$$\alpha_{conv} = u\left(\frac{\partial u}{\partial x}\right) = 0.6 \times (-0.55)$$

$$\alpha_{conv} = -0.33 \text{ m/sec}^2$$

$$\alpha_{total} = \alpha_{conv} + \alpha_{local}$$

$$\alpha_{total} = \alpha_{conv} + \alpha_{local}$$

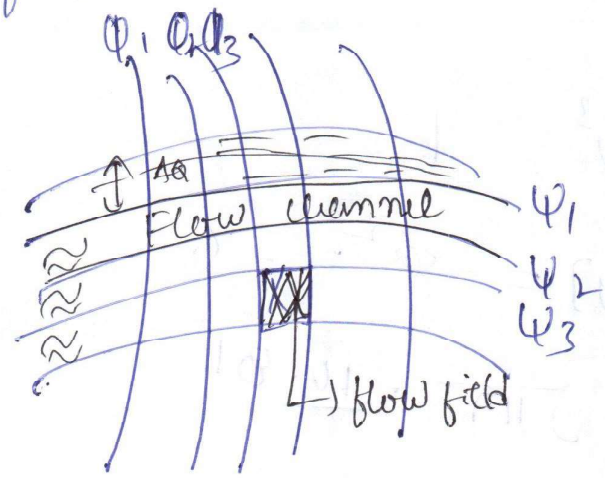
$$= (0.15) + (-0.33)$$

$$\alpha_{total} = -0.18 \text{ m/sec}^2$$

✱ Flow net Analysis ✱

→ **Flow net:-** → It is a graphical Representation of solution of laplace equation

ϕ (Potential)
ψ (Stream)



$\Delta\psi$ = Flow Rate

→ It consist of 'ϕ' lines & 'ψ' lines

there are 1 unit to each other

→ The intersected area are approximated square

square

→ **Flow Rate measurement**

✱ $\Delta\psi$ is the flow Rate through each flow channel which remains constant and is equal for all channels

→ $\Delta Q = \psi_1 \sim \psi_2$

$= \psi_2 \sim \psi_3$

Total flow rate → $Q = n_f \times \Delta Q$

→ n_f = no. of flow channels
i.e no. of stream lines − 1

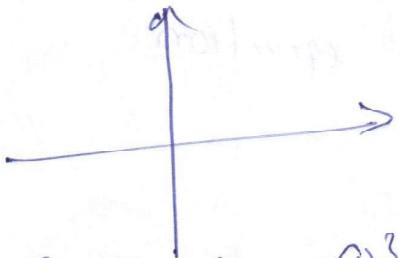
Total flow (Q) $= n_f \times \Delta Q$

ΔQ = Total flow rate

Note:

1) $\psi = 3xy$ velocity of (2,3). Find ϕ

Sol: vel of (2,3) $v = \sqrt{u^2 + v^2}$



$\frac{\partial \psi}{\partial x} = v = \frac{\partial}{\partial x}[3xy] = 3(2) = 9$

$\frac{\partial \psi}{\partial y} = u = -v = -\frac{\partial}{\partial y}[3xy] = -3x = -6$

$v = \sqrt{(-6)^2 + 9^2} = \sqrt{117} = 10.81$

Note

$\phi = \log_e(x^2 + y^2) \Rightarrow \psi = ?$ → $\left(\frac{\partial \phi}{\partial x}\right) = \left(\frac{\partial \psi}{\partial y}\right)$

Sol. $\frac{\partial \psi}{\partial y} = \frac{\partial}{\partial x}[\log_e(x^2 + y^2)]$

$\frac{\partial \psi}{\partial y} = \frac{1}{(x^2 + y^2)}(2x)$

$$\int d\psi = \int \frac{2 \cdot x}{x^2\left(1+(y/x)^2\right)}\, dy$$

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$$= 2\int \frac{1/x}{\left(1+(y/x)^2\right)} \cdot dy = 2 \cdot \tan^{-1}(y/x) + C$$

Gate 13 $\psi = 3/2\left[y^2 - x^2\right]$ flow rate $Q = ?$ the line joining of 2 pts A (0,3) & B (3,4)

Sol. $\psi_A = \psi_B$ ✓

$$\frac{3}{2}\left[3^2 - 0^2\right] \sim \frac{3}{2}\left[4^2 - 3^2\right]$$

$$\frac{3}{2}[9) \sim 3/2(7)$$

$$\frac{3}{2}[9-7) = (3)$$ ✓