1. Use the method of cylindrical shells to find the volume generated by rotating the region bounded by
the curves \( y = e^x, y = 0, x = 0 \) and \( x = 1 \) about the \( y \)-axis.

2. Find the length of the curve \( x = y^2 \) for \( 0 \leq y \leq 1 \).

3. Determine whether the improper integral is convergent or divergent. If convergent, evaluate the
integral.

\[
\int_0^\infty \frac{1}{x^2 + 3x + 2} \, dx
\]

4. Find the area of the surface obtained by rotating the curve \( x = \cos^3 t, y = \sin^3 t \) for \( 0 \leq t \leq \frac{\pi}{2} \) about
the \( x \)-axis.

5. Find the radius and interval of convergence of the power series \( \sum_{n=1}^{\infty} \frac{x^n}{n(-5)^n} \).
6. Test the series for convergence or divergence.

a. \[ \sum_{n=1}^{\infty} \frac{3^n n^2}{n!} \]

b. \[ \sum_{n=1}^{\infty} \frac{(n + 1)^2}{n(n + 2)} \]

c. \[ \sum_{n=1}^{\infty} \frac{1 + \sin n}{10^n} \]

d. \[ \sum_{n=1}^{\infty} \frac{n - 1}{n4^n} \]

7. Find a power series representation for the function \( f(x) = \frac{x}{(1 - x)^2} \) and determine the radius of convergence.