

1. Sketch the following sets and determine which are (i) connected, (ii) domain.

(a) $\operatorname{Re} z \geq 2$

(b) $-\frac{\pi}{4} < \arg z < \frac{\pi}{4}$

(c) $\{z : |z| < 2 \text{ or } |z - 3i| \leq 1\}$

2. Write the function $f(z) = z + \frac{1}{z}$, in the form $f(z) = u(x, y) + i v(x, y)$.

3. Suppose that $f(z) = x^2 - y^2 + 2x + i(2y - 2xy)$. Write $f(z)$ in terms of z , and simplify.

4. Find a region in the z plane whose image under the transformation $w = z^2$ is the square region in the w plane bounded by the lines $u = -1$, $u = -2$, $v = 1$, and $v = 3$.

5. Find the image of the semi-infinite strip $x \geq 1$, $-\frac{\pi}{4} < y \leq \frac{\pi}{4}$ under the transformation $w = \exp(z)$.