

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

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

(b) $\sum_{k=1}^{\infty} \left(\frac{5k+3}{4k-2} \right)$

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/ft³, calculate the hydrostatic force on the semicircular side of the tank.

