Formulae

\[ \int \tan(x) \, dx = \ln|\sec(x)| + C \]
\[ \int \frac{1}{1 + x^2} \, dx = \arctan(x) + C \]
\[ \frac{d}{dx} \tan(x) = \sec^2(x) \]
\[ 1 = \sin^2(x) + \cos^2(x) \]
\[ \cos^2(x) = \frac{1 + \cos(2x)}{2} \]
\[ |E_T| \leq \frac{K(b - a)^3}{12n^2} \]

\[ \int \sec(x) \, dx = \ln|\sec(x) + \tan(x)| + C \]
\[ \int \frac{1}{\sqrt{1 - x^2}} \, dx = \arcsin(x) + C \]
\[ \frac{d}{dx} \sec(x) = \tan(x) \sec(x) \]
\[ 1 + \tan^2(x) = \sec^2(x) \]
\[ \sin^2(x) = \frac{1 - \cos(2x)}{2} \]
\[ |E_S| \leq \frac{K(b - a)^5}{180n^4} \]
1. Compute the following integrals:
   (a) (10 points) \[ \int \ln(x)^2 \, dx \]

   **Solution:**
   
   (b) (10 points) \[ \int \tan^5(x) \sec^{-3}(x) \, dx \]

   **Solution:**
2. (20 points) Find the arc length of the curve $y = \ln(\cos(x))$ between 0 and $\pi/3$.

Solution:
3. (20 points) Compute the following integral:

\[ \int \frac{x^3 + x^2 - x + 1}{(x - 1)^2(x^2 + 1)} \, dx \]

Solution:
4. (a) (10 points) Use the Trapezoidal Rule with \( n = 4 \) to approximate the definite integral
\[
\int_0^8 f(x) \, dx,
\]
where \( f(x) \) takes the following values:

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Solution:

(b) (10 points) Assuming that \( |f''(x)| \leq 2 \), for all \( 0 < x < 8 \), how large an \( n \) would we need to choose to guarantee that
\[
|E_T| \leq 0.01
\]

Solution:
5. (20 points) Evaluate following improper integral:

\[ \int_{-1}^{0} \frac{(x+1)^5}{\sqrt{-x^2 - 2x}} \, dx \]

If it is divergent, write divergent and explain your reasoning.

Solution: