1. Find the real parts, imaginary parts, and absolute values of the complex numbers $z = (1 - i)/(1 + i)$ and $w = \exp(i\pi/3)$.

2. Find the domain of convergence of the following power series:

   (a) $\sum_{n=0}^{\infty} \frac{(z - 2)^n}{n}$

   (b) $\sum_{n=0}^{\infty} \frac{z^n}{n!}$

3. Suppose that an entire analytic function $f$ has arbitrarily small periods. That is, suppose that there is an infinite sequence $\{p_k : k \in \mathbb{N}\}$ with $|p_k| \to 0$ as $k \to \infty$ such that $f(z + p_k) = f(z)$ for all $k$ and all $z \in \mathbb{C}$. Prove that $f$ must be constant.

4. Let $C = \{z : |z| = r\}$ be a circle of radius $r > 0$, centered at the origin in $\mathbb{C}$, equipped with the positive (counterclockwise) orientation. Let $n > 1$ be an integer. Compute $\int_{C} \frac{1}{z^n} \, dz$. (Hint: parametrize $C$.)

5. Let $D \subset \mathbb{C}$ be the closed disk of radius $R$ centered at 0. Suppose that $f = f(z)$ is analytic on $D$ and satisfies $|f(z)| \leq M$ for all $z \in D$. Prove that $|f'''(0)| \leq 6M/R^3$.

6. Classify the following singularities as removable, poles, or essential. If the singularity is a pole, state its order.

   (a) $(\sin z)/z$ at $z = 0$

   (b) $\sin(1/z)$ at $z = 0$

   (c) $1/(\sin z)^3$ at $z = 0$

7. Use the Residue Theorem to evaluate the improper integral $\int_{-\infty}^{\infty} \frac{1}{x^2 + 1} \, dx$. 