

Exercise 8

$$U(x - \Delta x) = U(x) - \frac{\partial U}{\partial x} \Delta x + \mathcal{O}(\Delta x^2)$$

$\frac{\partial U}{\partial x}$

$$\frac{\partial U}{\partial x} = \frac{U(x) - U(x - \Delta x)}{\Delta x} + \mathcal{O}(\Delta x)$$

$$x_i = x_0 + i \Delta x$$

$$t_n = t_0 + n \Delta t$$

$$\therefore U_i^n = U(x_i, t_n)$$

$$\therefore \frac{\partial U}{\partial x} \approx \frac{U_i^n - U_{i-1}^n}{\Delta x}$$