Homework 1 (due 03/21/2016)

1. Derive the analytic solution of the parabolic-type partial differential equation and visualize the result with the change of time.

$$\frac{\partial \phi}{\partial t} = \frac{\partial^2 \phi}{\partial x^2}$$

Initial Condition: $\phi(x,0) = \delta(x-0) \quad (-\infty < x < \infty)$

Boundary Condition: $\phi(\pm\infty, t) = 0 \quad (t > 0)$

2. Derive the analytic solution of the advection partial differential equation and visualize the result with the change of time.

$$\frac{\partial u}{\partial t} + c\frac{\partial u}{\partial x} = 0 \quad (t > 0, \ -\infty < x < \infty)$$

$$u(x,0) = u^0(x) = \begin{cases} u^0 = u_1 & (-\infty < x \le 0) \\ u^0 = u_2 & (0 < x < \infty) \end{cases}$$

3. Derive the analytic solutions of BVP I (Dirichlet problem) and BVP II (Dirichlet and Neumann problem) of 1D steady heat convection problem in the note and visualize the result.