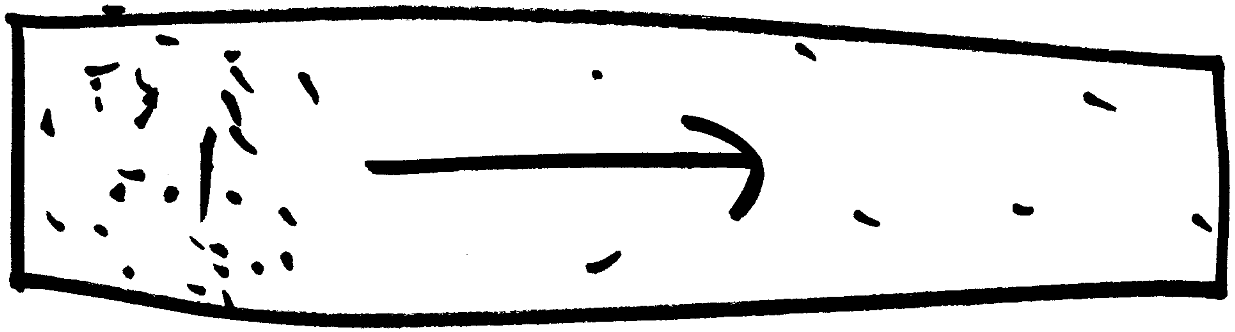
$C(x,t)$



higher concentration

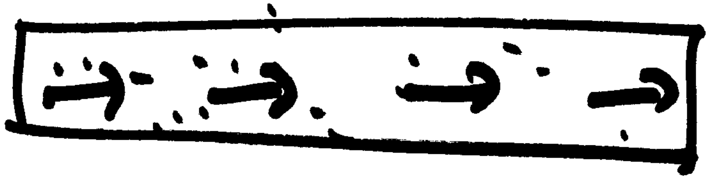
lower concentration

$$\vec{J} \propto \frac{\partial c}{\partial x}$$

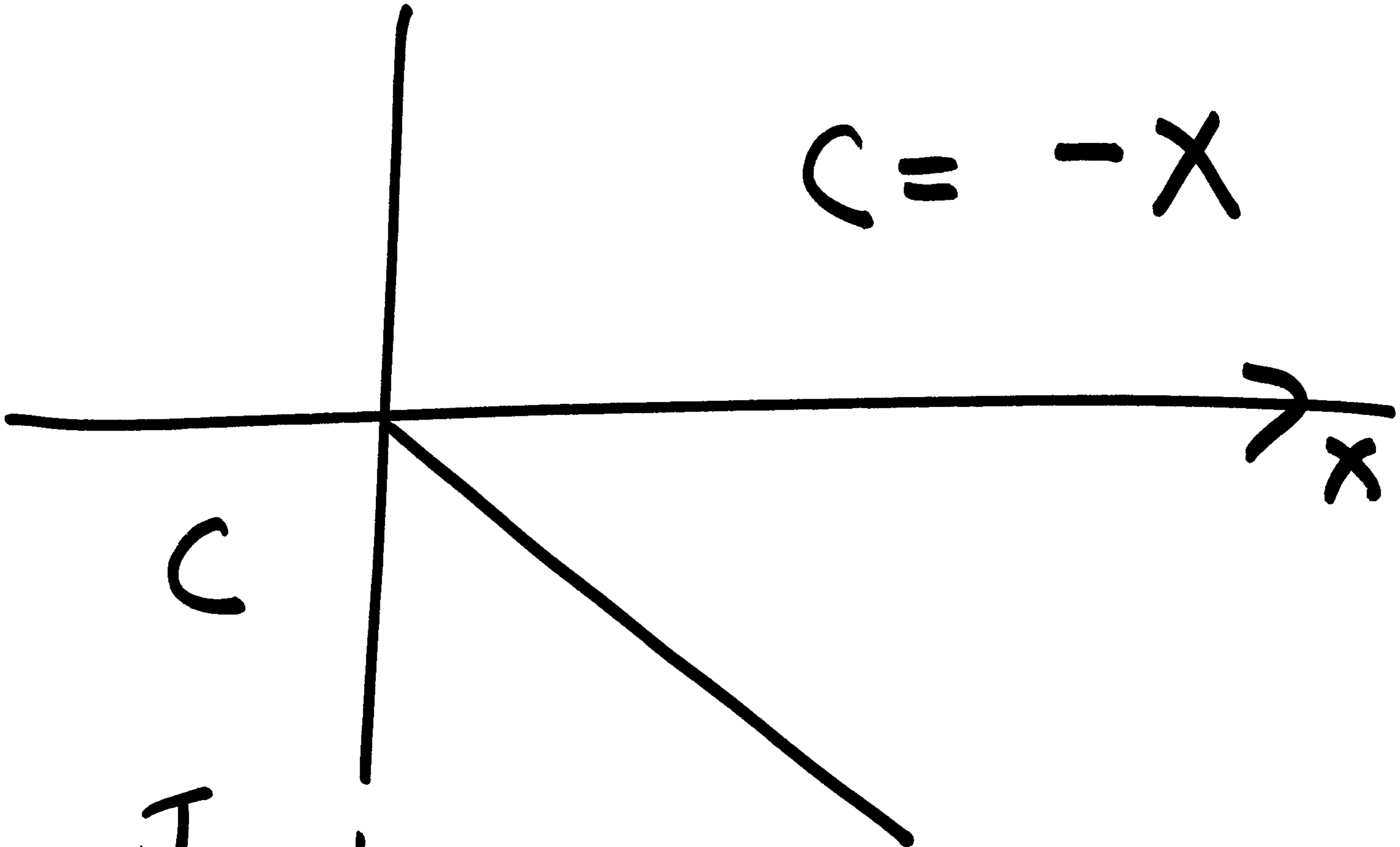
Prof. Ranjith. P (Lec. 18)
03/10/11

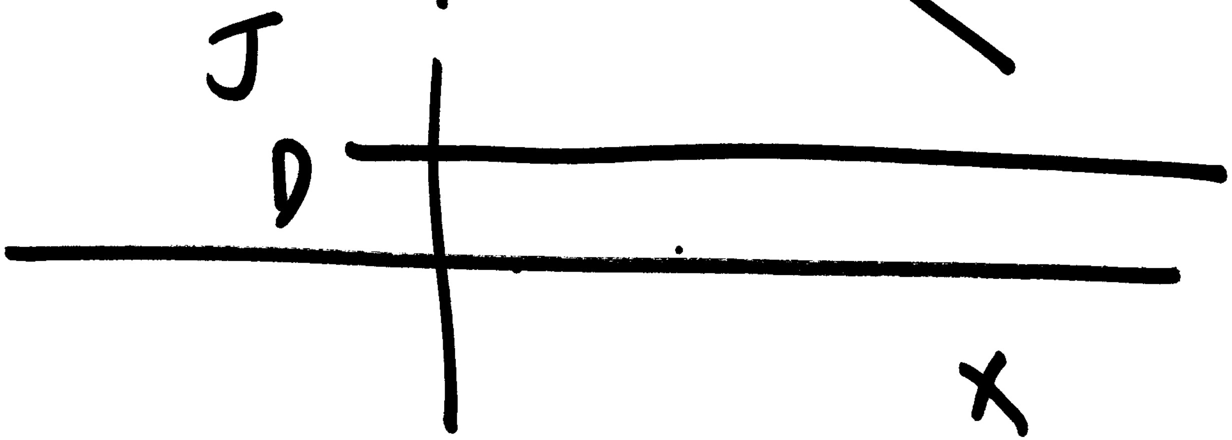
1

