Name _____ MA135 Final Exam A December 19, 2011

Instructor _____ Section _____

Be sure to show all of your work. All solutions should use calculus techniques from this course. Unsupported answers will receive no credit! Calculators are not allowed on this exam. You may only use the formula sheet and scratch paper supplied with this exam. Good Luck!!

Prob No.	**Max Pts**	**Points**	**Prob No.**	**Max Pts**	**Points**
1	18		8	17	
2	18		9	18	
3	18		10	18	
4	18		11	18	
5	17		12	18	
6	18		13	18	
7	18		14	18	
Subtotal	125		**Subtotal**	125	

Grand Total	

1. (9 points each) Find the derivatives of the following functions. You do not need to simplify your answers.

a. If $y = \ln(3x^2 + \sin x)$ then $\dfrac{dy}{dx} =$ _____

b. If $y = \dfrac{3x+2}{4x^2-1}$, then $\dfrac{dy}{dx} =$ _____

2. (9 points each) Find the following limits, giving reasons for your answers. You may use any method from this course.

a. $\lim_{x\to\pi} \dfrac{x-\pi}{x^3-\pi^3} =$ _____

b. $\lim_{x\to 0} \dfrac{e^{3x}-3x-1}{x^2} =$ _____

3. (9 points each) Find the following indefinite integrals.

a. $\int \frac{1+\sqrt{x}}{x}\,dx =$ _____

b. $\int (1+2x)^5\,dx =$ _____

4.

a. (10 points) If $x^3 + 2xy + y^3 = 13$, find $\dfrac{dy}{dx}$ at $(2, 1)$. _____

b. (8 points) If $y = x^{2x^2}$, find $\dfrac{dy}{dx}$ as a function of x. $\dfrac{dy}{dx}$ =_____

5. (17 points) At noon, a car traveling north at 45 mi/hr is 20 miles north of a truck traveling east at 35 mi/hr. At what rate will the distance between them be changing 3 hours later? You don't have to multiply out the numbers that occur in this problem.

6. (18 points) Let $f(x) = x^3(x+1)^4$ at $x = 1$. Use linear approximation or differentials to estimate $f(1.02)$.

7. (18 points) A store has been selling skateboards at a price of $40 per board and at this price skaters have been buying 45 boards a month. The owner of the store estimates that for each $1 increase in price, 3 fewer boards will be sold each month. Similarly, each $1 decrease in price will lead to 3 more sales. If each board costs the store $29, at what price should the store sell the boards to maximize profit?

8. (17 pts)

a. (9 points) Find $\lim_{x\to\infty} \dfrac{e^{2x}+4x}{2e^{2x}+x}$. Answer =_____

b. (8 points) Find $\lim_{x\to-\infty} \dfrac{e^{2x}+4x}{e^{2x}+x}$. Answer = _____

9. (18 points) Compute the value of the Riemann sum for the function $f(x) = \sqrt{2x+1}$ on the interval [1, 4] using $n = 3$ and taking x_k^* to be the left endpoint of the k^{th} interval in the partition. You can leave your answer as a sum of square roots.

Value:	

10. (9 points each)

a. Find $\dfrac{dy}{dx}$ if $y = \displaystyle\int_0^x e^{t^2}\,dt$.

b. Find $\dfrac{dy}{dx}$ if $y = \displaystyle\int_0^{x^2+1} e^{t^2}\,dt$.

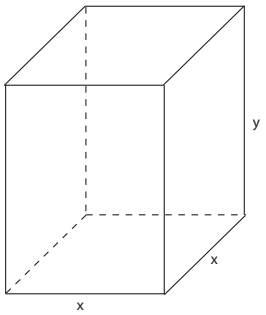
11. (9 points each)

a. Find the area under the curve $y = x\sin(x^2)$ from $x = 0$ to $x = \sqrt{\pi}$.

Answer = _____

b. The marginal revenue of a certain product is $R'(x) = 3x^2 + 2x$. If the revenue from selling 3 items is \$10, what is the revenue from selling 10 items? Answer = _____

12. (18 points) A closed box with a square base is to be built to house an ant colony. The bottom of the box and all four sides are to be made of materials costing \$1/ft^2, and the top is to be constructed of glass costing \$5/ft^2. What are the dimensions of the box of greatest volume that can be constructed for \$72?



13. (18 points) A radioactive frog hops out of a pool of radioactive goo and into a lab. The scientists discover that the frog registers 10 Curies of radioactivity initially and that two days later it registers 3 Curies of radioactivity. When will its level of radioactivity reach 1 Curie? This is an exponential decay problem.

14. (18 points) Consider the function $f(x) = x + (4/x)$. For this function, there are four important intervals, $(-\infty, A]$, $[A, B)$, (B, C), and $[C, \infty)$, where A and C are the critical numbers and $f(x)$ is not defined at B.

Find A:	
Find B:	
Find C:	
The function is increasing on the interval(s):	
The function is decreasing on the interval(s):	
The function is concave up on the interval(s):	
The function is concave down on the interval(s):	
There are inflection(s) at:	
There is a local maximum at:	