(8) I. The graph of the function $f(x) = \sqrt{x+1}$ is increasing and concave down on the interval [1, 10]. Put the following quantities in increasing order: $L_{100}$, $R_{100}$, $\int_{1}^{10} f(x) dx$.

(10) II. Let $I = \int_{1}^{3} x^2 dx$.

A. Use the Fundamental Theorem of Calculus to evaluate $I$ exactly.

B. Write out and add up the four terms in the approximating sums

$L_4 =$

$R_4 =$
(24) III. Evaluate. [Your final answer should not contain any integrals]:

A. \[ \int x \cos(x^2 + 1) \, dx = \]

B. \[ \int \frac{\cos x}{1 + \sin^2 x} \, dx = \]
C. \[ \int_{0}^{1} \frac{x^2}{x^3 + 4} \, dx = \]

(10) IV. Use Euler’s method with four steps on the differential equation \( y' = y - t \) to estimate \( y(3.0) \) if \( y(1.0) = 0 \) by filling in the table:

<table>
<thead>
<tr>
<th>STEP</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t )</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>( y'(t) )</td>
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<tr>
<td>( y(t) )</td>
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</tbody>
</table>
(8) V. Write (but do not evaluate) an integral that gives the arc length of the graph of 
\[ y = e^{2x} \] over the interval \([1, 2]\).

(10) VI. If \( A \) is the region bounded by the graphs of \( y = x^4 \) and \( y = x \), what is the volume of the solid obtained when \( A \) is revolved around the \( y \)-axis?
(10) VII. Set up and evaluate an integral that gives the area between the graphs of \( y = x^{1/3} \) and \( y = x \). Do not approximate the area, but rather calculate it exactly.

(10) VIII. Find the solution of the initial value problem:

\[ y' = \frac{x}{y} \text{ with } y(0) = 2. \]
(10) IX. A bucket that weighs 80 lb when filled with water is lifted from the bottom of a well that is 100 feet deep. The bucket has a hole in it, so it weighs only 60 lb when it reaches the top of the well. The water leaks out at a constant rate and the rope weighs 0.45 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.