MAT 191 Test 3 November 20, 2012

Name: ______________ Academic Integrity Signature: ______________

I have abided by the UNCG Academic Integrity Policy.

Read all of the following information before starting the exam:

- It is to your advantage to answer ALL of the questions.
- It is your responsibility to make sure that you have all of the problems.
- There is no need to complete the test in order. The problems are independent.
- Correct numerical answers with insufficient justification may receive little or no credit.
- Clearly distinguish your final answer from your scratch work with a box or circle.
- *Budget your time!*
- If you have read all of these instructions, draw a happy face here.

Page:	1	2	3	4	5	6	7	Total
Points:	10	22	22	15	8	12	11	100
Score:								

1. Evaluate the following.

   (a) (2 points) $\frac{d}{dx}\left(\ln(\sin(x))\right)$

   (b) (2 points) $\frac{d}{dx}\left(\log_7(x)\right)$

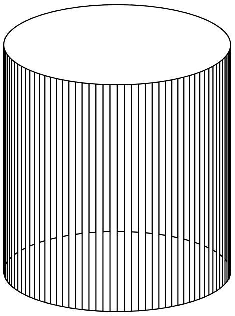
   (c) (2 points) $\frac{d}{dx}\left(\tan^{-1}(x^2+1)\right)$

   (d) (2 points) $\frac{d}{dx}\left(3^x\right)$

   (e) (2 points) $\frac{d}{dx}\left(\cos^{-1}(\frac{1}{x})\right)$

 Points earned: ______ out of 10.

2. (12 points) A solid cylinder is being heated and is growing slightly. Currently, its radius is $r = 5$ cm and its height is $h = 10$ cm. If, at this time, its radius is growing at the rate of 0.2 cm/ min and its height is growing at the rate 0.1 cm/ min, then at what rate is its volume increasing? Make sure you give your answer with the right units.



3. Evaluate the following limits:

   (a) (5 points) $\lim_{x \to 0} \frac{1 - \cos(x)}{x^2}$

   (b) (5 points) $\lim_{x \to \infty} x^{-1} \ln(x)$

4. Let $f(x) = \sqrt{4+x}$.

   (a) (5 points) Find the linearization L of f at $a = 0$.

   (b) (5 points) Use L to give an approximation to $\sqrt{4.1}$.

5. (12 points) Find the absolute minimum and absolute maximum of $f(x) = x^{2/3}$ on the interval $[-8, 27]$. Justify your answer. Make sure you specify where the absolute maximum and absolute minimum occur.

Points earned: ______ out of 22.

6. Let $f(x) = x^2 + 4x + 1$.
   (a) (5 points) Does the Mean Value Theorem apply to f on the interval $[0, 2]$? Explain why or why not.

   (b) (5 points) What is the average rate of change of f on $[0, 2]$?

   (c) (5 points) Find c in $(0, 2)$ so that $f'(c)$ equals the average rate of change you found in part (b).

 Points earned: ______ out of 15.

7. Let $f(x) = 12x - x^3$ on $(-3, \infty)$.

   (a) (4 points) Find the coordinates of any critical points of f.

   (b) (2 points) Find the intervals where f is increasing and those where f is decreasing.

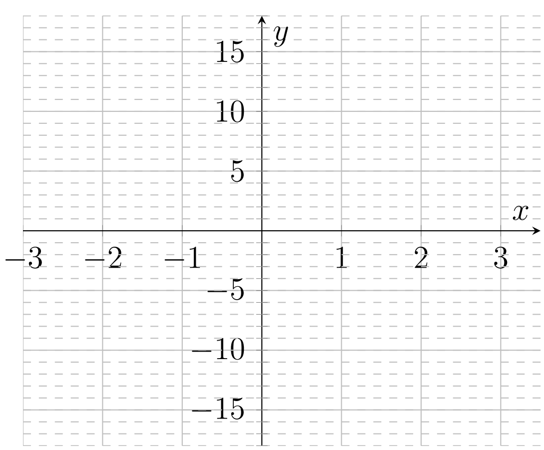
   (c) (2 points) Find the intervals where the graph $y = f(x)$ is concave up and those where it is concave down.

 Points earned: ______ out of 8.

(d) (4 points) Find the inflection points of f.

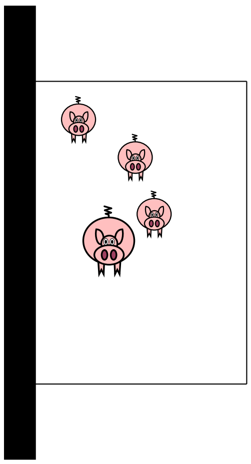
(e) (4 points) Identify all of the local extrema and where they occur. Clearly mark each as a local maximum or local minimum.

(f) (4 points) Sketch the graph of $y = f(x)$ using the information from (a)-(d).



 Points earned: ______ out of 12.

8. (11 points) A farm building has a straight wall 160 feet long. Farmer Brown wants to use 160 feet of fencing to create a rectangular fenced-in pen against the wall for Daisy Mae and her three piglets—Petunia, Porkchop, and Slim. The pen will use part of the wall as one of its sides but the other three sides of the pen will have to be created using the fencing as shown below. What are the dimensions of the pen that will give the largest area? [Drawing is not to scale.]



 Points earned: ______ out of 11.