1. Evaluate the following integrals.
   
   (a) $\int \tan^3 \theta d\theta$

   (b) $\int x^2 \sin(3x)dx$
2. (a) Write the form of the partial fraction decomposition of the following function. Do not solve for the undetermined coefficients.

\[ g(x) = \frac{1}{(x^2 + 2)(x - 1)^2(x + 3)} \]

(b) \[ \int \frac{19 - 4x}{(x^2 + 4)(2x - 1)} \, dx \]
3. \[ \int \frac{\sqrt{z^2 - 25}}{z^3} \, dz \]

4. Use Simpson’s Rule with \( n=4 \) to approximate the integral \( \int_0^{\pi} \sin t \, dt \)
5. Compute the length of the curve \( y = \cosh x \) on the interval \( 0 \leq x \leq \ln 2 \).

6. Solve the following initial value problem

\[ y' = \frac{1 + y}{\cos^2 x}, \quad y(0) = 2 \]
7. Determine whether the following are convergent or divergent. If the integral is convergent, evaluate it.

(a) \[ \int_{1}^{\infty} \frac{1}{x[\ln(x) + 1]^3} \, dx \]

(b) \[ \int_{1}^{\infty} \frac{1}{\sqrt{4x^2 - 1}} \, dx \]
**Bonus**
Pick one of the two following problems to do. Circle the number of the problem you want graded.

1. Compute
\[ \int \cos(x)e^{2x}dx \]

2. Compute
\[ \int \frac{x^3}{x^3 + 1}dx \]
Scratch Paper and a Few Formulas

cosh \( x = \frac{e^x + e^{-x}}{2} \)

sinh \( x = \frac{e^x - e^{-x}}{2} \)

\( 1 + \tan^2 \theta = \sec^2 \theta \)

\( \cos 2\theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta \)

\( \sin 2\theta = 2 \sin \theta \cos \theta \)

\[ \int \sec x \, dx = \ln |\sec x + \tan x| + C \]

\[ \int \csc x \, dx = \ln |\csc x - \cot x| + C \]

\[ \frac{\Delta x}{2} [f(x_0) + 2f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-1}) + f(x_n)] \]

\[ \frac{\Delta x}{3} [f(x_0) + 4f(x_1) + 2f(x_2) + \cdots + 4f(x_{n-1}) + f(x_n)] \]