

LC 2018: PAPER 1

QUESTION 2 (25 MARKS)

Question 2 (a)

$$z_1 = -2 + 3i$$

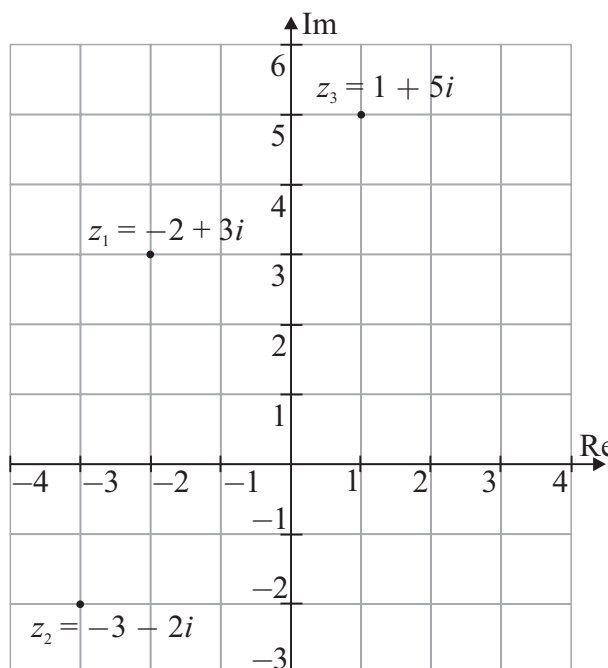
$$z_2 = -3 - 2i$$

$$\begin{aligned} z_3 &= z_1 - z_2 = -2 + 3i - (-3 - 2i) \\ &= -2 + 3i + 3 + 2i \\ &= 1 + 5i \end{aligned}$$

MARKING SCHEME NOTES

Question 2 (a) [Scale 15D (0, 3, 7, 13, 15)]

- 3:**
- $z_3 = z_1 - z_2$ with some substitution
 - 1 or 2 correct plots (z_1 and/or z_2) without labels
- 7:**
- z_3 correct, with or without plotting
 - 2 correct plots (z_1 and z_2) with labels
- 13:**
- Plot of incorrect z_3 and 2 correct plots labelled
 - Mixes up real and imaginary axes but plots and labels 3 points 'correctly'



Question 2 (b)

$$z_1 = -2 + 3i \Rightarrow |z_1| = \sqrt{(-2)^2 + 3^2} = \sqrt{13}$$

$$z_2 = -3 - 2i \Rightarrow |z_2| = \sqrt{(-3)^2 + (-2)^2} = \sqrt{13}$$

$$z_3 = 1 + 5i \Rightarrow |z_3| = \sqrt{1^2 + 5^2} = \sqrt{26}$$

$$|z_1| + |z_2| = 2\sqrt{13} = 7.2$$

$$|z_3| = \sqrt{26} = 5.1$$

$$\therefore |z_1| + |z_2| \neq |z_3|$$

Question 2 (c)

$$\begin{aligned} z_4 &= \frac{z_1}{z_2} = \frac{(-2 + 3i)}{(-3 - 2i)} \times \frac{(-3 + 2i)}{(-3 + 2i)} = \frac{6 - 4i - 9i + 6i^2}{9 - 6i + 6i - 4i^2} \\ &= \frac{6 - 13i - 6}{9 + 4} = \frac{-13i}{13} = 0 - 1i \end{aligned}$$

MARKING SCHEME NOTES

Question 2 (b) [Scale 5D (0, 2, 3, 4, 5)]

- 2:**
- $|z_1|$ or $|z_2|$ or $|z_3|$ formulated with some substitution
 - Correct formula
- 3:**
- $|z_1|$ or $|z_2|$ or $|z_3|$ correct
- 4:**
- $|z_1|$ and $|z_2|$ and $|z_3|$ correct but no conclusion or incorrect conclusion

Question 2 (c) [Scale 5C (0, 3, 4, 5)]

- 3:**
- Some correct substitution
 - Correct formula
 - Some multiplication above and below by same number, even if incorrect conjugate
 - correct answer without work
- 4:**
- $\frac{(-2 + 3i)(-3 + 2i)}{(-3 - 2i)(-3 + 2i)}$