[Note: The Final Exam is comprehensive. Use the old review sheets, exams, and quizzes to study previous material.]

1. Evaluate the following integrals. [**Note:** You may or may not need to use substitution.] Check your answer by differentiating the result.

(a). $\displaystyle\int_0^2 t^2\sqrt{1+t^3}\ dt$

(b). $\displaystyle\int \sin x \cos(\cos x)\ dx$

(c). $\displaystyle\int 3x^5 - 4x^3 + 6x + 2\ dx$

(d). $\displaystyle\int (3x-1)(3x^2-2x)^2\ dx$

(e). $\displaystyle\int x(3x^2-2x)^2\ dx$

(f). $\displaystyle\int \left(1+\frac{1}{t}\right)\left(\frac{1}{t^2}\right)\ dt$

(g). $\displaystyle\int_0^{\pi/6} \sec x \tan x\ dx$

(h). $\displaystyle\int \sin x \cos x\ dx$

(i). $\displaystyle\int \frac{5x}{\sqrt[3]{1-x^2}}\ dx$

(j). $\displaystyle\int_1^3 \frac{x^2+1}{x^2}\ dx$

(k). $\displaystyle\int y^2\sqrt{y}\ dy$

(l). $\displaystyle\int_0^1 (2-x)^6\ dx$

(m). $\displaystyle\int \theta\sin(3\theta^2)\ d\theta$

2. Sketch the region bounded by the graphs of the following functions. Find the **_area_** of the region.

(a). $f(x) = 3 - 2x - x^2$, $g(x) = -x + 1$ **(b).** $x = y^2$, $x = -y$

3. Find the **_volume_** of the solid generated by rotating the region bounded by the given curves about the given line.

(a). $y = x^2, y = 4x - x^2$ about the line $y = 6$

(b). $xy = 6, y = 2, y = 6, x = 6$ about the line $x = 6$. [**Set up, but do not evaluate!!!**]

4. The force exerted by gravity on an object sent into space is given by $F(x) = \dfrac{4.8 \times 10^{11}}{x^2}$ pounds where x is measured in miles from the *center* of the earth. How much work is done to propel a satellite module to 800 miles above the earth. Use 4000 miles for the radius of the earth.   [Similar problems not requiring a calculator may be on the test.]

5. If 18 J of work is required to stretch a spring 40 cm from it's natural length, find the work required to stretch it an additional 30 cm.

6. Given $f(x) = \dfrac{4x^2 + 4}{x^2}$

(a). Find the average value of $f(x)$ on the interval $[1, 3]$.

(b). Use the Mean Value Theorem for integrals to find all values $x = c$ where $f(c) = f_{ave}$.

7. Find the value of k so that the average value of $f(x) = kx^2 - x$ on $[0,2]$ is equal to 4.