Fall 2016, Math 308 **Fourth Weekly Assignment**

Due Thursday, October 6 2016 (at the end of class).

- Euler's method for approximating a solution to the initial value problem

$$y' = f(t, y)$$
$$y(t_0) = y_0$$

on an interval $[t_0, s_0]$ is executed by taking a (large) positive integer N, defining $h = (s_0 - t_0)/N$ and considering points

$$t_0, \quad t_1 = t_0 + h, \quad t_2 = t_0 + 2h, \quad \cdots \quad , \quad t_N = t_0 + Nh \quad (= s_0).$$

If the solution to the initial value problem is the function y, an approximation $y_k \simeq y(t_k)$ estimated on the points $t_0, t_1, \ldots, t_N$ is given by the algorithm

$$(*) \qquad y_k = y_{k-1} + hf(t_{k-1}, y_{k-1}),$$

where $y_0 = y(t_0)$ is the initial condition.

- Heun's method is an improvement of Euler's method giving a more accurate estimation. The difference between the two methods is that in the latter one $(*)$ is replaced with

$$(**) \qquad \begin{aligned} w_k &= y_{k-1} + hf(t_{k-1}, y_{k-1}), \\ y_k &= y_{k-1} + h\left(\frac{f(t_{k-1}, y_{k-1}) + f(t_k, w_k)}{2}\right). \end{aligned}$$

Keep in mind that w_k is not an output value.

- The assignment is to modify the given Matlab file "eulermethod.m" and make it execute Heun's method instead of Euler's method. Please turn in your assignment in printed form.