1. (10+15 pts)
   (a) Find a conformal map from \( D = \{ z \in \mathbb{C} : \text{Re} \, z < 1 \} \) onto the unit disc \( \mathbb{D} = \{ z : |z| < 1 \} \).
   (b) Let \( f \) be a holomorphic function on the unit disc \( \mathbb{D} = \{ z : |z| < 1 \} \) such that \( f(0) = 0 \) and \( \text{Re} \, f(z) < 1 \). Show that \( |f(z)| \leq \frac{2|z|}{1-|z|} \).

2. (20 pts) If \( a > 1 \) show that the equation \( z + e^{-z} = a \) has exactly one solution with positive real part.

3. (25 pts) Compute \( \int_{|z|=1} z^n e^{1/z} dz \) where \( n \) is an integer.

4. (10+10+10 pts) Decide whether the following statements are true or false. Justify your answer!
   (a) \( \mathbb{C} \) is conformally equivalent to the unit disc \( \mathbb{D} = \{ z : |z| < 1 \} \).
   (b) \( D = \{ z : 1 < |z| < 2 \} \setminus (1, 2) \) is conformally equivalent to the upper half plane.
   (c) \( \frac{1}{z} \) has an antiderivative in \( A = \{ z : 1 < |z| < 2 \} \).