Q1. Steady state heat transfer in a rectangle is governed by:

$$\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}=0$$

Boundary Conditions:

$$T(0,y)=0 \text{ and } T(1,y)=0$$

$$T(x,0)=0 \text{ and } T(x,1)=400$$

i. Plot the temperature T w.r.t x, at $y=0,0.25,0.50,0.75,0.9$ and 1. [All the plots should be present in a single figure]

ii. Find the value of T at $x=0.6$ and $y=0.4$.

Q2. The temperature distribution along a long thin insulated (except at its ends along the direction of heat transfer) rod is given by the equation:

$$k\frac{\partial^2 T}{\partial x^2}=\frac{\partial T}{\partial t}$$

Solve for the temperature distribution along the length of the rod that has a total length of 10cm and the following values: $\Delta x = 2\text{cm}$, $\Delta t = 0.1$ s.

At t=0, the temperature of the rod is zero,

And the boundary conditions are fixed for all times at T(0) = 100 ^{0} C and T(10) = 50 ^{0} C.

$$T(0,t)=100^0 C \text{ ,} \qquad T(10,t)=50^0 C$$

The rod is made of aluminium with C = 0.2174 cal/(g . ^{0}C), ρ = 2.7 g/cm^3, k=0.835 cm^2/s and λ=0.020875, k '= 0.49 cal/(s. cm. ^{0}C).

i. Plot the temperature T w.r.t x for t= 3, 6, 9, 12.

ii. Find the value of T at x= 2 and t=9.