Mathematics 141: Review for Test 2.

(1) *Basic computation of derivatives.* Since the last test we have spent a good deal of time learning formulas for the derivatives of various functions. In doing applications of calculus in other areas one of the things you need to be able to do is compute derivatives correctly, and hopefully quickly. So a big part of the test will be computing derivatives. Rather than list the various types of functions and derivatives we have covered, here are sample problems from the text which should get you ready. Note that in doing these problems you will need to know such things as the product, quotient, and chain rules.
   (a) Section 3.5 (Trigonometric functions) Problems 1–37 odd.
   (b) Section 3.6 (Chain rule) Problems 23–77 odd.
   (c) Section 3.8 (Logarithms) Problems 11–51 odd.
   (d) Section 3.9 (Inverse trigonometric functions) Problems 21–41 odd.
   (e) Practice Exercise at the end of Chapter 3 (Page 215). Problems 1–63 odd.

(2) *Implicit differentiation.* Good problems to look at would be Section 3.7 Problems 1–19 odd, 25, 27, 31a, 33a.

(3) *Inverse functions.* You should understand the basic method of finding the derivative of an inverse function. In Section 3.7 look at Problems 7, 9.

(4) *Related rates.* As worked examples look at Section 3.10 Examples 1, 2, 3, 6. Problems to look at in Section 3.10 are 11, 17, 23, 27, 31, 39.

(5) *Linearization and differentials.*
   (a) Knowing the basic formula for linear approximation

$$f(x) \approx f(a) + f'(a)(x - a)$$

   when x is close to a will come up. Problems to look at related to this are Section 3.11 Problems 1, 3, 7–17 odd.
   (b) Also know the formula for the differential: if $y = f(x)$, then

$$dy = f'(x)\,dx.$$

   What this formula gives us is that if x is changed to $x+dx$, then dy is a good approximation of the change in y. Problems for computing differentials are Section 3.11 Problems 19–35. Note some of these involve implicit differentiation.
   (c) Some other problems from Section 3.11 worth looking at are 47, 51, 57.

(6) *Extreme values.* From Section 4.1 you should know the definitions of the following terms: ***absolute maximum***, ***absolute minimum***,

extreme values, ***critical point***, ***local maximum***, ***local minimum***, and ***local extrema***. A very important fact is the ***Extreme Value Theorem***, (Theorem 1 in Section 4.1) which tells us that for continuous functions on closed intervals that the absolute maximum and absolute minimum exist. You will definitely have to find the absolute maximum and minimum of a function. Some practice here would be Section 4.1 Problems 21–39 odd and 85.

(7) *Rolle's Theorem and the Mean Value Theorem.* You should know the statement of both of these theorems. You should know that if $f' \equiv 0$ on an interval then $f = C$, is constant. Likewise if $f' = g'$ on an interval, then $f = g + C$ for some constant C. Some problems form Section 4.2 are 21–27 odd, 33–37 odd, 39, 41.

(8) *The first derivative and monotone functions.* You should know that if $f' > 0$ on an interval, then f is increasing on the interval and how to use the Mean Value Theorem to prove this. You should also be able to use the first derivative to determine if a critical point is a local maximum or minimum (what the text calls the ***first derivative test***. Problems to look at here are Section 4.3 Problems 1–11 odd, Problems 19–43 odd.