1. Find the following. [See Review for Exam II for integration tips and strategies.]

(a) \( \int 12x^2 \cos(x^3) \, dx \)

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

(c) \( \int_0^6 \frac{dx}{(x - 4)^2} \)

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

(e) \( \int_0^{\pi/3} \tan^3 x \sec^5 x \, dx \)
(f) \( \int \sqrt{25 - x^2} \, dx \)

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 \( \int_{a}^{b} \ln x \, dx \) (where \( a \) and \( b \) are positive), how would the following be ordered from least to greatest? \( L_{100}, R_{100}, M_{100}, T_{100}, \int_{a}^{b} \ln x \, dx \).
4. Find bounds for each of the following errors if \( I = \int_{0}^{2} e^{-5x} \, dx \).

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

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

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

5. If \( I = \int_{0}^{2} e^{-5x} \, dx \), how many subdivisions are required to obtain a midpoint sum approximation with error of at most 1/1,000,000?

6. Write an integral equal to the area between \( y = 2x + 3 \) and \( y = x^2 + 7x - 3 \).

7. Compute the arc length of \( y = \sqrt{1 - x^2} \) from \( x = 0 \) to \( x = 1/2 \).
8. Consider the region bounded by $y = 0$, $x = 2$, and $y = x^2$. Write an integral equal to the volume of the object created when the region is revolved about

(a) the $x$-axis

(b) the line $x = 5$

9. The probability density function (pdf) of the weights of newborn toads in a certain pond is given by $f(x) = \frac{k}{(x+1)^4}$, where $x$ is the weight (in ounces). Note that the domain is $x \geq 0$ since no toad can have a negative weight.

(a) What must be the value of $k$?

(b) What fraction of the newborn toads weigh more than one ounce?

10. Find the solution to $\frac{dy}{dx} = \frac{\cos x}{y^2}$ that passes through $(0, 2)$.