

## Chapter # 7

### Problem # 7-1

Try to calculate and prove that the following equations are convergent for Jacobi iterative method, whereas are divergent for GS point iterative method.

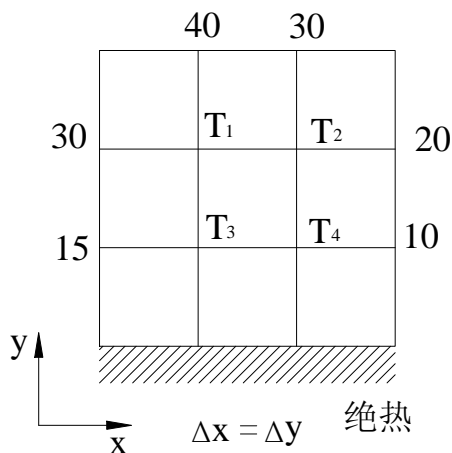
$$x_1 + 2x_2 - 2x_3 = 1$$

$$x_1 + x_2 + x_3 = 3x$$

$$2x_1 + 2x_2 + x_3 = 5x$$

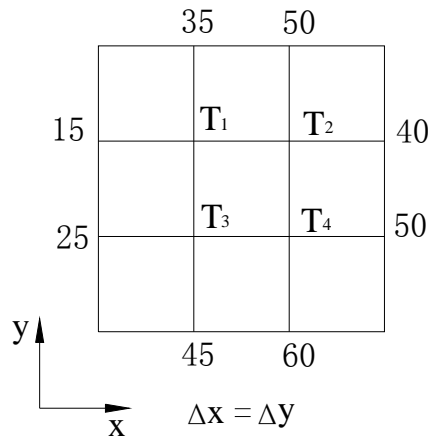
### Problem # 7-4

Bottom of a square object is thermally insulated, and the temperature of remaining three sides is shown in figure given below. Determine the temperature inside the square nodes 1,2,3,4. Thermal properties of the object are constants, and without internal heat source.



### Problem # 7-6

A physical square, as shown in figure below, is the steady state heat conduction problem. Calculate the temperature of internal nodes 1,2,3,4 using the GS point iterative method and linear iterative method and compare their convergence rate. Also compare the results with example 1 and explain the observed facts.



**Problem # 7-8**

A sufficient condition for GS and Jacobi point iteration convergence is that the algebraic equation coefficient matrix must be strictly diagonally dominant, that is the formula (7-21) must be tenable for either rows or columns. Take the following algebraic equations as an example

$$4x_1 - x_2 + x_3 = 4 \quad (\text{Construct the iterative formula for } x_1)$$

$$x_1 + 4x_2 + 2x_3 = 9 \quad (\text{Construct the iterative formula for } x_2)$$

$$-x_1 + 2x_2 + 5x_3 = 2 \quad (\text{Construct the iterative formula for } x_3)$$

Prove that when strictly diagonally dominant is tenable, the error present in one iteration step will be gradually attenuated with the iteration process.