1. Express the definite integral as the limit of a Riemann sum. Explicitly define all expressions you use. \[ \int_{-2}^{5} \sin(x) \, dx \]

2. Approximate the definite integral \( \int_{2}^{4} \frac{x-3}{x} \, dx \) as a sum. Use four equal subintervals and right endpoints.

3. Find the derivative \( \frac{dy}{dx} \) if \( y = \int_{x}^{5} \ln(t^3) \, dt \). Be sure to show your work and give the statement of any theorems that you use.

4. Given the graph of \( y = f(x) \):
   a) Find \( \int_{3}^{8} f(x) \, dx \).
   b) Find the average value of \( f \) on \([3,8]\).

5. Find the general antiderivatives for the following functions:
   a) \( f(x) = \frac{x^2 - 3x + 1}{x} \)
   b) \( g(\theta) = \sec^2 \theta \)
   c) \( h(x) = \frac{(\ln x)^3}{x} \)
6. Use the Fundamental Theorem of Calculus to evaluate the following definite integrals.
   a) \( \int_1^4 \frac{1+\sqrt{x}}{\sqrt{x}} \, dx \)
   b) \( \int_0^1 xe^x \, dx \)

7. Find \( N(t) \) if \( \frac{dN}{dt} = 3e^{-3t} \) and \( N(0) = 50 \).

8. Find the total area bounded by \( y = x \) and \( y = x^3 \).
   Partial credit will be given for an accurate graph with all points of intersection labeled.

9. Find the volume of the solid obtained by rotating the region bounded by \( y = e^x \),
   \( y = e^{-x} \), and \( x = \ln 2 \) about the x-axis.
   Partial credit will be given for an accurate graph with all points of intersection labeled.

10. A tank is in the shape of a cone with vertex down. The diameter is 16m and the height is 10m. The tank is filled with water to a depth of 3m and the density of water is 1000 kg/m^3. Set up the integral necessary to find the work done pumping the water over the edge of the cone.

THESE QUESTIONS ARE FROM AN ACTUAL OLD EXAM. YOUR EXAM WILL RESEMBLE THIS EXAMPLE OF AN OLD EXAM IN DEGREE OF DIFFICULTY AND LENGTH. THE ACTUAL QUESTIONS MAY OR MAY NOT BE SIMILAR. FOR A LIST OF TOPICS THAT YOU ARE RESPONSIBLE FOR PLEASE SEE “Review for Exam 1” ON THE SYLLABUS WEBPAGE.