<u>REVIEW FOR TEST 3 OF CALCULUS I:</u>

The first and best line of defense is to complete and understand the homework and lecture examples. Past that my old test might help you get some idea of how my tests typically look (although our course differs significantly in content). Most of the test will be like problems you've done before, they may not be the same format but they should require the same skill set.

• the problems and examples I list are representative of likely test questions. This review is meant to be a comprehensive representation of material to appear on Test 3.

<u>Applications of Derivatives:</u>

1. Know what is a related rates problem? What three step process do we use to solve almost every such problem? (3.8# 1, 15 or Ex. 5.2.1, 5.2.2, 5.2.4)

2. Be able to find the linearization of a function. (3.9 #1 or Ex. 5.1.1, 5.1.2)

3. What is a critical number? What is a critical point? Given a particular function, is there a critical point for every critical number? If not give an example of a function with a critical number but no critical point.

4. Be able to find critical numbers (4.1#29, 31, 33, 35 and most other problems we considered in 4.3, 4.7 or 4.5.)

5. What is an absolute extrema? What is the closed interval method. How is this different than finding local extrema via the first and second derivative tests? How is it the same? (see 4.1#45 and Ex. 5.3.3, 5.3.4, 5.3.5, 5.3.6)

6. When is a function increasing/decreasing? Be able to set-up a sign chart (or other equally neat organizational device) to easily read intervals of increase/decrease from the sign of $\frac{df}{dx}$. (see Ex. 5.3.10b, 5.3.12, 5.3.13, and 4.3#7, 9, 11, 13, 29, 40 also 4.5#9, 13)

7. Geometrically speaking what is the meaning of concave up/down? Be able to set-up a sign chart (or other equally neat organizational device) to easily read intervals of concave up/down from the sign of $\frac{d^2f}{dx^2}$. (see Ex. 5.3.12 part d, 5.3.13, 4.3#7, 9, 11, 13, 29, 40 also 4.5#9, 13)

8. What is an inflection point? Do inflection points have to be at critical points? See Ex. 5.3.11 and 5.3.13 and also think about it for each of the problems listed in 7.

9. What is the first derivative test? How and when can you apply it? What does it find for you? What does it not find?

10. What is the second derivative test? How and when can you apply it? What does it find for you? What does it not find?

11. Be able to put together increase/decrease, concavity, local maximums, local minimums and other useful information to sketch a graph. You should expect to work one or two problems on the test like this that will be worth a substantial amount of the credit (40-50%)

12. Optimization. (4.7# 5, 19, 21, 23 Ex. 5.4.1, 5.4.3, 5.4.4, 5.4.5, 5.4.7) In most cases you need to first set up the problem, drawing a picture tends to help. Also, it is not enough to just find the critical number, you must use calculus to verify that it is a maximum or minimum. I will be picky about omitting this in your solution, you are warned.

And now for something completely different:

1. Memorize the basic limits at infinity. Or be able to figure them out from a graph, or arithmetic reasoning (like 1 / big # is tiny etc…). I assume you know limits of inverse tangent, if we covered it in lecture you are to know it.

2. See Examples 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.3.7, 5.3.8, 5.3.9, 5.3.10, 5.3.11, 5.3.14, 5.3.15, 5.3.16, 5.3.17, 5.3.18, 5.3.18(oops). In other words all the easy examples in section 5.3 of my notes which corresponds to section 4.4 in Stewart. Also the homework from 4.4 except #29)

3. There are basically only two or three tricks to calculate indeterminant limits here. Make it a point to know them. (probably 15% of test)

4. What is a horizontal asymptote, what does that have to do with these limits at infinity? What is a vertical asymptote? Give an example of a function with both and write the equations for the asymptotes. I may ask you to give me the equations of the asymptotes (VA or HA) for some function.

Integration:

1. Be able to carefully state the definition of the definite integral as the limit of Riemann sums.

2. You should also know how the points $x_0, x_1, \ldots, x_n$ are found once the interval of integration $[a, b]$ is given. Be able to calculate left or right end points rules for easy functions as in the homework. (see 5.1#3)

3. Antiderivatives or indefinite integration: know your basic antiderivatives. I might ask all of them. See all the homework from section 4.9. (page 143 has all the basic ones, and the corresponding derivatives)

4. Questions like 5.3#15 are out. I did not cover this idea in much depth.

5. What is the FTC? Be able to apply it to definite integrals. See all the homework from section 5.3.

6. Notice there are absolute value bars in $\int \frac{1}{x} dx = \ln|x| + c$. They matter.

7. Know the properties for definite and indefinite integrals. In particular, recall that we need the last property to deal with piecewise defined functions. (Ex. 6.3.5)

$$\int (f(x) + g(x))dx = \int f(x)dx + \int g(x)dx$$
$$\int cf(x)dx = c \int f(x)dx, \ c \text{ constant}$$
$$\int_a^b (f(x) + g(x))dx = \int_a^b f(x)dx + \int_a^b g(x)dx$$
$$\int_a^b cf(x)dx = c \int_a^b f(x)dx, \ c \text{ constant}$$
$$\int_a^c f(x)dx = \int_a^b f(x)dx + \int_b^c f(x)dx, \ a < b < c \text{ constants}$$

<u>If it is mentioned here that means I intend to test it. Of course I cannot cover absolutely everything, but I'll try… bring your questions Monday.</u>