

1. Find the limits, if they exist, of the following sequences

$$z_n = \frac{i}{n}, \quad w_n = (-i)^n, \quad u_n = \operatorname{Arg} \left(-1 + \frac{i}{n} \right), \quad v_n = e^{2\pi i n/5}, \quad s_n = \left(\frac{1-i}{4} \right)^n.$$

2. Prove the continuity of the function $f(z) = \bar{z}$ at every $z_0 \in \mathbb{C}$.
3. Prove the continuity of the function $f(z) = z^2$ at every $z_0 \in \mathbb{C}$.
4. Prove the continuity of the function $f(z) = \frac{1}{z^2}$ at every $z_0 \in \mathbb{C} \setminus \{0\}$.
5. Write the following functions $\mathbb{C} \rightarrow \mathbb{C}$ in the form $u(x, y) + iv(x, y)$, where $u, v \in \mathbb{R}$, $z = x + iy$:

$$f(z) = \frac{z+i}{z^2+1}, \quad g(z) = \frac{2z^2+3}{|z-1|}.$$

6. Prove that the following functions $\mathbb{C} \rightarrow \mathbb{C}$ are nowhere differentiable
 $z \rightarrow \operatorname{Re} z, \quad z \rightarrow \operatorname{Im} z, \quad z \rightarrow |z|.$