Math 444/544 **Fall 2010**
Homework 2, due Friday 17 September.

1. (20 points) (444 students do individually) Explore the Wikipedia pages on the topics that we have covered so far. Find something that is incorrect, incomplete, or poorly explained. It should be more than just a typo, but does not need to be very big. Something that requires one paragraph addition or modification is about right. Edit *your user page* to include

   (a) A description of what you think is wrong with what is there.

   (b) Your corrected/ improved version. This should be ready to be pasted into the real Wikipedia page.

   Print out and submit (that portion of) your user page.

2. (30 points)

   (a) For the quadratic polynomial ax^2+bx+c, the standard quadratic formula says the roots are at
   $$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}.$$
   By rationalizing the numerator we obtain the alternative formula
   $$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}\left(\frac{-b \mp \sqrt{b^2-4ac}}{-b \mp \sqrt{b^2-4ac}}\right) = \frac{-2c}{b \pm \sqrt{b^2-4ac}}.$$
   Construct an algorithm that determines each of the two roots using the version of the formula that is most accurate for it.

   (b) Write a MATLAB function program to implement your algorithm. Name/format it as
   `function [x1,x2]=quadroots(a,b,c)`

   (c) Write a MATLAB function program to test your `quadroots` function. Have it call `quadroots` to get x_1 and x_2, and then compute $r_1 = ax_1^2+bx_1+c$ and $r_2 = ax_2^2+bx_2+c$. Name/format it as
   `function [r1,r2]=testquadroots(a,b,c)`
   Use it to check on several quadratic polynomials, including x^2+1, x^2-2x+1, and x^2-x+10^{-16}.

3. (25 points) Do this problem as a Good Problem, paying attention to the *Logic* handout.

   Find an approximation to $\sqrt{3}$ correct within 10^{-4} by using the bisection method on $f(x) = x^2-3$ starting on $[1,2]$.

4. (25 points) For $A > 0$ and $n \geq 1$, consider the fixed point iteration
   $$x_n = \frac{1}{2}x_{n-1} + \frac{A}{2x_{n-1}}.$$

   (a) Show that if $x_0 > 0$ then this converges to $\sqrt{A}$.

   (b) Use it to approximate $\sqrt{3}$ correct within 10^{-4} starting at $x_0 = 2$.