

Solomon Practice Paper

Pure Mathematics 6H

Time allowed: 90 minutes

Centre: www.CasperYC.club

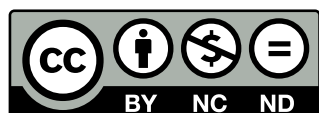
Name:

Teacher:

Question	Points	Score
1	5	
2	8	
3	8	
4	12	
5	13	
6	14	
7	15	
Total:	75	

How I can achieve better:

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Last updated: July 14, 2025

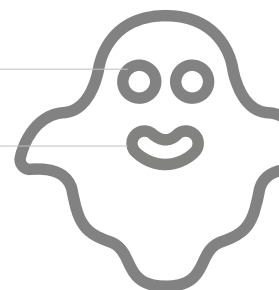


1. Given that

[5]

$$t_{n+1} = t_n - 4 \quad n \geq 1, \quad t_1 = 3,$$

prove by induction that $t_n = 7 - 4n$ for all integers $n, n \geq 1$.



2. (a) On the same Argand diagram sketch the locus of the points defined by the equations

[6]

i. $z + z^* = 2$,

ii. $\arg\left(\frac{z-2}{z+2}\right) = \frac{\pi}{4}$, where $\text{Im}(z) \geq 0$.

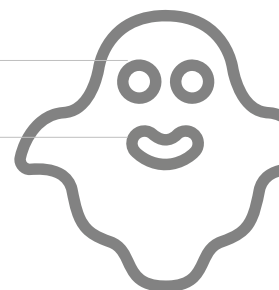
The region R of the complex z -plane is defined by the inequalities

$$z + z^* \leq 2, \quad \arg\left(\frac{z-2}{z+2}\right) \geq \frac{\pi}{4} \quad \text{Im}(z) \geq 0.$$

(b) Shade the region R on the Argand diagram.

[2]

Total: 8



3. The points A, B and C with coordinates (x_{-1}, y_{-1}) , (x_0, y_0) and (x_1, y_1) respectively lie on the curve $y = f(x)$ where $x_1 - x_0 = x_0 - x_{-1} = h$ and $y_n = f(x_n)$.

(a) By drawing a sketch, or otherwise, show that

[3]

$$f'(x_0) \approx \frac{f(x_0 + h) - f(x_0 - h)}{2h}.$$

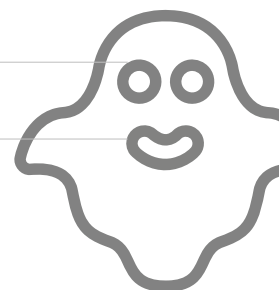
Given that

$$f'(x) = \sqrt{2x + f(x)}, \quad f(0) = 1, \quad f(0.2) = 1.25,$$

- (b) use two applications of the approximation in (a) with a step length of 0.2 to find an estimate for $f(0.6)$.

[5]

Total: 8



$$\begin{aligned}\mathbf{a} &= 2\mathbf{i} - \mathbf{j} + \mathbf{k}, \\ \mathbf{b} &= \mathbf{i} + q\mathbf{j} - 3\mathbf{k}, \\ \mathbf{c} &= 3\mathbf{i} - 4\mathbf{j} + 5\mathbf{k},\end{aligned}$$

(a) Find $\overrightarrow{AB} \times \overrightarrow{AC}$, giving your answer in terms of q . [5]

(c) Find an equation of the plane Π , giving your answer in the form $\mathbf{r} \cdot \mathbf{n} = p$. [2]

(d) find the volume of the tetrahedron $OABC$. [3]



5. (a) Use De Moivre's theorem to show that

[6]

$$\cos(5\theta) \equiv \cos(\theta) \left(16 \cos^4(\theta) - 20 \cos^2(\theta) + 5 \right).$$

(b) By solving the equation $\cos^5(\theta) = 0$, deduce that

[7]

$$\cos^2\left(\frac{3\pi}{10}\right) = \frac{5 - \sqrt{5}}{8}.$$

Total: 13



6. (a) Find the first three derivatives of $\ln\left(\frac{1+x}{1-2x}\right)$. [6]
- (b) Hence, or otherwise, find the expansion of $\ln\left(\frac{1+x}{1-2x}\right)$ in ascending powers of x up to and including the term in x^3 . [4]
- (c) State the values of x for which this expansion is valid. [1]
- (d) Use this expansion to find an approximate value for $\ln\left(\frac{4}{3}\right)$, giving your answer to 3 decimal places. [3]

Total: 14



$$\mathbf{A} = \begin{pmatrix} 2 & a & 2 \\ -1 & b & -2 \\ 0 & 0 & c \end{pmatrix} \quad \text{and} \quad \mathbf{B} = \begin{pmatrix} 6 & 5 & 2 \\ -1 & 0 & -2 \\ 0 & 0 & 5 \end{pmatrix}$$
$$(\mathbf{B} - 2\mathbf{I})\mathbf{A} = 3\mathbf{I} \quad (\star)$$

(a) Find the values of a, b and c . [6]

(c) Find an equation satisfied by all the points which remain invariant under T . [4]

(d) Find the values of p, q and r . [3]