1. (12 pts) Determine whether the series converges or diverges.

(a) \[ \sum_{k=1}^{\infty} \frac{k}{2^k} \]

(b) \[ \sum_{k=1}^{\infty} \frac{5k + 3}{4k - 2} \]

2. (10 pts) Find the Taylor series expansion of the function \( f(x) = \cos x \) about \( x_0 = \pi/2 \).

3. (10 pts) Suppose that a bee follows the trajectory

\[ x = t - 2\cos t, \quad y = 2 - 2\sin t, \quad 0 \leq t \leq 10. \]

(a) At what times was the bee flying horizontally?

(b) At what times was the bee flying vertically?

4. (10 pts) Calculate the arc length of the polar curve \( r = e^{3\theta} \) from \( \theta = 0 \) to \( \theta = 2 \).

5. (10 pts) Find the area between the curves \( y = x^2 - 3x + 3 \) and \( y = x \).

6. (10 pts) The region bounded by the curve \( y = \sqrt{x} \), the \( x \)-axis, and the line \( x = 9 \) is revolved about the \( x \)-axis to generate a solid. Find the volume of the solid.

7. (18 pts) Evaluate the following integrals:

(a) \[ \int_{-\infty}^{0} \frac{dx}{(4x - 1)^3} \]

(b) \[ \int x^2 \sin(3x) \, dx \]

(c) \[ \int \frac{z + 5}{z(z + 1)(z - 2)} \, dz \]

8. (10 pts) Compute the radius of convergence for the series \[ \sum_{n=1}^{\infty} \frac{(x - 5)^n}{n^2} \]

9. (10 pts) A fish tank has a rectangular top of width 2 ft, a length of 6 ft, and semicircular sides of height 3 ft. If the tank is filled with water weighing 62.5 lb/ft\(^3\), calculate the hydrostatic force on the semicircular side of the tank.