\[ \nu = \mu / \rho \]  \text{"kinematic viscosity"}

\[ p = p(x, y) \]

\[ \frac{\partial p}{\partial x} = -p \frac{U_0^2}{L} \left[ 1 + \frac{x}{L} \right] \]

\[ \frac{\partial p}{\partial y} = \]

\[ u = U_0 \left[ 1 + \frac{x}{L} \right] \]

\[ v = -\frac{U_0y}{L} \]
for $2-D$, $p = \text{const}$, $\mu = 0$, steady, discretized

$$
\sqrt{gy} \quad \frac{\Delta U}{\Delta x} + \frac{\Delta V}{\Delta y} = 0 \quad \text{continuity}
$$

$$
x\text{-mom: } p \left[ u \frac{\Delta U}{\Delta x} + v \frac{\Delta U}{\Delta y} \right] = \sigma_{xx} \frac{\Delta p}{\Delta x} + \lambda
$$

$$
y\text{-mom: } p \left[ u \frac{\Delta V}{\Delta x} + v \frac{\Delta V}{\Delta y} \right] = \sigma_{yy} \frac{\Delta p}{\Delta y}
$$

Stagnant condition (calm air)

$u = 0$, $v = 0$, $p = 1$ bar everywhere

(calm water)

$p > 0$

---

un
Uniform flow

$U = U_0$ everywhere, $v = 0$

$\Rightarrow$ $p$ uniform everywhere

couette flow

$\Rightarrow p \neq p(x)$

$p \neq p(y)$
\[ p(x, y) = p(x) \]

\[ u(x, y) = ? \]

\[ v(x, y) = ? \]

\[ p = 1 \text{ bar} \quad (\text{lo on } R) \]

\[ p = 1.1 \text{ bar} \]

\[ p = 1.2 \text{ bar} \quad (\text{press hi on } L) \]

Assume \( g_x = 0 \)

\( g_y = 0 \)
simplify N.S to make Bernoulli equ.

\[
V = \sqrt{2gy}
\]

\[
\frac{P_1}{\rho} + g\frac{z_1}{2} + \frac{V_{1}^{2}}{2} = \frac{P_2}{\rho} + g\frac{z_2}{2} + \frac{V_{2}^{2}}{2}
\]

(from \[
\frac{P_x}{\rho} + g\frac{z_x}{2} + \frac{V_{x}^{2}}{2} = \text{Bernoulli const.}
\]

\[
\frac{\text{Pathm}}{\rho} + gy + \phi = \frac{\text{Pathm}}{\rho} + g\phi + \frac{V_{2}^{2}}{2}
\]

Bernoulli const. is not a number like \(\pi\). It is a number with units \(\text{m}^2/\text{s}^2\) that varies from problem-to-problem and from streamline-to-streamline within a problem.
BE from N S \circ \mu = 0 \quad (frictionless)

1. along a streamline -

\[ \frac{\partial z}{\partial s} \]

2. steady flow

\[ \int \frac{dp}{P} + \frac{V^2}{2} + g z = \text{const} \]

3. \( P = \text{const} \)