

# Solomon Practice Paper

## Pure Mathematics 4B

Time allowed: 90 minutes

Centre: [www.CasperYC.club](http://www.CasperYC.club)

Name:

Teacher:

Question	Points	Score
1	6	
2	8	
3	9	
4	9	
5	10	
6	15	
7	18	
Total:	75	

How I can achieve better:

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Last updated: May 5, 2023













6. The complex numbers  $z_1, z_2$  and  $z_3$  are given by

$$z_1 = 7 - \mathbf{i}, \quad z_2 = 1 + \mathbf{i}\sqrt{3}, \quad z_3 = a + \mathbf{i}b,$$

where  $a$  and  $b$  are rational constants.

Given that the modulus of  $z_1z_3$  is 50,

(a) find the modulus of  $z_3$ . [3]

Given also that the argument of  $\frac{z_2}{z_3}$  is  $\frac{7\pi}{12}$ ,

(b) find the argument of  $z_3$ . [3]

(c) Find the values of  $a$  and  $b$ . [2]

(d) Show that  $\frac{z_1}{z_3} = \frac{1}{5}(4 + 3\mathbf{i})$ . [3]

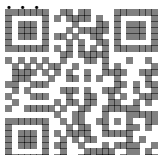
(e) Represent  $z_1, z_3$  and  $\frac{z_1}{z_3}$  on the same Argand diagram. [2]

(f) By considering the modulus and argument of  $z_1$  and  $z_3$ , explain why [2]

$$\frac{z_3}{z_1} = \left(\frac{z_1}{z_3}\right)^*$$

Total: 15

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7. (a) Given that  $x = e^t$ , find  $\frac{dy}{dx}$  in terms of  $\frac{dy}{dt}$  and show that [5]

$$\frac{d^2y}{dx^2} = e^{-2t} \left( \frac{d^2y}{dt^2} - \frac{dy}{dt} \right).$$

- (b) Show that the substitution  $x = e^t$  transforms the differential equation [3]

$$x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = 6x^2$$

into the differential equation

$$\frac{d^2y}{dt^2} - 2 \frac{dy}{dt} - 3y = 6e^{2t}.$$

- (c) Given that when  $x = 1, y = 3$  and  $\frac{dy}{dx} = -5$ , solve the differential equation [10]

$$x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = 6x^2.$$

Total: 18

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