# Checklist of Topics for Test # 2
# Calculus I
# Fall, 2013

- Limits involving infinity --- $\lim_{x\to a^\pm} f(x) = \pm\infty$ and $\lim_{x\to\pm\infty} f(x) = L$.
  - Know how to compute them
  - Know how to interpret them. (E.g. if you know that $\lim_{x\to 2^-} f(x) = +\infty$, what does this tell you about the behavior of *f* ? You should be able to give both a graphical and a numerical interpretation.)

- Antiderivatives, Differential Equations (DiffEq's, DE's), Initial Value Problems (IVP's)
  - You need to be able to compute basic antiderivatives.
  - Know what it means to say that something is a solution to a DE or to an IVP and how to verify whether it is so in a particular case.
  - Given an initial value, know how to find a particular solution to a DiffEq from the general solution.
  - There is a small collection of DE's we know how to solve:
    - $y' = f(t)$ where *f* is easy to antidifferentiate.
    - $y' = ky$ where *k* is constant
    - $y' = ky + b$ where *k* and *b* are both constants

  You should be able to find the general solution to a DE of this form, or an IVP based on one.

- Modeling using differential equations, as in the assignment "Solving Some Special Initial Value Problems" and the Investments/loans project.

- Derivatives of elementary functions---polynomials, rational functions, trig and inverse trig functions, exponential functions, logarithms.

- Using the product rule, Quotient rule, chain rule, you should be able to find the derivative of a function:
  - Given a formula
  - From data about the function(s) and derivative(s) at specified points
  - From graphs and/or a graph combined with a formula(s).

- Derivatives and local extrema---you should be able to find and classify local extrema.
- Global maxes and mins:
  - You should be able to determine whether a given function has global max/min and explain how you know. (In restricted circumstances:
    - The Extreme Value Theorem---know when it applies and be able to use it!
    - The case when EVT doesn't hold, but there is a unique critical point.
  - When a function has a global max or a global min, you should be able to find it and be able to explain why it is what you claim it is.
  - Context: applied max/min problems--- "bigger/smaller" handout.

- Newton's method
  - Know how to set up the recursion relation for a function, make a reasonable guess at a root, and be able to compute several "updated" guesses directly showing your reasoning at each step.  You may, of course, use Maple or a calculator to do the arithmetic for you.
  - Know how to set up Newton's method to find a root, make a reasonable first guess, and be able to use the Maple program to implement the method to get an answer good to a specified number of decimal places.

  And be able to succinctly articulate how you do all of these things, so that you may annotate a solution rather than just having some mysterious answer show up on your test paper.