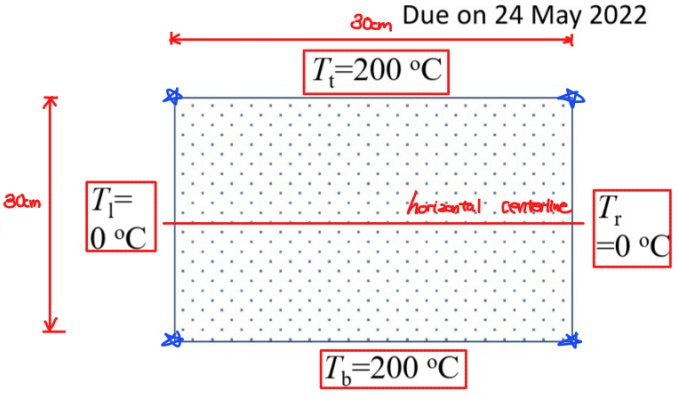
〈Homework #5: Steady 2-D Heat Conduction〉

Due on 24 May 2022

Write a Matlab code to solve the following steady, 2-D heat conduction problem.

- **30 cm X 30 cm rectangular copper plate.**
  The temperature on the top and bottom side is fixed at 200 °C
  & the temperature on the left and right side is fixed at 0 °C.



- **Your code must do the following tasks.**
  1. Stop the iteration when the average relative error becomes less than 10^{-5}
  2. Plot 2-d temperature distribution at steady-state.
  3. Plot the temperature profile along a horizontal centerline.

〈Average relative error: $\sum_{n=m=1}^{n,m} abs\left(\left(T_{current}(m,n) - T_{previous}(m,n)\right)\right)/100$〉

$\sum_{n=1}^{n}\sum_{m=1}^{m} \frac{|T_{current}(m,n) - T_{previous}(m,n)|}{100}$

	i = 1	i = 2	i = 3	. . .	. . .	i = m-2	i = m-1	i = m
k=1		200	200	. . .	. . .	200	200	
k=2	0	100	100	. .	. . .	100	100	0
⋮	0	100	100			100	100	0
⋮	0							0
k=n-2	0	100	100			100	100	0
k=n-1	0	100	100			100	100	0
k=n		200	200	200	200	200	200	

Assumption: Fixed boundaries temperature, no heat generation, Interior node, $n=m$, $T_0(m,n)=100$℃

Governing Equation: $\frac{\partial T}{\partial t} = \alpha \frac{(T_{m+1,n} + T_{m-1,n} + T_{m,n+1} + T_{m,n-1} - 4T_{m,n})}{\Delta x^2}$

$\therefore \Delta T = \alpha \cdot \frac{dt}{dx^2} \cdot (T_{m+1,n} + T_{m-1,n} + T_{m,n+1} + T_{m,n-1} - 4T_{m,n})$