Exam #2, October 28, Calculus I, Fall, 2006, W. Stephen Wilson

I agree to complete this exam without unauthorized assistance from any person, materials or device.

Name: ________________________________ Date: ______________

TA Name and section: ______________________

NO CALCULATORS, NO PAPERS, SHOW WORK. (60 points total)

The sin²(u) isn’t particularly important in these first problems. The function f(x) is always assumed to be continuous.

1. (3 points) Compute \( \frac{d}{dx} \int_{0}^{x} \sin^2(u) du \).

2. (3 points) Compute \( \frac{d}{dx} \int_{0}^{x^2} \sin^2(u) du \).
3. (3 points) Compute \( \frac{d}{dx} \int_0^{x^2} \sin^2(u) du. \)

4. (3 points) Compute \( \frac{d}{dx} \int_{x^2}^{x^3} \sin^2(u) du. \)
5. (3 points) Compute \( \int_0^1 \frac{dx}{1+x^2} \).
6. (3 points) Find the area under one hump of the curve $y = \sin(x)$. 
7. (3 points) What is the average value of one hump of \( \sin(x) \)?
8. (3 points) What is $\int x^n dx$ for $n \neq -1$?

9. (3 points) What is $\int \frac{dx}{x}$?
10. (3 points) What is $\int \frac{dx}{\sqrt{x}}$?

11. (3 points) What is $\int \cos(2x) dx$?
12. (3 points) If \( f(x) > 0 \), what is the integral for the area under \( f \) and above the \( x \)-axis from \( a \) to \( b \), \( a < b \)?

13. (3 points) If \( f(x) > 0 \), what is the integral for the volume of the solid of revolution obtained by rotating the area under \( f \) and above the \( x \)-axis from \( a \) to \( b \), \( a < b \) about the \( x \)-axis?
14. (3 points) What is the area trapped between the function $f(x)$ and the $x$-axis between $a$ and $d$, $a < d$. 
15. (3 points) Set up the integral for the area inside a circle of radius $a$. (Do not try to integrate it.)
16. (3 points) What is the integral for the length of the curve $y = f(x)$ from $a$ to $b$, $a < b$?
17. (3 points) Set up the integral for the length of $y = x^2$ from $x = 0$ to $x = 1$. 


18. (3 points) Set up the integral for the solid of revolution for the area between \( y = x \) and \( y = x^2 \) between \( x = 0 \) and \( x = 1 \) when it is rotated about the \( x \)-axis.
19. (3 points) Set up the integral for the solid of revolution for the area between $y = x$ and $y = x^2$ between $x = 0$ and $x = 1$ when it is rotated about the line $x = -1$. 
20. (3 points) If your speed is given by $t^3 - 1$, how far do you go from time 1 to time 2?