1. Given the function \( u(x, y) = 1 + \frac{(x-1)}{(x-1)^2 + y^2} \). Find
(a) if this function is a harmonic function and if it is then,
(b) find the conjugate harmonic function \( v(x, y) \);
(c) write \( f(z) \) (in terms of \( z \)) using real part \( u(x, y) \) and obtained imaginary part \( v(x, y) \).

2. Find the function \( f(z) \) that maps the first quadrant of the unit circle into the semicircle of the radius \( R \).

3. Evaluate the integral
\[
\int_{-\infty}^{\infty} \frac{\cos mx}{x-a} \, dx = \cdots \quad a - \text{real, } m > 0.
\]

4. Evaluate the integral
\[
\int_{-\infty}^{\infty} \frac{\cos (x/a)}{x^2-a^2} \, dx = \cdots \quad a - \text{real}
\]

5. Find general solution of the nonhomogeneous equation \( y'' - 2y' + y = 4e^x \).