1. Find the following.

(a) \[ \int 7x^2 \cos(x^3) \, dx \]

(b) \[ \int_0^\infty xe^{-3x} \, dx \]

(c) \[ \int_0^6 \frac{1}{x - 4} \, dx \]

(d) \[ \int \frac{3x^2 + 2x - 5}{(x^2 + 1)(x - 4)} \, dx \]

(e) \[ \int \tan^2 x \sec^4 x \, dx \]
(f) \[ \int \sqrt{9-x^2} \, dx \]

2. Find the best possible left, right, midpoint, trapezoidal, and Simpson’s approximations to \( \int_{-2}^{0} f(x) \, dx \) given the data in the table below.

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1.5</th>
<th>-1</th>
<th>-0.5</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

3. If you use numerical integration to estimate \( \int_{a}^{b} \ln x \, dx \), how would the following be ordered from least to greatest? \( L_{100}, R_{100}, M_{100}, T_{100}, S_{200} \).

What can you say with certainty about where \( \int_{a}^{b} \ln x \, dx \) would fit into your ordering?
4. Find bounds for each of the following errors if \( I = \int_{0}^{2} e^{-3x} \, dx \).

(a) \(|I - L_{100}|\)

(b) \(|I - T_{100}|\)

(c) \(|I - M_{100}|\)

(d) \(|I - S_{100}|\)

5. Sketch the slope field for \( \frac{dy}{dx} = y - 3 \).

6. Use Euler’s Method with 3 steps to estimate \( y(3/4) \) if \( \frac{dy}{dx} = y - 3 \) and \( y(0) = 1 \). Is your answer an overestimate or underestimate?
7. Consider the region bounded by $y = 0$, $x = 0$, $x = 2$, and $y = x^2$. Write an integral equal to the volume of the shape created when the region is revolved about

(a) the $x$-axis

(b) the line $x = 5$

8. A spherical tank of radius 8 feet is buried 5 feet below ground and filled to a height of 11 feet with gasoline (42 pounds per cubic foot). Write an integral equal to the work done in pumping all the gasoline to ground level.

9. What is the formula for each of the following?

(a) the arc length of $y = f(x)$ from $x = a$ to $x = b$

(b) the present value of an income stream $P(t)$ from time $a$ to time $b$ at a continuous interest rate $r$