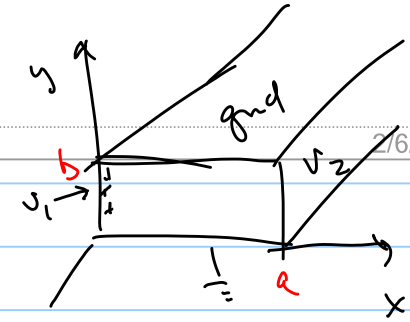
Note Title 2/6/2009

$V = \sum_i A_i V_i$ Fourier Series



$$V(x,y) = \sum_{n=1}^{\infty} \left(A_n e^{-\frac{n\pi x}{b}} + B_n e^{\frac{n\pi x}{b}} \right) \sin\left(\frac{n\pi y}{b}\right)$$

Satisfy bndry cond at $x=0$

$$V(0,y) = \sum \left(A_n + B_n\right) \sin \frac{n\pi y}{b}$$

$\overset{\shortparallel}{V_1}$

Find A_n & B_n & then I'm done!

multiply both sides by $\sin \frac{m\pi y}{b}$ & integrate y from 0 to b

$$V_1 \int_0^b \sin \frac{m\pi y}{b}\, dy = \sum_n (A_n + B_n) \int_0^b \sin\left(\frac{n\pi y}{b}\right) \sin\left(\frac{m\pi y}{b}\right) dy$$

$$V_1 \left[-\frac{b}{m\pi} \cos\left(\frac{m\pi y}{b}\right) \right]_0^b = \sum_{n=1}^{\infty} \left(A_n + B_n\right) \frac{b}{2} \delta_{nm}$$

$$-\frac{bV_1}{m\pi} \left(\cos(m\pi) - 1\right) = \left(A_m + B_m\right) \frac{b}{2}$$

$$\left.\begin{array}{ll} m = \text{odd} & +\frac{2bV_1}{m\pi} \\ m = \text{even} & 0 \end{array}\right\} = \left(A_m + B_m\right) \frac{b}{2}$$

$$\boxed{A_n + B_n = \begin{cases} \frac{4V_1}{n\pi} & n \text{ odd} \\ 0 & n \text{ even} \end{cases}}$$

1 eqn in
2 unknowns
A_n & B_n

Last bndry condition at $x = a$

$$V(a,y) = V_2 = \sum_n \left(A_n e^{-\frac{n\pi a}{b}} + B_n e^{\frac{n\pi a}{b}}\right)\sin\left(\frac{n\pi y}{b}\right)$$

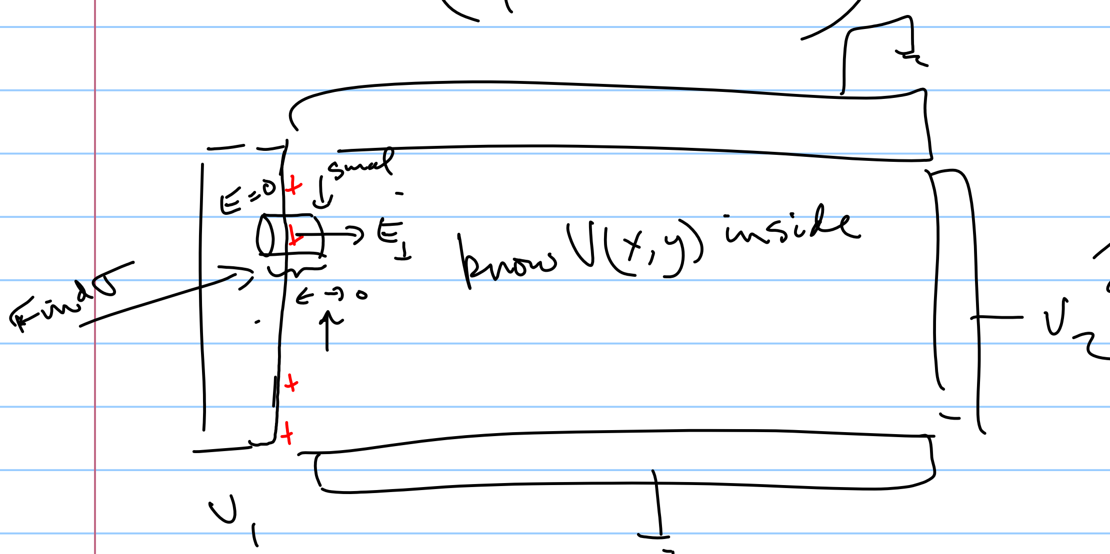
need A_n & B_n. Multiply by $\sin\left(\frac{m\pi y}{b}\right)$ & integrate

