MATH 181

Exam I

October 4, 2011

Closed book and notes. No calculators.

(20) **1.** Evaluate $\lim_{x\to 0}\left(\dfrac{3x-\sin 3x}{x^3}\right)$.

(20) **2.** Find $\int x^2(x+1)^{3/2}\,dx$. (Don't forget the plus ...)

(20) **3.** Graph the functions $y = x^3$ and $y = x^4$ on the interval $0 \le x \le 1$. (Note that $x^4 < x^3$ when $0 < x < 1$, i.e., that x^3 is the "top" curve and x^4 is the "bottom" curve.) Let $\mathcal{A}$ denote the area enclosed by these two curves. Do not evaluate the integrals in this problem. Just write them down.

a) Write down an integral with respect to dx which represents the volume of the solid obtained by revolving $\mathcal{A}$ about the x-axis. (Do not evaluate.)

b) Write down **two** integrals which represent the volume of the solid obtained by revolving $\mathcal{A}$ about the y-axis. One integral should be with respect to dx, the other with respect to dy. (Do not evaluate.)

c) Write down quotients of integrals with respect to dx for the x and y coordinates of the centroid of the area $\mathcal{A}$. (Do not evaluate.)

(20) **4.** Find numbers a, b, and c so that

$$\int_3^7 e^{(2x+1)^2}\,dx = c\int_a^b e^{u^2}\,du.$$

(20) **5.** A hemispherical tank with a radius of 8 feet is full of water (which weighs $62.4\,\text{lbs/ft}^3$). Set up (but do not evaluate) an integral representing the amount of work required to pump out all the water to the level of the top of the tank.