1. The lines $x = 0$, $x = 1$, $y = 0$ and the curve $y = xe^{x^2}$ bound a region of the $xy$-plane. If we rotate this region about the $x$-axis, what is the volume of the resulting solid?

2. (a) Find the Taylor series expansion of the function $f(x) = x^3 \cos(x^2)$ about $0$.

(b) Evaluate $f^{(75)}(0)$.

(c) Use the series in part (a) to approximate $f(1/2)$ to within $10^{-3}$.

3. Find the following indefinite integrals.
   (a) $\int \frac{x}{\sqrt{3-x^4}} \, dx$ (b) $\int \tan^3 x \, dx$

4. Find the area of the surface obtained by rotating the curve $y = 2\sqrt{x}$, $0 \leq x \leq 8$, about the $x$-axis.

5. Decide whether the following infinite series are absolutely convergent, conditionally convergent, or divergent.
   (a) $\sum_{n=2}^{\infty} \frac{1}{n \ln n}$ (b) $\sum_{n=1}^{\infty} \frac{\cos n}{n^3}$

6. Sketch the curve given by the polar equation $r = 4 - 2 \sin \theta$. Find the area enclosed by the curve.
7. Determine whether the following integrals are convergent or divergent.

(a) \( \int_{\pi/2}^{\infty} \frac{\arctan x}{x^2} \, dx \)

(b) \( \int_{0}^{\pi/2} \tan x \, dx \)

8. Find \( \lim_{x \to \infty} (x \ln(x + 2) - x \ln x) \).

9. Does the sequence \( a_n = (-1)^n \frac{\ln n}{\sqrt{n}} \) converge as \( n \to \infty? \) If it does, find its limit.

10. Determine the radius of converge and the interval of convergence of the power series \( \sum_{n=0}^{\infty} \frac{2^n(x-3)^n}{3n+1} \).