Math 207 Review of Integral Calculus

1. Explain what a definite integral is and what it represents geometrically.

2. State the Fundamental Theorem of Calculus and outline a proof.

3. Find each of the following derivatives:

a. $\frac{d}{dx}(\int_0^4 e^{x^2} dx)$

b. $\frac{d}{dx}(\int_3^x e^{t^2} dt)$

c. $\frac{d}{dx}(\int_x^4 e^{t^2} dt)$

d. $\frac{d}{dx}(\int_0^{x^3} e^{t^2} dt)$

e. $\frac{d}{dx}(\int_{f(x)}^{g(x)} h(t)dt)$

4. Evaluate the following definite/indefinite integrals. Do not use a calculator.

a. $\int_0^1 \frac{x}{4-x^2} \quad dx$

b. $\int_0^1 \frac{1}{4-x^2} \quad dx$

c. $\int_0^1 \frac{1}{4+x^2} \quad dx$

d. $\int_0^\infty xe^{-x^2} \quad dx$

e. $\int_0^\infty xe^{-x} \quad dx$

f. $\int_0^1 \frac{1}{\sqrt{1-x^2}} \quad dx$

g. $\int_0^1 \frac{1}{\sqrt{1+x^2}} \quad dx$

h. $\int_0^1 (x+1)\sqrt{x}\, dx$

i. $\int_0^1 x\sqrt{x+1} \quad dx$

j. $\int_{-1}^1 \frac{x}{1+x^8} \quad dx$

k. $\int \frac{\cos 3x}{(1+4\sin 3x)^2}\, dx$

l. $\int_0^\infty \frac{x}{1+x^4} \quad dx$

m. $\int_0^{\frac{\pi}{2}} \cos^3 x \quad dx$

n. $\int \arctan x \quad dx$