MATH 1352-H02 Exam I February 7, 2002

Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Do your own work. Show all relevant steps which lead to your solutions. Retain this question sheet for your records.

Instructions:

A. On problems which ask you to compute the area of a region *R*, the volume of a solid of revolution obtained by revolving a region *R* about an axis of revolution, the arc length of a curve *C* or the surface area of a surface of revolution obtained by revolving a curve *C* about an axis of revolution, please include as part of your solution a sketch of the region *R* or the curve *C* and (where relevant) the location of the axis of revolution.

B. On problems which ask you to compute the value of an integral, explicitly identify an anti-derivative for the integral. Identifying each such anti-derivative should require either the use of one of the basic anti-differentiation formulas, the method of subsitution or a formula from the Table of Integrals — or maybe a combination of the above. In the process of identifying the anti-derivative of the integral, if you use a substitution, then explicitly identify the change of variable you use in the substitution. If you use a formula from the integral table, then explicitly identify the formula line from the table which you use and the choice of parameters which you use in the formula.

1. Compute the total area bounded between the curves $y = 3 + 2x - x^2$ and $y = 3 - 2x$ between $x = -1$ and $x = 5$.

2. Set up (DO NOT EVALUATE) an integral for the volume of the solid of revolution obtained by revolving the region *R* about the axis *l* where:

   a. *R* is the region bounded between the curves $y^2 = x + 2$ and $y = x$ and *l* is the line $y = 12$.

   b. *R* is the region bounded between the curves $y^2 = x + 2$ and $y = x$ and *l* is the line $x = 12$.

3. Set up (DO NOT EVALUATE) an integral for the volume of the solid of revolution obtained by revolving the region *R* about the axis *l* where:

   a. *R* is the region bounded between the curves , $y = \sqrt{x+1}$ $y = 3$ and the *y*-axis and *l* is the line $y = 12$.

   b. *R* is the region bounded between the curves $y = \sqrt{x+1}$, $y = 3$ and the *y*-axis and *l* is the line $x = 12$.

4. Find the arc length of the curve $x = \frac{1}{3}(2 + y^2)^{\frac{3}{2}}$ where $3 \le y \le 6$.

5. Set up (DO NOT EVALUATE) an integral for the surface area of the surface of revolution obtained by revolving the curve C about the axis l where:

   C is the curve given by $y = 2(x + 1)^{\frac{3}{2}}$ and $1 \le x \le 4$ and l is the y-axis.

6. A 20 lb bucket is attached to a chain which weights 0.5 lb/ft. The bucket is filled with 110 pounds of mortar and then winched by an electric motor from the ground to the top of the scaffolding (at the stadium renovation) which is 60 feet above the ground. How much work is expended by the winch in lifting the bucket, chain and mortar from the ground to the scaffolding top?

7. The radius of a circular water main is 2 ft. Assuming the main is half full of water, find the total force exerted by the water on a gate that crosses the main at one end.

8. Find: $\int (2 + 3x)\sqrt{4 + 9x}\, dx$

9. Find: $\int \frac{4\, dx}{x^{\frac{1}{2}} + 2x^{\frac{1}{4}}}$

10. Find: $\int \frac{x\, dx}{\sqrt{8x + x^2}}$