MAT 202
Assignment 3

Wednesday, July 17, 2011

For full credit on these problems, each must be submitted with a complete and clear solution, showing all of your work. You may work with other classmates on these problems, but please indicate on your assignment if you received help. Partial answers and incomplete solutions may be eligible for some partial credit, depending on the level of completeness and demonstrated understanding.

1. Evaluate the following definite and indefinite integrals by using u-substitution.
   (a) $\int_0^4 (2x-1)\sqrt{x^2-x}\,dx$
   (b) $\int_1^2 \frac{x^2}{x^3+1}\,dx$
   (c) $\int_0^{\pi/2} \frac{\sin x}{\cos^2 x}\,dx$
   (d) $\int \tan x \sec^2 x\,dx$
   (e) $\int \frac{2x-1}{x^2+4x+12}\,dx$
   (f) $\int \frac{1}{(x-1)\sqrt{x^2-2x}}\,dx$
   (g) $\int \frac{x^2+4x+1}{x-2}\,dx$

2. Prove that the function
$$F(x) = \int_x^{2x} \frac{1}{t}\,dt$$
is constant on the interval $[0, \infty)$.

3. Without integrating, explain why $\int_{-2}^{2} x(x^2+1)^2\,dx = 0$.

4. If f is continuous and $\int_0^8 f(x)\,dx = 32$, find $\int_0^4 f(2x)\,dx$.

5. A population P of bacteria is changing at a rate of
$$\frac{dP}{dt} = \frac{3000}{1+0.25t}$$
where t is the time in days. The initial population (when $t = 0$) is 1000. Write an equation that gives the population at any time t, and find the population when $t = 3$ days.