$$\vec{J} = (-D)\frac{\partial c}{\partial x}\hat{x}$$

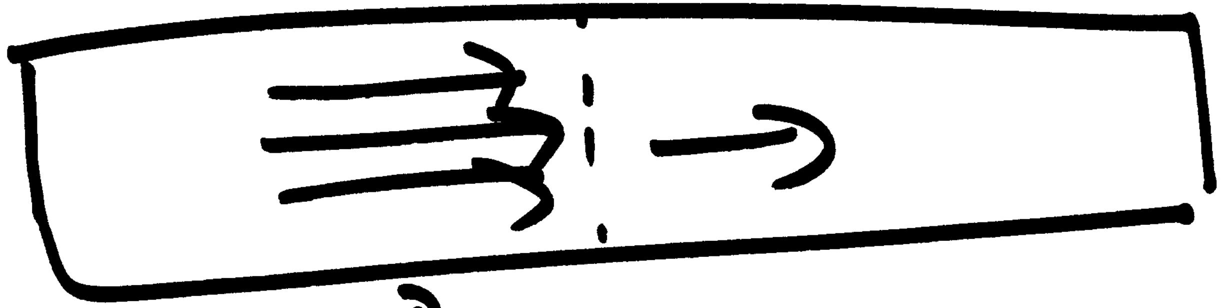


$C = -X$





$$\vec{\nabla} = \hat{x}\frac{\partial}{\partial x}$$



$\vec{J}(x)$

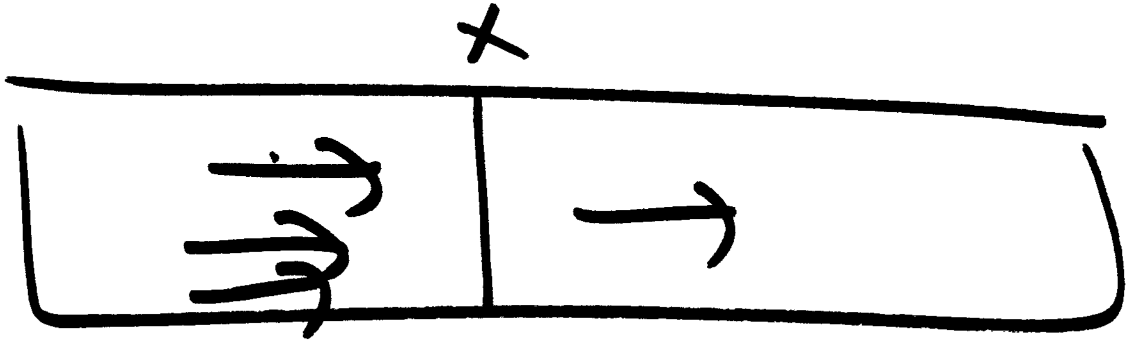
$\vec{\nabla}$, $\vec{J}$

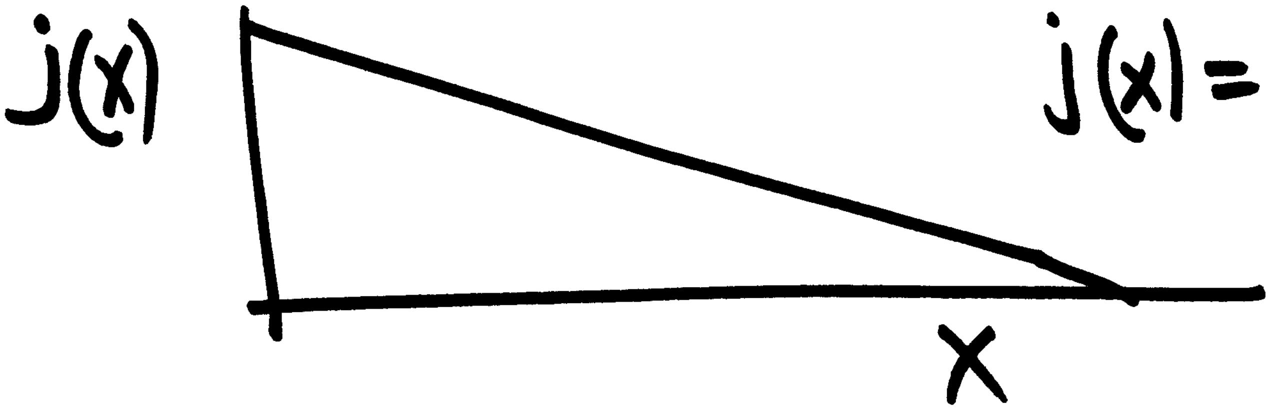
$$\underbrace{\frac{\partial c}{\partial t}}_{\text{scalar}} \propto \left\{ \begin{array}{l} \text{change in flow} \\ \text{along } x \end{array} \right.$$

$$\vec{\nabla}, \quad J$$

$$\frac{\partial c}{\partial t} \propto \vec{\nabla} \cdot \vec{J}$$

$$\vec{\nabla} \cdot \vec{J} = \frac{\partial j(x)}{\partial x} = -\frac{\partial x}{\partial x} = -k$$





