Math 5600 **Fall 2012**
Homework 7, due Friday 26 October.

1. (20 points) Explore the learning materials at
   `http://en.wikiversity.org/wiki/Topic:Numerical_analysis`
   Choose one page or section of a long page that you find unsatisfying.
   Be sure that it is a Wikiversity page and not a Wikipedia page.
   Edit this page to make it better. Use your Good Problem *Logic* and *Flow* skills.
   Report what you did on your user page.

2. (80 points) We consider the differential equation $u''(t) + u(t) = 0$ with initial conditions $u(0) = 1$ and $u'(0) = 0$. For the approximations below we will use two steps with step size $h = \pi/8$ and approximate the values of $u(\pi/4)$ and $u'(\pi/4)$.

   (a) Find the exact solution to this differential equation and the exact values of $u(\pi/4)$ and $u'(\pi/4)$.

   (b) Convert this second order differential equation to a system of first order equations.

   (c) Apply the Euler method twice.

   (d) Apply the Midpoint method twice.

   (e) Apply the Backward Euler method twice.

   (f) Apply the Runge-Kutta fourth order method twice.

   (g) Using the values from the Runge-Kutta fourth order method at $t = h$, apply the Two-step Adams-Bashforth method once.

   (h) Collect the errors in approximating $u(\pi/4)$ and $u'(\pi/4)$ from all these methods in a table and comment on what you observe.