Name _____ MA135 Final Exam A December 15, 2008

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! 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	15		8	14	
2	14		9	14	
3	14		10	14	
4	14		11	15	
5	14		12	14	
6	15		13	14	
7	14		14	15	
Subtotal	100		**Subtotal**	100	

Grand Total	

1. Find the following limits (5 points each), giving reasons for your answers. You may use any method from this course.

a. $\lim_{x\to 2} \dfrac{\sqrt{x+2}-\sqrt{2x}}{x^2-2x} =$ _____

b. $\lim_{x\to\infty} \left(1+\dfrac{2}{x}\right)^{3x} =$ _____

c. $\lim_{x\to 0} \dfrac{\sin(5x)-5x}{x^3} =$ _____

2. Find the derivatives of the following functions (7 points each). You do not need to simplify your answers.

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

b. If $y = e^{\frac{x}{x+1}}$ then $\dfrac{dy}{dx} =$ _____

3. Find the following indefinite integrals (7 points each).

a. $\int t^2 \cos(1 - t^3)\, dt =$ _____

b. $\int \sqrt{x - 1}\, dx =$ _____

4. Calculate the following definite integrals (7 points each).

a. $\int_2^3 \frac{\ln(x)}{x}\,dx =$ _____

b. $\int_1^2 x\sqrt{x-1}\,dx =$ _____

5. (14 points) Estimate the area under the graph of $f(x) = x^2 + 5x$ from $x = 3$ to $x = 4$ using 3 equally spaced approximating rectangles and right endpoints. You may leave your answer as a sum. You will receive no credit for evaluating the integral exactly.

Approximate area:	

6. (15 points) Find the equation of the normal line to the curve described by

$$5x^2y + 2y^3 = 22$$

at the point $(2, 1)$. Any correct equation specifying this line is acceptable.[1]

Normal line:	

[1]The normal line is perpendicular to the tangent line.

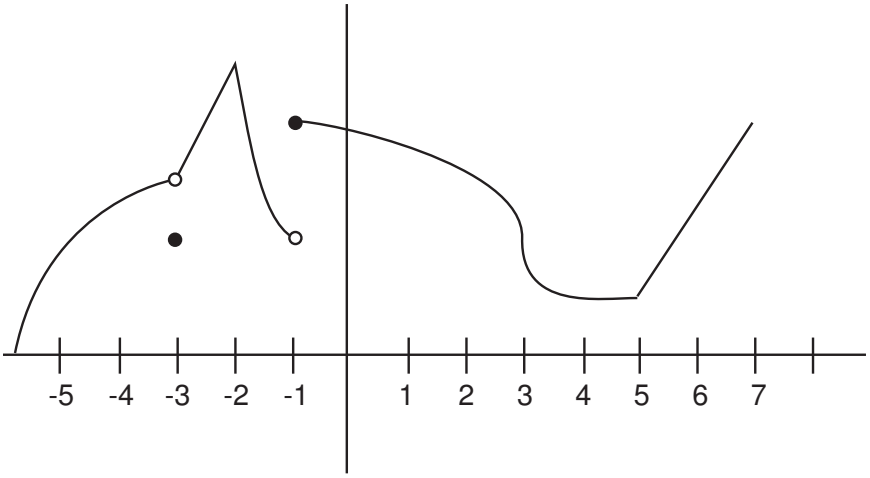
7. (14 points) A radioactive frog hops out of a pond full of nuclear waste in Oak Ridge, TN. If its level of radioactivity declines to 1/3 of the original value in 30 days, when will its level of radioactivity reach 1/100 of its original value? Note that this is an exponential decay problem.

# of days:	

8. (14 pts) Let $f(x) = x^3 - 12x + 5$ on the interval $[-5, 3]$. Find the absolute maximum and minimum of $f(x)$ on this interval.

Absolute max:	
Absolute min:	

9. (14 points) The graph of $y = g(x)$ is given.
   a. For which values of x is $g(x)$ discontinuous? Don't worry about the endpoints at -6 and 7 in either part a or part b.
   b. For which values of x is $g(x)$ not differentiable?