$$\boxed{A_n e^{-n\pi a/b} + B_n e^{n\pi a/b} = \begin{cases} \frac{4V_2}{n\pi} & n \text{ odd} \\ 0 & n \text{ even} \end{cases}}$$

2 unknowns A_n & B_n

$$A_n = \frac{4}{n\pi}\left(\frac{V_1 - V_2 e^{-n\pi a/b}}{1 - e^{-2n\pi a/b}}\right)$$

$$B_n = \frac{4}{n\pi}\left(\frac{V_2 e^{-n\pi a/b} - V_1}{1 - e^{-2n\pi a/b}}\right)$$



$$\oint \vec{E}\cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

$$\underbrace{\cancel{\int E}}_{cap} + \underbrace{\int^{\to 0}}_{body} + \underbrace{\int E\,da}_{cap}$$

body: $E_\perp da$; cap: vac

$$= EA = \frac{\sigma A}{\epsilon_0}$$

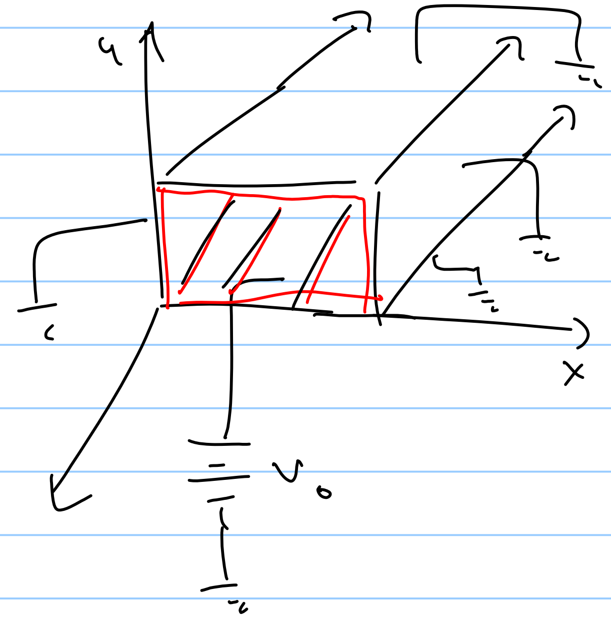
$$\sigma = \epsilon_0 E_\perp$$

$$-\vec{\nabla}V = -\frac{\partial V}{\partial x}\hat{x} - \frac{\partial V}{\partial y}\hat{y}$$

know $V(x,y) = \sum_n$

$\nabla^2 V = -\rho/\epsilon_0$ gives you ρ at $x = 0$

$$\sigma = -\epsilon_0 \frac{\partial V(x,y)}{\partial x}\bigg|_{x=0}$$



trig function for $Y(y)$ & $X(x)$ to satisfy boundary condition

$$\underbrace{\frac{1}{X}\frac{d^2X}{dx^2}}_{C_1} + \underbrace{\frac{1}{Y}\frac{d^2Y}{dy^2}}_{C_2} + \underbrace{\frac{1}{Z}\frac{d^2Z}{dz^2}}_{C_3} = 0$$

$$C_1 + C_2 + C_3 = 0$$

$$-k^2 - \ell^2 + C_3 = 0$$

$$C_3 > 0$$