

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

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1.

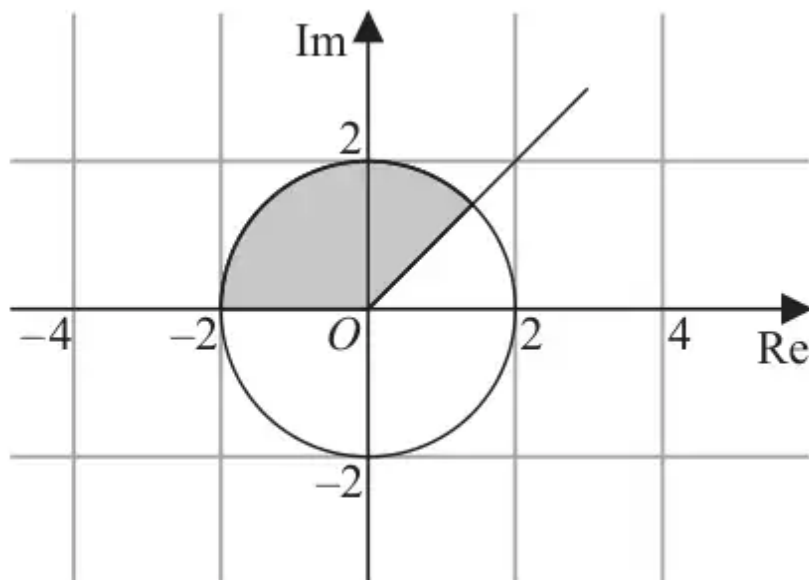


Figure 1

Figure 1 shows an Argand diagram.

The set of points, A , that lies within the shaded region, including its boundaries, is defined by

$$A = \{z : p \leq \arg(z) \leq q\} \cap \{z : |z| \leq r\}$$

where p , q and r are positive constants.

(a) Write down the values of p , q and r . (2)

Given that $w = -2\sqrt{3} + 2i$ and $z \in A$,

(b) find the maximum value of $|w - z|^2$ giving your answer in an exact simplified form. (4)

(Total 6 marks)

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

$$w = \frac{z + 2i}{iz} \quad z \neq 0$$

The transformation maps points on the real axis in the z -plane onto a line in the w -plane.

Find an equation of this line.

(4)

(Total 4 marks)

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3.

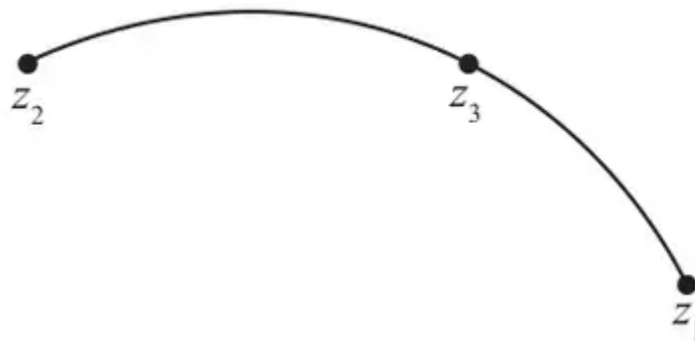


Figure 1

Figure 1 shows a locus in the complex plane.

The locus is an arc of a circle from the point represented by $z_1 = 3 + 2i$ to the point represented by $z_2 = a + 4i$, where a is a constant, $a \neq 1$

Given that

- the point $z_3 = 1 + 4i$ also lies on the locus
- the centre of the circle has real part equal to -1

(a) determine the value of a . (2)

(b) Hence determine a complex equation for the locus, giving any angles in the equation as positive values. (3)

(Total 5 marks)

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4.

- (i) A circle C in the complex plane is defined by the locus of points satisfying

$$|z - 3i| = 2|z|$$

- (a) Determine a Cartesian equation for C , giving your answer in simplest form. (3)

- (b) On an Argand diagram, shade the region defined by

$$\{z \in \mathbb{C} : |z - 3i| > 2|z|\}$$

(2)

- (ii) The transformation T from the z -plane to the w -plane is given by

$$w = z^3$$

- (a) Describe the geometric effect of T . (2)

The region R in the z -plane is given by

$$\left\{z \in \mathbb{C} : 0 < \arg z < \frac{\pi}{4}\right\}$$

- (b) On a **different** Argand diagram, sketch the image of R under T . (2)

(Total 9 marks)