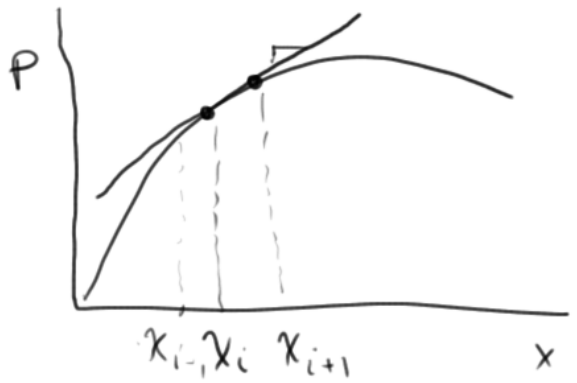
$$\frac{\partial \rho}{\partial t} = \alpha \frac{\partial^2 \rho}{\partial x^2}$$



$$\frac{\partial \rho}{\partial x} \approx \frac{\rho(x_{i+1}) - \rho(x_i)}{x_{i+1} - x_i}$$

$$\approx \frac{\rho(x_{i+1}) - \rho(x_i)}{\Delta x}$$ forward difference

$$f(x) = f(x_i) + f'(x_i)(x - x_i) + \frac{f''(x_i)}{2!}(x - x_i)^2 + \frac{f'''(x_i)(x - x_i)^3}{3!} + \dots$$

$$\rho(x_{i+1}) = \rho(x_i) + \rho'(x_i)(x_{i+1} - x_i) + \frac{\rho''(x_i)}{2}(x_{i+1} + x_i)^2 + H.O.T.$$

$$\rho'(x_i) \approx \frac{\partial \rho}{\partial x}\Big|_{x_i} = \frac{\rho(x_{i+1}) - \rho(x_i)}{(x_{i+1} - x_i)} + \frac{\rho''(x_i)(\Delta x)}{2!} + \dots + \dots$$

$$\rho'(x_i) = \frac{\rho(x_{i+1}) - \rho(x_i)}{(\Delta x)} + \mathcal{O}(\|\Delta x\|)$$