1. (a) Find and plot all the values of \((1 - \sqrt{3}i)^{\frac{1}{3}}\).

(b) Sketch the following sets and determine whether they are open closed or neither
(1) \(|\arg z| < \frac{\pi}{3}, z \neq 0\), (2) \(\text{Im} z = \text{Re} z\).

2. (a) Determine whether on not \(f(z) = e^{-y}\sin x - ie^{-y}\cos x\) is entire.

(b) Show that if \(f\) and \(\bar{f}\) are analytic in a domain \(D\) then \(f\) is a constant in \(D\).

3. (a) Find a branch of \(\log(z - 1)\) that is analytic inside the unit circle. What is the value of this branch at \(z = 0\).

(b) Determine the domain of analyticity of \(f(z) = \log(4 + i - z)\).

4. (a) Find all the branches of \((1 + z)^{\frac{1}{2}}\).

(b) Determine the domain of analyticity of the following functions,
(1) \(f(z) = \sin(\log z^2)\), (2) \(f(z) = \frac{z^2 + 3}{(z^2 + 2)^{\frac{1}{2}}}\), where the principal branch is used for the square root function.