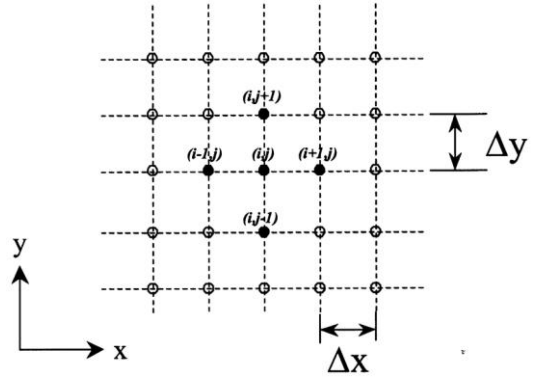
Mini-Project: Solving Differential Equations



- Write a program to solve $T(t)$ satisfying $\frac{dT(t)}{dt} = -T(t)$ with an initial condition $T(0) = 1$. Compare your result to the exact solution.
  - *hint*: use finite difference: $\big(T(t+\Delta t) - T(t)\big)/\Delta t = -T(t)$ and pick a good Δt.
- Write a parallel program to numerically solve the temperature distribution for a 2D system, i.e., a square plate with one side at a fixed temperature *T* = 20°C and the other three sides fixed at *T* = 40°C.
  - *hint*: heat equation: $\frac{\partial T}{\partial t} = \kappa\big(\partial_x^2 T + \partial_y^2 T\big)$ with κ a constant. Similar to the above, pick a Δx to numerically evaluate $\partial_x^2 T = \big(T(x-\Delta x) + T(x+\Delta x) - 2T(x)\big)/\Delta x^2$.
- Change the number of processes involved in the above 2D calculation and evaluate speedup and efficiency.