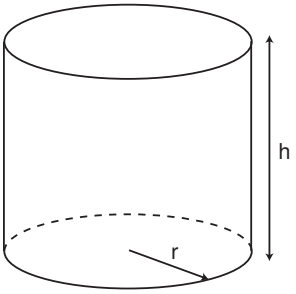


Discontinuous	
Not differentiable	

10. (14 pts) During the summer months, Terry makes and sells necklaces on the beach. Last summer, he sold the necklaces for \$10 each and his sales averaged 20 per day. He also found that for each \$1 increase in price sales drop by two per day. If the material for each necklace costs Terry \$6, what should the selling price be to maximize his profit?

Price:	

11. (15 points) An open cylindrical can (without top) is to be constructed to hold 16π cubic cm of liquid. The cost of the material for the bottom is \$2 per cm^2, and the cost of the material for the curved surface is \$1 per cm^2. Find the radius and the height of the least expensive can. (The area of the curved surface is the circumference of the circle times the height.)



r=	
h=	

12. (15 points) Use linear approximation or differentials to find an approximate value for $\sqrt[3]{8.5}$.

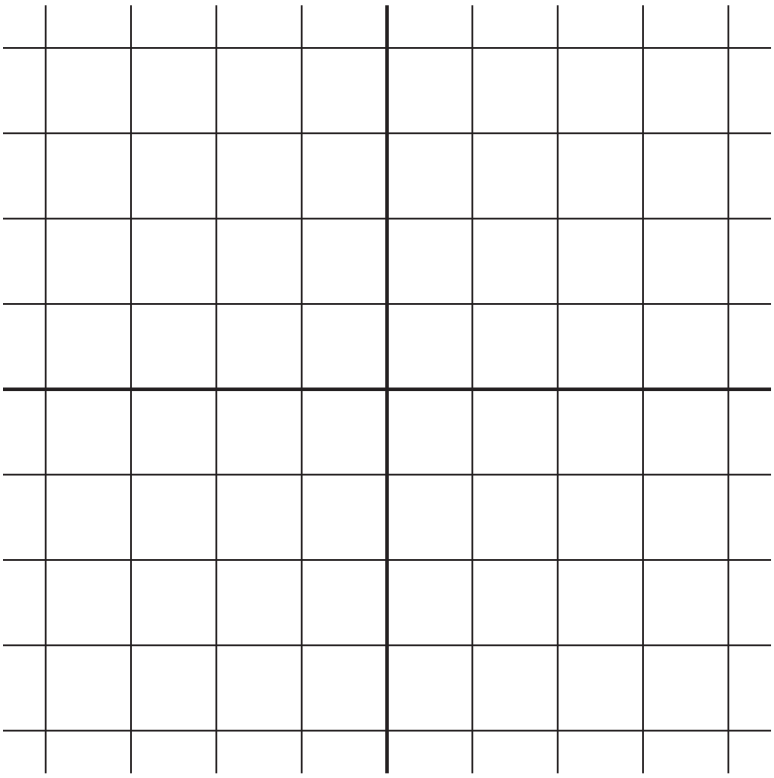
Approx value:	

13. (15 points) The altitude of a triangle is increasing at a rate of one ft/min while the area is increasing at a rate of 2 ft^2/min. At what rate is the base of the triangle changing when the altitude is 10 ft and the area is 100 ft^2?

Rate of change:	

14. (15 points) Sketch the graph of the function $f(x) = 24/(x^3 + 8)$. For this function,

$$f'(x) = \frac{-72x^2}{(x^3+8)^2} \text{ and } f''(x) = \frac{288x(x^3-4)}{(x^3+8)^3}.$$



Horizontal asymptote(s):	
Vertical asymptote(s):	
Increasing:	
Decreasing:	
Concave up:	
Concave down:	
Relative max/min:	
Inflections:	