1. Prove

\[ e^{z_1}e^{z_2} = e^{z_1+z_2} \]

for any pair of complex numbers \( z_1 \) and \( z_2 \). Use the definition

\[ e^z = 1 + z + \frac{z^2}{2!} + \frac{z^3}{3!} + \cdots = \sum_{n=0}^{\infty} \frac{z^n}{n!}. \]

2. Find the real and imaginary parts of \( e^z \)

3. Let \( f(z) \) be a complex function of a complex variable. Show that \( f(z)f(z)^* \) is always real and non-negative.

4. Use the quadratic formula to factorize the polynomial

\[ P(z) = z^2 + 3z + 12. \]

Use complex arithmetic to verify that the polynomial is recovered by multiplying the factors.

5. Calculate the real and imaginary parts of

\[ \frac{10 + i5}{7 - 3i}. \]

6. Find the modulus and argument of \( \cos(ix) \).