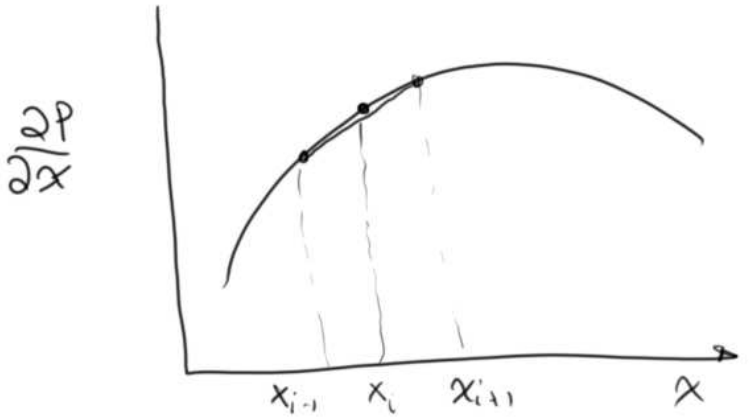
$$\frac{\partial P}{\partial t} = \alpha \underbrace{\frac{\partial^2 P}{\partial x^2}}$$

$$\frac{\partial^2 P}{\partial x^2} \approx \frac{\left.\frac{\partial P}{\partial x}\right|_{x_{i+1}} - \left.\frac{\partial P}{\partial x}\right|_{x_{i-1}}}{2\Delta x}$$



$$\approx \frac{-\frac{P(x_i) - P(x_{i-1})}{\Delta x} + \frac{P(x_{i+1}) - P(x_i)}{\Delta x}}{2\Delta x}$$

$$\approx \frac{P(x_{i+1}) - 2P(x_i) + P(x_{i-1})}{\Delta x^2}$$

T.S.

$$P(x+\Delta x) = P(x) + \left.\frac{\partial P}{\partial x}\right|_x \Delta x + \frac{1}{2!}\left.\frac{\partial^2 P}{\partial x^2}\right|_x \Delta x^2 + \frac{1}{3!}\left.\frac{\partial^3 P}{\partial x^3}\right|_x \Delta x^3 + \dots +$$

$$+\left(P(x-\Delta x) = P(x) - \left.\frac{\partial P}{\partial x}\right|_x \Delta x + \frac{1}{2!}\left.\frac{\partial^2 P}{\partial x^2}\right|_x \Delta x^2 - \frac{1}{3!}\left.\frac{\partial^3 P}{\partial x^3}\right|_x \Delta x^3 + \dots +\right.$$

$$P(x+\Delta x) + P(x-\Delta x) = 2P(x) + \left.\frac{\partial^2 P}{\partial x^2}\right|_x (\Delta x)^2 + \frac{2}{4!}\frac{\partial^4 P}{\partial x^2}(\Delta x)^4 + \dots$$

$$\frac{\partial^2 P}{\partial x^2} \simeq \frac{P(x+\Delta x) - 2P(x) + P(x-\Delta x)}{\Delta x^2} + \mathcal{O}(|\Delta x|^2)$$

$$\frac{\partial^2 P}{\partial x^2} = \frac{1}{\alpha}\frac{\partial P}{\partial t}$$

↓ For the "i^{th}" grid block

$$\frac{P_{i-1}^{n} - 2P_i^{n} + P_{i+1}^{n}}{(\Delta x)^2} = \frac{1}{\alpha}\left(\frac{P_i^{n+1} - P_i^n}{\Delta t}\right)$$ Explict

$$P^{n+1} = \alpha \Delta t \left[\frac{P_{i-1}^n - 2P_i^n + P_{i+1}^n}{(\Delta x)^2}\right] + P_i^n$$