Math 444/544 **Fall 2010**
Homework 4, due Friday 8 October.

1. (10 points) Based on the feedback you received from me and from the discussion page on your proposed edits, do one of:
   - Edit the actual Wikipedia topic page. Print (that portion of) the page and highlight your contribution.
   - Decide your proposal was a bad idea. Explain why, what you learned fro this process, and what you will do better next time.

2. (30 points) Suppose you have the values $f(x_0)$, $f(x_0 + h)$ and $f(x_0 + 2h)$.
   (a) Compute the best estimate for $f'(x_0)$ and an error bound.
   (b) Compute the best estimate for $f''(x_0)$ and an error bound.

3. (30 points) Do this problem as a Good Problem, paying attention to the *Intros* handout.
   (a) Use Simpson's rule to approximate the integral
   $$\int_1^{1.5} x^2 \ln(x) dx\,.$$
   (b) Compute the error bound.
   (c) Compute the actual value of the integral and the actual error.

4. (30 points)
   (a) Write a MATLAB function to do the composite trapezoid rule. Start from
   ```
   function x = trapezoid(f,a,b,n)
   % Uses the composite trapezoid rule to approximate int_a^b f(x) dx.
   % Inputs: f -- the function, as an inline
   %         a -- the left end of the interval
   %         b -- the right end of the interval
   %         n -- the number of subintervals to use.
   ```
   Include comments explaining each step.
   (b) Write a MATLAB function to do Romberg's method for integration. Start from
   ```
   function x = romberg(f,a,b,depth)
   % Uses Romberg's method int_a^b f(x) dx.
   % Inputs: f -- the function, as an inline
   %         a -- the left end of the interval
   %         b -- the right end of the interval
   %         depth -- the number of levels to use.
   % Output: x -- the estimated integral.
   ```
   Have it call your subroutine `trapezoid` to do the trapezoid rule part. Include comments explaining each step.
   (c) Test your routines on $f(x) = x^2 \ln(x)$ on $[1, 1.5]$ for various `n` and `depth`. In particular, compare the performance of the two routines when $n = 2^{depth}$.