$$j(x) = -kx$$

$$\frac{\partial c}{\partial t} = -\vec{\nabla}\cdot\vec{J} = +k$$

If

$j(x) = -kx$

$\cancel{\nabla} - k$

$$=$$

$$\frac{\partial c}{\partial t} = k$$

$$c = \int k\,dt = kt + c_0$$

$$c(x) = kt + c_0$$

$$\frac{\partial c}{\partial t} = -\vec{\nabla} \cdot \vec{J}$$

$$\vec{\nabla} \cdot \vec{J} = \frac{\partial j}{\partial x}$$, where

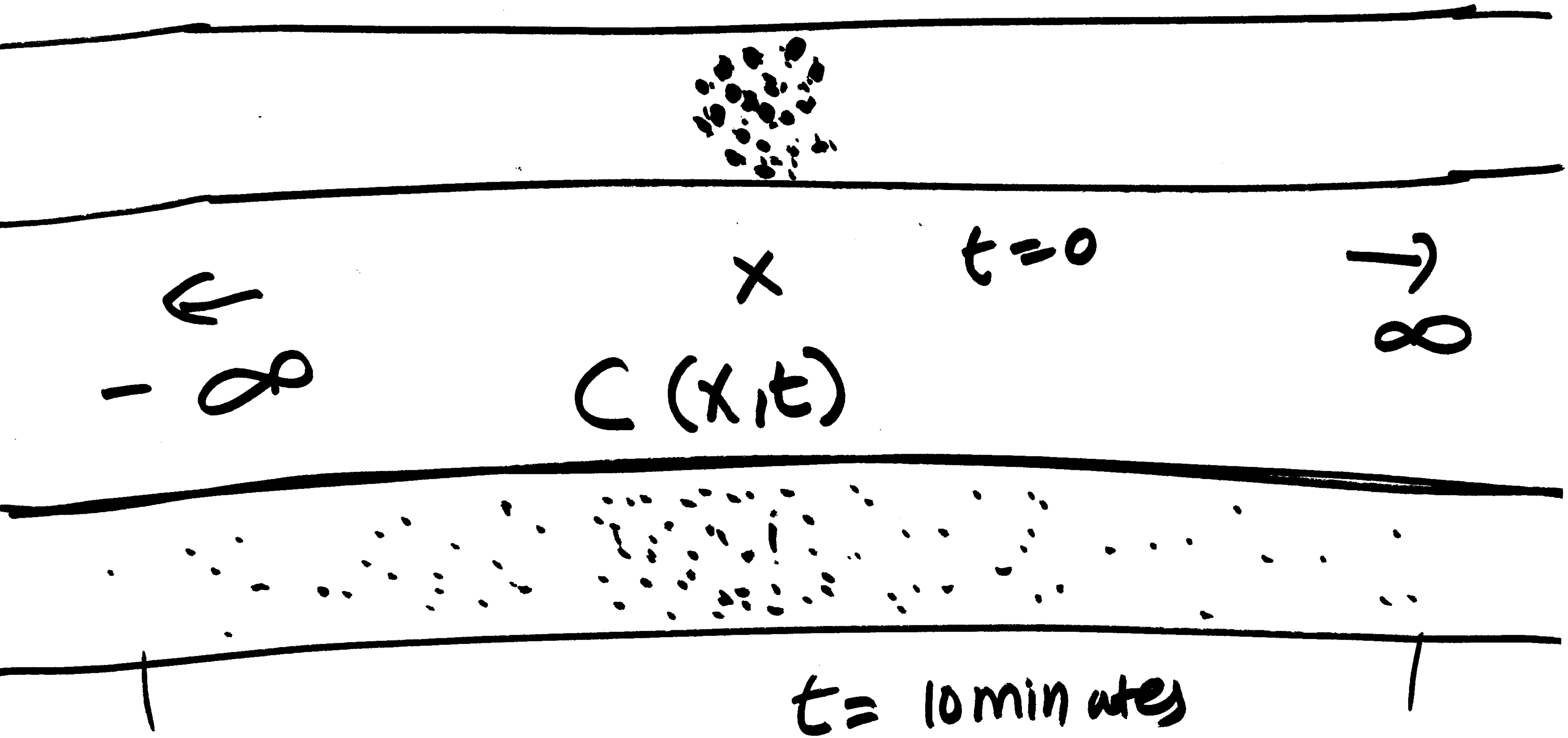
$$j = |\vec{J}|$$

$$\vec{J} = -D \frac{\partial c}{\partial x} \hat{x}$$

$$j = -D \frac{\partial c}{\partial x}$$

$$\frac{\partial c}{\partial t} = + \frac{\partial}{\partial x} D \frac{\partial c}{\partial x} = D \frac{\partial^2 c}{\partial x^2}$$

$$\frac{\partial c(x,t)}{\partial t} = D\frac{\partial^2 c}{\partial x^2}$$



final

$$\langle x^2 \rangle = \int_{-\infty}^{\infty} x^2 \, C(x) \, dx$$

$$\langle x \rangle = \int_{-\infty}^{\infty} x \, C(x) \, dx$$