Math 252 NAMES:_____
Lab #3 (From material covered in Ch. 5, 6.1, and 6.2)

This lab will be due Monday, of week 6. The lab will be graded based on completeness, neatness and accuracy. Your lab should be completed on separate paper, answers only written here, and stapled together. Again, as usual, I encourage you to work in groups of 2-4 with everyone's name on one lab report.

1. Given: $\int_1^3 x^3 - 2x + 4\,dx$ **For this problem keep all your approximations as fractions. In other words, keep your calculations exact. Show a large careful sketch of the graph in the interval [0, 3].**

a) Approximate this definite integral by using the Left Hand Sum with n = 4 intervals.

b) Approximate this definite integral by using the Right Hand Sum with n = 4 intervals.

c) Approximate this definite integral by using the Midpoint Sum with n = 4 intervals.

d) Approximate this definite integral by using the Trapezoid Rule with n = 4 intervals.
(This is just the average of the Right Hand Sum and the Left Hand Sum)

e) A powerful numerical integration technique is called Simpson' Rule. One way to find this sum is to find the weighted average as follows: S = (2M + T)/3. In this formula, T is the sum from the trapezoid rule and M is the sum from the midpoint rule.

Approximate $\int_1^3 x^3 - 2x + 4\,dx$ by using Simpson' Rule

f) Find $\int_1^3 x^3 - 2x + 4\,dx$ by using Fundamental Theorem of Calculus (Part 2)

2. Consider the region bounded by $y = \sqrt{x}$, $y = 0$, and the line $x = 4$. Show a sketch of the graph.

a) Find the area of the region described above.

b) Rotate this region about the x-axis and find the volume of the resulting solid.

c) Now, rotate this region about the y-axis and find the volume of the resulting solid.

3. Find the area of the **regions** from $x = 0$ to $x = 4$ between the curves $y = \sqrt{x}$ and $y = \frac{1}{3}x + \frac{2}{3}$ Show a sketch of the graph.

4. Find the area of the region bounded by $y = 3x^2$, the tangent line of $y = 3x^2$ at $x = 1$, and $y = 0$. Show a sketch of the graph.

5. Find the following antiderivatives.

a) $\int x^2\sqrt{x^3 - 8}\, dx$

b) $\int x^2 e^{x^3} dx$

c) $\int \frac{x^2}{x^3 + 4} dx$

d) $\int \frac{x^2}{(x^3 + 4)^4} dx$