7. A transformation T from the z-plane, where $z = x + iy$, to the w-plane, where $w = u + iv$ is given by

$$w = \frac{z - 3}{2i - z} \qquad z \neq 2i$$

The line in the z-plane with equation $y = x + 3$ is mapped by T onto a circle C in the w-plane.

(a) Determine

(i) the coordinates of the centre of C

(ii) the exact radius of C

(8)

The region $y > x + 3$ in the z-plane is mapped by T onto the region R in the w-plane.

(b) On a single Argand diagram

(i) sketch the circle C

(ii) shade and label the region R

(2)

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