1. Evaluate the following complex integrals (all simple closed contours are oriented positively)

(a) \( \int_C z e^z \, dz \) where \( C \) is the circle \( |z - i| = 1 \).

(b) \( \int_C \frac{z e^z}{(z - i)^2} \, dz \) where \( C \) is circle \( |z| = 2 \).

(c) \( \int_C e^z \, dz \) where \( C \) is the straight line from \( -i \) to \( 2 + i \).

(d) \( \int_C \frac{1}{z^2(z^2 + 1)} \, dz \) where \( C \) is the circle \( |z - i| = \frac{3}{2} \).

(e) \( \int_C x - iy^2 \, dz \) where \( C \) is the straight line from \( 0 \) to \( 1 + i \).

(f) \( \int_C \left( \frac{e^{2iz}}{z^4} + \frac{z^4}{(z - i)^3} \right) \, dz \) where \( C \) is the circle \( |z| = 6 \).

2. Evaluate the integral

\[ \int_C \frac{3z + 1}{z(z - 2)^2} \, dz \]

where \( C \) is the following figure-eight contour:

3. Find the limit (if it exists) of the following sequences:

(a) \( z_n = \frac{3 + ni}{n + 2m} \)

(b) \( z_n = 5i^n \)

(c) \( z_n = \left( \frac{1 + i}{4} \right)^n \) (Hint: You can use polar coordinates).

4. Determine whether the given series is convergent or divergent. If convergent, find its sum.

(a) \( \sum_{n=0}^{\infty} (1 - i)^n \)

(b) \( \sum_{n=0}^{\infty} \left( \frac{i}{2} \right)^n \)

(c) \( \sum_{n=0}^{\infty} \frac{1}{2} i^n \)

(d) \( \sum_{n=0}^{\infty} 3 \left( \frac{2}{1 + 2i} \right)^n \)