Calculus **Chapter 3 Test** **2014-2015** **Dr. Brigham**

Name:

Do not begin your test until instructed to do so. You will have 45 minutes to complete the test. The **only** items you are permitted to use are a pencil, eraser, and calculator. Any use of any other item will result in getting a 0 on the test. Keep your eyes on your own test. Getting answers in any form from others will result in getting a 0 on the test. When it comes to partial credit, a majority is for showing your work (when appropriate), and the rest is for the right answer. Box your answers. Talking while any test is out will result in a 10 point penalty.

Good luck! (Even though this is a matter of skill, not luck.)

Page	Points	Score
2	40	
3	33	
4	27	
Total:	100	

1. (7 points) Find the maximum and minimum values of $f(x) = x^3 - 12x - 4$ on $[-1, 3]$.

2. Consider $f(x) = x + 2\sin x$ on $[0, 2\pi]$.
   (a) (7 points) Use a sign chart to find where f is increasing and decreasing.

   (b) (3 points) Identify the extrema (just the inputs).

3. Consider $f(x) = -x^6 + 10x^4 + 9001x + 9001$.
   (a) (7 points) Use a sign chart to find where f is concave up and concave down.

   (b) (3 points) Identify the inflection points (just the inputs).

4. (6 points) Determine $\lim_{x \to +\infty} \dfrac{3x^4 - 3x^2 + 7}{6x^4 + \pi x - \sin x + \sqrt{3}}$.

5. (7 points) Determine $\lim_{x \to -\infty} \dfrac{x - \sqrt{x^2 + 1}}{4 - 2x}$.

6. (a) (7 points) State the Mean Value Theorem.

(b) (6 points) State the two interpretations of the conclusion of the Mean Value Theorem. (Hint: one has to do with lines, the other with rates of change.)

(c) (7 points) Does the Mean Value Theorem apply to $f(x) = \sqrt{2-x}$ on $[-7, 2]$? If so, find c which satisfies the conclusion of the Mean Value Theorem.

7. You have 150 square inches of material to build a box with a square bottom. You wish to build such a box with greatest volume.

(a) (4 points) Draw a picture modeling this scenario (keep in mind the bottom is square).

(b) (4 points) Use the fact that the surface is 150 square inches to get volume as a function of one variable.

(c) (5 points) Find the maximum volume of such a box.

8. Consider $f(x) = -2\sqrt[3]{x}(4+x)$.

   (a) (6 points) Find the domain, intercepts and asymptotes.

   (b) (8 points) Use a sign chart to find where f is increasing and decreasing. Identify any extrema and vertical tangent lines (hint: do not use Product Rule to find f').

   (c) (8 points) Use a sign chart to find where f is concave up and concave down. Identify any inflection points (do not use Product Rule to find f'' either).

   (d) (5 points) Sketch f.

9. Something new: the `differential` of y, written dy, is defined as $dy := y' \cdot dx$ (for example, the differential of $y = x^2$ is $dy = 2x \cdot dx$). For what this means, dy is the approximate change in y, and dx is the change in x (for example, the approximate change in $y = x^2$, starting at $x = 3$ and increasing x by .01, is $dy = 2 \cdot 3 \cdot .01 = .06$).

   (a) (5 points (bonus)) Find the differential of $y = \tan x$.

   (b) (5 points (bonus)) Use differentials to find the approximate change in $y = \tan x$, starting at $x = \pi/3$ and increasing x by .01.