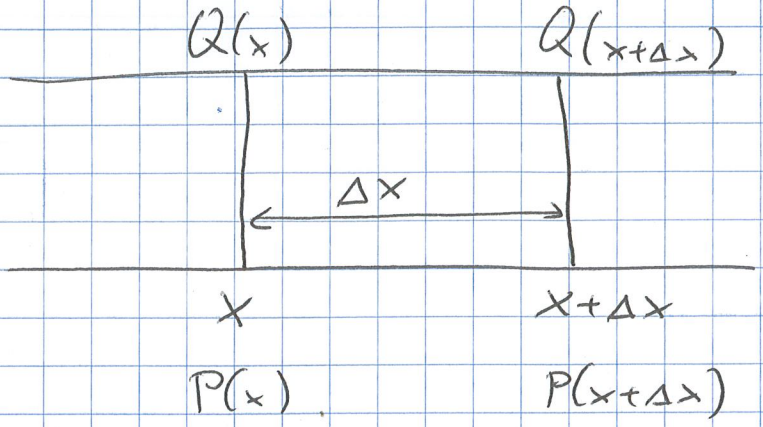
Single ended pipe



$$Q(x+\Delta x) - Q(x) = \underbrace{2\pi R \Delta x q}_{\text{surface} \cdot \text{outgassing rate}} \quad \text{total load of segment}$$

$$\frac{\Delta Q}{\Delta x} = 2\pi R q$$

$$\frac{dQ}{dx} = 2\pi R q$$

$$Q(x+\Delta x) = \underbrace{+C \frac{L}{\Delta x}}_{\text{conductance of pipe segment } \Delta x} \left(\underbrace{P(x) - P(x+\Delta x)}_{-\Delta P} \right) \qquad P_1 - P_2$$

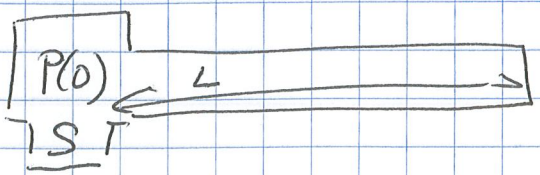
$$Q(x) = -CL \frac{\partial P}{\partial x}$$

$$\frac{\partial Q}{\partial x} = -CL \frac{\partial^2 P}{\partial x^2} = 2\pi R q$$

$$\frac{\partial^2 P}{\partial x^2} = -\frac{1}{CL} \cdot (2\pi R q)$$

$$\boxed{P(x) = -\frac{2\pi R q}{CL} \frac{x^2}{2} + A_0 x + B}$$

Boundary Conditions for the single ended pipe



$$P(0) = \frac{Q_{tot}}{S} \qquad \boxed{Q_{tot} = 2R\pi \cdot L_q}$$

$$\left.\frac{\partial P(x)}{\partial x}\right|_{x=L} = 0$$

$$0 = -\frac{2\pi R_q}{CL} \cdot L + A_0$$

$$A_0 = \frac{2\pi R_q L}{CL^2} = \frac{Q_{tot}}{CL^2} \quad \frac{Q_{tot}}{CL}$$

$$P(x) = -\frac{2\pi R_q L}{CL^2} \cdot \frac{x^2}{2} + \frac{Q_{tot}}{CL} x + \underbrace{\frac{Q_{tot}}{S}}_{P(0)}$$

$$\boxed{P(x) - P(0) = -\frac{Q_{tot}}{C} \cdot \left[\frac{1}{2}\left(\frac{x}{L}\right)^2 - \frac{x}{L}\right]}$$

$$P(L) - P(0) = -\frac{Q_{tot}}{C}\left[\frac{1}{2} - 1\right]$$

$$= \frac{Q_{tot}}{2C} \leftarrow \text{max pressure}$$

For the average pressure $\int_0^{L_p} P(x)\,dx / L_p$!