

Solomon Practice Paper

Pure Mathematics 3J

Time allowed: 90 minutes

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	5	
2	5	
3	8	
4	10	
5	10	
6	12	
7	12	
8	13	
Total:	75	

How I can achieve better:

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Last updated: July 14, 2025

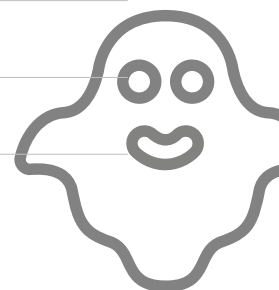


1. Given that

[5]

$$\frac{x^2 + 9x - 10}{(x - 2)^2(x + 1)} \equiv \frac{A}{(x - 2)^2} + \frac{B}{x - 2} + \frac{C}{x + 1},$$

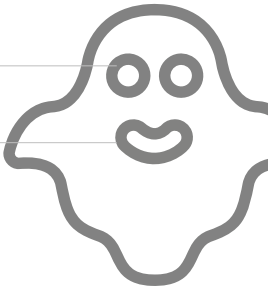
find the values of A, B and C .



2. Show that

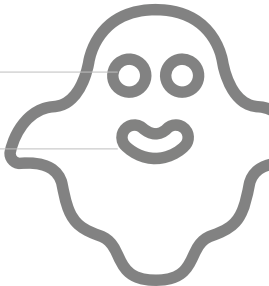
[5]

$$\int_2^4 x \left(x^2 - 4\right)^{\frac{1}{2}} \, dx = 8\sqrt{3}.$$



3. (a) Find the binomial expansion of $(1 + 4x)^{\frac{1}{4}}$ for $|x| < \frac{1}{4}$ in ascending powers of x as far as the term in x^3 . [3]
- (b) By substituting $x = 0.01$ into your expansion, find the fourth root of 16.64 correct to 6 decimal places. [5]

Total: 8



4. (a) Use the identity

[4]

$$\cot(x) \equiv \frac{\cos(x)}{\sin(x)}$$

to show that

$$\frac{d}{dx} \cot(x) = -\csc^2(x).$$

(b) Use integration by parts to find

[6]

$$\int x \csc^2(x) \, dx.$$

Total: 10



5. At time t the vectors \mathbf{r} and \mathbf{s} are given by

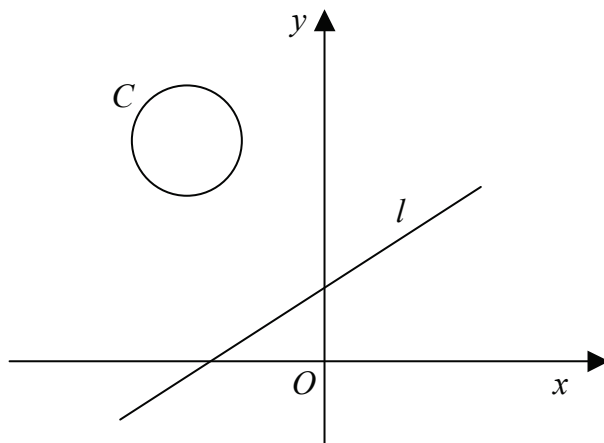
$$\begin{aligned}\mathbf{r} &= 2t^2\mathbf{i} - t\mathbf{j} + \mathbf{k}, \\ \mathbf{s} &= (t + 2)\mathbf{i} + (t^2 + 5)\mathbf{j} + (1 - t^3)\mathbf{k}.\end{aligned}$$

- (a) Find the angle between \mathbf{r} and \mathbf{s} when $t = 2$, giving your answer in degrees correct to 1 decimal place. [5]
- (b) Find the values of t for which \mathbf{r} and \mathbf{s} are perpendicular. [5]

Total: 10

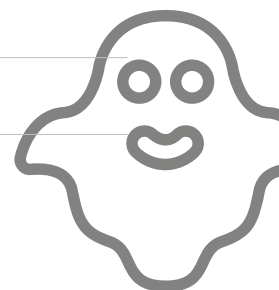


6. Figure shows the circle C with equation $x^2 + y^2 + 10x - 16y + 85 = 0$ and the line l with equation $2x - 3y + 8 = 0$.



- (a) Find an equation of the line which is perpendicular to line l and passes through the centre of circle C . [7]
- (b) Hence, or otherwise, find the minimum distance between l and C . [5]

Total: 12



- $$V = \frac{k}{h + 10},$$

A bubble of volume 0.1 m^3 is formed at a depth of 5 m in a water tank. Using the student's model,

- (b) show that, at this instant, V is increasing at the rate of $\frac{1}{96}$ m³ per metre the bubble rises. [3]

(c) find, correct to 2 significant figures, the rate at which the radius of the bubble is increasing per metre the bubble rises at the instant when it has risen 3 m. [5]



- [3]

$$\frac{dx}{dt} = -(\ln(3)) 3^{1-t}.$$

A curve has parametric equations

$$x = 3^{1-t} \quad \text{and} \quad y = 9^t - 1.$$

- [4]

$$\frac{dy}{dx} = (-2) \cdot 3^{3t-1}.$$

- [3]

- [3]

Total: 13

