1. Evaluate the integrals:

A. \( \int \sec^2(3x) \, dx \)

B. \( \int \frac{x}{x^2 + 2x - 15} \, dx \)
2. Consider the IVP $y' = y - 2$, $y(0) = 1$.
   
a) Use Euler’s Method with 2 steps of size 0.5 to estimate $y(1)$.
   
b) Solve this IVP using the method of separation of variables.
   
c) Using your answer in part(b), find $y(1)$. 
3. a) Graph the region bounded by the curve $y = \sqrt{1-x^2}$ and the x-axis.

b) Find the area of this region.

c) Find the volume of the solid formed when this region is rotated about the x-axis.
4. For the graph \( y = \ln(\cos(x)) \), write the integral to find the length of the arc from \( x = 0 \) to \( x = \pi/4 \).

5. Let \( f(x) = \ln(x) \).
   
   a) Using the Taylor Polynomial formula, find the third degree polynomial for \( f \) based at \( x_0 = 1 \).
b) Use the power series representation of \( \frac{1}{1-x} \) to produce a power series representation for \( f(x) = \ln(x) \).

6. Does the improper integral \( \int_{1}^{\infty} \frac{\ln(x)}{x^2} \, dx \) converge or diverge? Justify your answer.
7. For each of the following series, test (using one of the tests developed in class) to determine whether the series converges absolutely, converges conditionally, or diverges and explain why. If the series converges, find an Upper Bound.

a) $\sum_{n=1}^{\infty} \frac{(-1)^n}{3^n + 1}$

b) $\sum_{n=1}^{\infty} e^{-1/n}$

c) $\sum_{n=1}^{\infty} \frac{m^3}{m^2 + 3}$
d) \[ \sum_{n=1}^{\infty} \frac{(-1)^n(n+1)}{\ln(n+1)} \]

9. For the power series \[ \sum_{n=1}^{\infty} \frac{x^n}{2^n n} \]

a) Find the radius of convergence.

b) Find the interval of convergence.
10. Evaluate the integral you found in #4.

11. Consider the series $\sum_{n=0}^{\infty} \frac{1}{2^n n!}$.

a) Show that this series converges.

b) Using a well-known function and its power series expansion, find the sum of this series. Identify the function and explain how you obtained the sum.