NAME: ______________________________ **Panther ID:** ______________

Exam 3 - MAC 2311 - Section 10 Fall 2012

General Directions: *Read the problems carefully and provide answers exactly to what is requested. Use complete sentences and use notation correctly. Incomprehensible work is worthless. Full credit will be awarded only for work which is both correct and neatly presented. I am grading the work, not just the answer. Don't rush, don't try to do too many steps of a computation at once; work carefully. Good luck!*

1. (12 pts) Fill in the appropriate words:

(a) If x_0 is a critical point for the function $f(x)$, then the derivative at that point is ______________________.

(b) If $f'(x) < 0$ for all $x \in (a, b)$, then $f(x)$ is ______________________ on the interval (a, b).

(c) An inflection point for a function $f(x)$ is a point where ______________________ changes.

(d) If $f'(x_0) = 0$ and $f''(x_0) > 0$, then the point x_0 is a ______________________ for the function $f(x)$.

2. (12 pts) Find the absolute maximum/minimum (if any) of the function $f(x) = x - \ln x$ on the interval $x \in (0, e]$. Recall that $e = 2.718....$

3. (12 pts) Suppose a car runs with 88 ft/s (this is the equivalent of 60 mi/h) when the driver sees an obstacle on the road and hits the brakes. Suppose the car decelerates with a constant (negative) acceleration and comes to a stop in 11 seconds (without hitting the obstacle :)).

(a) (4 pts) What is the acceleration of the car in this time interval? (Give your answer in ft/s^2.)

(b) (8 pts) What is the distance traveled by the car in the 11 seconds interval?

4. (24 pts) Find each antiderivative:

(a) $\displaystyle\int (4\sec^2 x + \frac{1}{2x} - 3)\, dx$ (b) $\displaystyle\int x^2 \cos(2x^3)\, dx$ (c) $\displaystyle\int \frac{1 - x\sqrt{x}}{\sqrt{x}}\, dx$

5. (10 pts) Find the slope of the tangent line to the ellipse $x = 3\cos t,\ y = 2\sin t$ at $t = \pi/4$.

6. (20 pts) You are asked to make a cylindrical can with a given volume of 250π cm^3. The top and the bottom of the can should be made from a material that costs 2 cents per cm^2, while the side of the can should be made from a material that costs 1 cent per cm^2. Find the dimensions of the can (radius and height) that will minimize the cost.

7. (24 pts) Give a complete graph of the function $f(x) = \frac{x^2-1}{(x+2)^2}$. Your work should include: the domain of the function, equations of eventual asymptotes (vertical or/and horizontal), coordinates for the axis intercepts, a sign chart for the derivative and the second derivative, the location and nature of the critical points (if any), location of inflection points (if any). To save you time, here is the second derivative $f''(x) = \frac{-8x+2}{(x+2)^4}$. The first derivative you have to compute on your own. (Please, do it well!).