HOMEWORK # 5[1]

1. Use computer to plot the following analytical functions between 0 and 1 for $n = 1, 2, 3$.
   (a) $sin(n\pi x)$
   (b) $cos(n\pi x)$
   (c) $tan(n\pi x)$
   (d) $sinh(n\pi x)$
   (e) $cosh(n\pi x)$
   (f) $tanh(n\pi x)$

2. Solve the following homogenous PDE
$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \tag{1}$$
   with the nonhomogenous boundary conditions
$$u_x(0,t) = 0, \quad u_x(\pi,t) = 10 \tag{2}$$
   and the following initial conditions
$$u(x,0) = \frac{10x^2}{2\pi} \tag{3}$$

3. Solve the following nonhomogenous PDE
$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2} + sin(3\pi x), \qquad 0 < x < 1 \tag{4}$$
   with the homogenous boundary conditions
$$u(0,t) = u(1,t) = 0, \quad t > 0 \tag{5}$$
   and the initial conditions
$$u(x,0) = sin(\pi x), \quad 0 < x < 1 \tag{6}$$

4. Use the separation of variables, $u(x,y,t) = X(x)Y(y)T(t)$, to solve the following vibrating membrane problem
$$\frac{\partial^2 u}{\partial t^2} = c^2 \left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right] \tag{7}$$
   in a domain with $0 < x < 1$ and $0 < y < 1$. The boundary conditions are
$$u(0,y) = 0, \qquad u(1,y) = 0 \tag{8}$$
$$u(x,0) = 0, \qquad u_y(x,1) = 0 \tag{9}$$
   and the initial conditions are
$$u(x,y,0) = f(x,y) \tag{10}$$
$$u_t(x,y,t) = 0 \tag{11}$$

[1] Return date is on 31 May 2012.