Test 3 Study Guide

Things you should know.

1. Stuff from the first exam.
   (a) How to compute limits.
      i. Multiplying by conjugates.
      ii. Factoring.
      iii. Limits of trig functions.
   (b) Continuity.
      i. The following functions are continuous everywhere:
         A. All polynomials $p(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots a_1 x + a_0$.
         B. The exponential function e^x.
         C. The trig functions $\sin x$ and $\cos x$.
         D. Any product, sum, difference, or composition of any of the above.
      ii. Know the definition of continuity and how to show that a function is continuous or discontinuous on a given interval.
      iii. Intermediate Value Theorem and it's application to showing that solutions to certain equations exist.
   (c) Differentiation.
      i. Know the definition and how to use it to compute derivatives.
      ii. Know how to interpret the derivative geometrically (as the slope of the tangent line).
      iii. Be able to find the equation of a tangent line.
2. Stuff from the second exam.
   (a) The Derivative
      i. How to compute it
         A. The derivative of a constant
         B. Power rule
         C. Linear Combination rule
         D. Product rule
         E. Quotient rule
         F. Chain rule
      ii. How to interpret the derivative as a rate of change.
         A. Position function and how it is related to the velocity function and the acceleration function.
         B. Be able to compute rates of change with respect to different variables. E.g., problems 49-53 in § 3.3.
      iii. How to interpret the derivative graphically.
         A. What information about $f(x)$ can be derived from its derivative and vice versa.
3. Stuff from the third exam.
   (a) Know and *understand* the statement of the Absolute Maxima and Minima theorem (pg144)

(b) Be able to apply the above theorem to find an absolute maximum or an absolute minimum of a continuous function on a closed interval.

(c) Know the standard volume, area, and perimeter equations (Sphere, Cylinder, Cone, Circle, Box, Square, etc...)

(d) Similar triangles

(e) New derivatives

i. trig functions

ii. exponential functions and the natural logarithm

(f) Be able to set up and solve a max min story problem like those in the homework.

i. Identify the quantity that is to be minimized or maximized.

A. Write this as a function of one variable.

ii. Identify a closed interval of interest (possibly using a constraint or physical properties (can't have negative length etc...))

iii. Show that the function is continuous on this closed interval.

iv. Find all possibilities for the extrema (endpoints and critical points)

A. Recall a critical point for a function $f(x)$ is a point so that $f'(x)$ is either undefined or zero.

v. Check these values to in the function to determine which gives the desired minimum or maximum.

vi. Be able to write a complete sentence that finishes the problem.

4. Stuff from the fourth exam.

(a) Implicit differentiation and related rates.

i. Use implicit differentiation to find the equation of a tangent line.

ii. Related rates word problems.

A. Read the problem and find an equation that relates the variables.

B. Implicitly differentiate the equation and look to see what other values are needed.

C. Go back and reread the problem and see ifyou can derive the necessary information.

D. Solve for the desired rate of change.

(b) Increments, Differentials, and Linear Approximation.

i. Be able to compute a linear approximation of a function.

A. Be able to aprroximate quantities like $\sqrt{24}$ using linear approximation.

(c) Increasing and decreasing functions.

i. Be able to find the intervals on which a function is increasing and decreasing.

ii. Be able to show that a particular equation has exactly one solution on a given interval.

iii. Be able to use the first derivative to sketch a rough sketch of a function.

(d) Open-Interval Maximum-Minimum Problems.

i. Be able to use the first derivative test to classify all critical points as local mins/maxs or global mins/maxs on a given open interval.

ii. Be able to solve word problems like those assigned in the homework from § 4.4.

5. New stuff.

   (a) Curve sketching

      i. Find where a function is increasing/decreasing using sign analysis on the first derivative.

      ii. Find where a function is concave up/down using sign analysis on the second derivative.

      iii. Identify vertical asymptotes if any.

      iv. Identify limits at infinity.

         A. Horizontal asymptote.

         B. Asymptotic to another function. E.g., $f(x) = x^2 + 2 + 1/x$ is asymptotic to $g(x) = x^2 + 2$ since $|f(x) - g(x)| \to 0$ as $x \to \infty$.

   (b) Antidifferentiation.

      i. Know standard formulas (§ 5.2Theorem 2).

      ii. Find general and particular solutions to simple differential equations.

      iii. Rectilinear motion (§ 5.2).

My office is Boyd 434E and my email is chadm@math.uga.edu. If you need help, let me know. Remember it is my job to help you understand this material.