Exam 5

Math 8 BB
December 7, 1994

Directions: Set up a definite integral or integrals for the solutions of the following problems. DO NOT EVALUATE ANY INTEGRALS. All integrals must be in terms of a single variable. Sketching graphs can be very helpful. Each problem is worth 10 points.

1. Find the area of the region bounded by \( f(x) = (x - 1)^3 \) and \( g(x) = x - 1 \).

2. Use the disc or washer method to find the volume of the solid generated by revolving the region bounded by the graphs of \( y = x \), \( y = 3 \), and \( x = 0 \) about the line \( y = 4 \).

3. Find the volume of the solid whose base is bounded by the graphs of \( y = x + 1 \) and \( y = x^2 - 1 \) and whose cross-sections perpendicular to the \( x \)-axis are rectangles of height 1.

4. Use the shell method to find the volume of the solid generated by revolving the region bounded by the graphs of \( y = \frac{1}{x}, \ x = 1, \ x = 2, \) and \( y = 0 \) about the \( x \)-axis.

5. The base of a solid is a circle of radius \( a \) and its vertical cross sections are equilateral triangles. Find the volume of the solid.

6. Find the length of the graph of \( y = \cos x \) over the interval \( -\frac{\pi}{2} \leq x \leq \frac{\pi}{2} \).

7. A right circular cone is generated by revolving the region bounded by \( y = h \ x / r, \ y = h, \) and \( x = 0 \) about the \( y \)-axis. Find the lateral surface area of the cone.

8. A force of 15 pounds stretches a spring 6 inches in an exercise machine. Find the work done in stretching the spring 1 foot from its natural position. (Be careful with the units.)
9. The fuel tank on a large truck has trapezoidal cross sections with dimensions (in feet) shown in the figure. Assume that the engine is approximately 2 feet above the top of the fuel tank and that diesel fuel weighs 55.6 pounds per cubic foot. Find the work done by the fuel pump in raising a full tank of fuel to the level of the engine.

10. The figure illustrates the vertical side of a form for poured concrete that weighs 140.7 pounds per cubic foot. Determine the force on this part of the form.