin(3x)\sin(2x)\,\mathrm{d}x.$$

(b) Use the substitution $u^2 = x + 1$ to evaluate

$$\int_0^3 \frac{x^2}{\sqrt{x+1}} \,\mathrm{d}x$$

Total: 12

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[4]

[8]

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	6

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7. Figure shows the curve with parametric equations



The point P on the curve has x-coordinate $\frac{1}{2}$.

- (a) Find the value of the parameter t at P.
- (b) Show that the tangent to the curve at P has the equation y = 2x + 1. [5]
- The shaded region is bounded by the curve, the coordinate axes and the line $x = \frac{1}{2}$.
- (c) Show that the area of the shaded region is given by

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} k \cos(t) \, \mathrm{d}t,$$

where k is a positive integer to be found.

(d) Hence find the exact area of the shaded region.

[3]

[2]

[4]

Total: 14



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