1. Find the radius and interval of convergence for the series \( \sum_{k=0}^{\infty} (-1)^k \frac{x^k}{k!} \). Show that the McLaurin series for \( e^{-x} \) converges to the given series.

**Hint:** Find McLaurin series expansion for \( e^{-x} \) and use remainder theorem to show the convergence.

2. Using alternating series test to show that \( \sum_{k=2}^{\infty} (-1)^k \frac{k}{k \ln k} \) converges. Using the integral test check the conditional convergence of the given series.

3. Evaluate \( \int_{0}^{\infty} \frac{5}{x^2 + x - 2} \, dx \).

4. Find the volume of the solid generated by revolving \( x = \sin^2 y \) about \( x = 1 \) between 0 and \( \frac{\pi}{2} \).

5. Find the area of the surface generated when the curve \( y = x^2 \) from \( x = 0 \) to \( x = 1 \) is revolved about \( x \)-axis.

6. Find the area of the region enclosed by \( y = \ln x \), \( x = e \) and the \( x \)-axis.