

STEP II, 2020, Q7

7 In this question, $w = \frac{2}{z-2}$.

- (i) Let z be the complex number $3 + ti$, where $t \in \mathbb{R}$. Show that $|w - 1|$ is independent of t . Hence show that, if z is a complex number on the line $\operatorname{Re}(z) = 3$ in the Argand diagram, then w lies on a circle in the Argand diagram with centre 1.

Let V be the line $\operatorname{Re}(z) = p$, where p is a real constant not equal to 2. Show that, if z lies on V , then w lies on a circle whose centre and radius you should give in terms of p . For which z on V is $\operatorname{Im}(w) > 0$?

- (ii) Let H be the line $\operatorname{Im}(z) = q$, where q is a non-zero real constant. Show that, if z lies on H , then w lies on a circle whose centre and radius you should give in terms of q . For which z on H is $\operatorname{Re}(w) > 0$?



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