1. (10 pts) The graph of a function is decreasing and concave up on the interval [1,5]. Put the following quantities in increasing order: \( L_{100}, R_{100}, \int_{x_1}^{x_2} f(x) \, dx, T_{100}, M_{100} \). 

2. (10 pts each) Evaluate. [Your final answer should not contain any integrals]:

   A. \( \int \sqrt{1 - 2x^2} \, (4x) \, dx \)
B. \[ \int \tan^3(x) \sec^2(x) \, dx \]

c. \[ \int \frac{x - 1}{x^2 + 1} \, dx \]
3. (10 pts) Use Euler’s method with four steps on the differential equation \( y' = -y \) to estimate \( y(2.0) \) if \( y(0) = 1.0 \) by filling in the table:

<table>
<thead>
<tr>
<th>Step</th>
<th>t</th>
<th>( \Delta t )</th>
<th>( y(t) )</th>
<th>( y'(t) )</th>
<th>( \Delta y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tbody>
</table>
4. (10 pts) Find the solution of the initial value problem:

\[ y' = 2xy \text{ with } y(0) = 2. \]

5. (5 pts each) If A is the region bounded by the graphs of \( y = \sqrt{x} \), \( y = 0 \), and \( x = 1 \), set-up an integral that gives the volume of the solid obtained when A is revolved around:

a) the x-axis

b) the y-axis

c) \( y = -1 \).
6. Consider the function $y = \frac{13}{23} + \frac{x^2}{3} + 1$ over the interval $[0, 8]$.

A. (5 pts) Write an integral that gives the arc length of the graph over the interval $[0, 8]$.

B. (10 pts) Evaluate this integral.

7. (10 pts) A bucket that weighs 30 lbs. when filled with water is lifted from the bottom of a well that is 50 feet deep. The bucket has a hole in it, so it weighs only 10 lbs. when it reaches the top of the well. The water leaks out at a constant rate and the rope weighs 0.25 lb/ft.

**Set up but do not evaluate** an integral whose value is the work required to lift the bucket from the bottom of the well to the top.