**RULES**

1. The answers of the exercises will be posted on our website at 17:00 PM on 04.01.2013: www2.ce.metu.edu.tr/~ce305 .
2. This is the **version 7.0**. In case there are any corrections for this exercise, we will post an updated version on our website. You can follow the changes in the exercises by the **Version History** section below.

**Version History**

**V7.0** Exercise is released.



**1.** The following equation can be used to model the deflection of a sailboat mast subject to a wind force:

$$\frac{d^2y}{dz^2} = \frac{f(z)}{2EI}(L-z)^2$$

where $f(z)$ is the wind force, $E$ is the modulus of elasticity, $L$ is mast length, and $I$ is the moment of inertia. Note that the force varies with height according to:

$$f(z) = \frac{200z}{5+z}e^{-2z/30}$$

Calculate the deflection if $y=0$ and $\frac{dy}{dz}=0$ at $z=0$ using Heun's (one-cyle, non-iterative) method along the length of mast.

Use a step size of 0.5 m, parameter values of L=30 m, E=1.25*10$^8$ Pa and I=0.05 kg.m$^2$ for your computation.

**Hints:**

- You should use a system of ordinary differential equations approach.
- Do not make any changes in units.

**2.** Consider the boundary value problem;

$$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 4x(t) = 0 \text{ with } x(0.5)=3 \text{ and } x(2.5)=-2$$

Find x(1.0), x(1.5) and x(2.0) using $O(h^2)$ finite difference formula. Note that h=0.5.