

QQQ – Further Pure 2 – Chapter 3 – Complex Numbers (Version 1)

Total Marks: 22

(22 = Platinum, 20 = Gold, 18 = Silver, 15 = Bronze)

1. Sketch on an Argand diagram the region defined by

$$\left\{ z \in \mathbb{C} : -\frac{\pi}{4} < \arg(z + 2) < \frac{\pi}{4} \right\} \cap \{ z \in \mathbb{C} : -1 < \operatorname{Re}(z) \leq 1 \}$$

On your sketch

- shade the part of the diagram that is included in the region
- use solid lines to show the parts of the boundary that are included in the region
- use dashed lines to show the parts of the boundary that are not included in the region

(4)

(Total 4 marks)

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2. A complex number $z = x + iy$ is represented by the point P in an Argand diagram.

Given that

$$|z - 3| = 4|z + 1|$$

(a) show that the locus of P has equation

$$15x^2 + 15y^2 + 38x + 7 = 0$$

(2)

(b) Hence find the maximum value of $|z|$

(3)

(Total 5 marks)

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3. A complex number z is represented by the point P on an Argand diagram.

Given that

$$\arg \left(\frac{z - 4 - \mathbf{i}}{z - 2 - 7\mathbf{i}} \right) = \frac{\pi}{2}$$

(a) sketch the locus of P as z varies, **(2)**

(b) determine the exact maximum possible value of $|z|$ **(5)**

(Total 7 marks)

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4. A transformation from the z -plane to the w -plane is given by

$$w = \frac{3\mathbf{i}z - 2}{z + \mathbf{i}} \quad z \neq -\mathbf{i}$$

(a) Show that the circle C with equation $|z + \mathbf{i}| = 1$ in the z -plane is mapped to a circle D in the w -plane, giving a Cartesian equation for D . **(4)**

(b) Sketch C and D on Argand diagrams. **(2)**

(Total 6 marks)

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