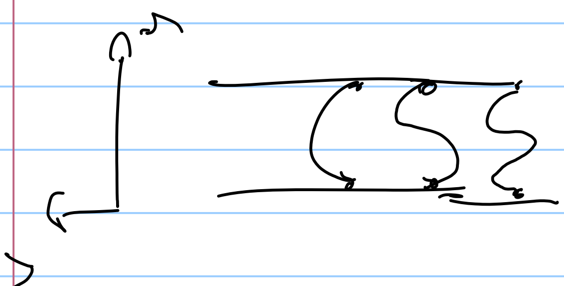
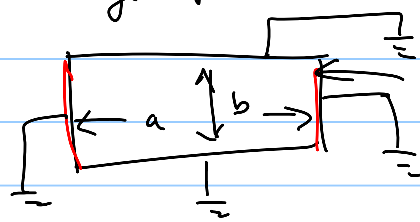
$$V = X(x)\,Y(y) = \overbrace{\sin ky}^{Y(y)}\left(\underbrace{G e^{kx} + H e^{-kx}}_{X(x)}\right)$$

$$k = \frac{n\pi}{b}$$



Charge problem $\sigma = -(\vec{\nabla} V)_\perp$

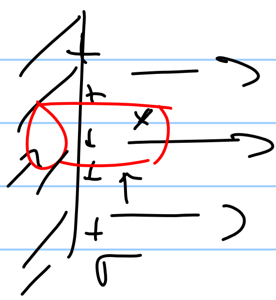


$\underline{\sigma = 0 \text{ on surface}}$

$m = 1, 2, 3, \ldots$

$n = 1, 2, 3, \ldots$

Soln of $\sin ky \sin k'x = \sin\left(\frac{n\pi}{b} y\right) \sin\left(\frac{m\pi}{a} x\right) = V(x, y)$



$$E_\perp = \frac{\sigma}{\epsilon_0} \qquad E_\perp = -(\vec{\nabla} V)_\perp = -\frac{\partial V}{\partial n}$$

normal

$$\vec{\nabla} V(x,y) = \hat{x} \frac{\partial}{\partial x} \sin\left(\frac{n\pi}{b} y\right) \sin\left(\frac{m\pi}{a} x\right) + \hat{y} \frac{\partial}{\partial y} \sin\left(\frac{n\pi}{b} y\right) \sin\left(\frac{m\pi}{a} x\right)$$

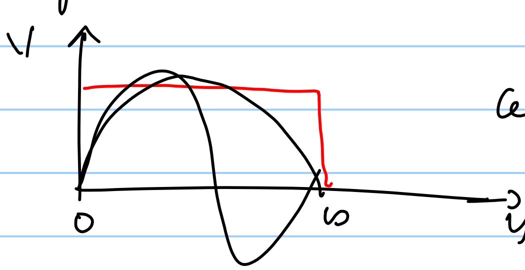
$$= \hat{x} \sin\left(\frac{n\pi}{b} y\right) \cos\left(\frac{m\pi}{a} x\right) \frac{m\pi}{a} + \hat{y} \_\_\_\_\_$$

$m = 0 \quad n = 0 \quad$ so $\quad V(x, y) = 0$

$$V = X(x)\,Y(y) = \overbrace{\sin ky}^{Y(y)}\left(\underbrace{G e^{kx} + H e^{-kx}}_{X(x)}\right)$$

left plate is at $x = 0$ $\quad V(x=0, y) = G' \sin \frac{n\pi}{b} y$

$G' = G + H$



add sines to get any arbitrary function using Fourier series

$$\boxed{V(x,y) = V_1 = \sum_{n=1}^{\infty}{}' \left(A_n e^{-\frac{n\pi x}{b}} + B_n e^{\frac{n\pi x}{b}}\right) \sin\left(\frac{n\pi y}{b}\right)}$$

A_n & B_n are determined by bndy conditions

at $x = 0$ $$\underbrace{V(0) = V_1 = \sum_{n=1}^{\infty}{}' (A_n + B_n) \sin\left(\frac{n\pi y}{b}\right)}_{\text{multiply by } \sin\left(\frac{m\pi y}{b}\right) \text{ \& integrate}}$$

$$V_1 \int_0^b \sin\left(\frac{m\pi y}{b}\right) dy = \sum_n{}' (A_n + B_n) \underbrace{\int_0^b \sin\left(\frac{n\pi y}{b}\right) \sin\left(\frac{m\pi y}{b}\right) dy}_{\frac{b}{2}\delta_{nm}}$$

$$V_1 \left[-\frac{b}{m\pi} \cos\left(\frac{m\pi y}{b}\right)\right]_0^b$$

Integrate [——— n m elements Integers

$$= \sum_n{}' (A_n + B_n) \frac{b}{2} \delta_{nm} = (A_m + B_m) \frac{b}{2}$$

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

1 eqn 2 unknowns, A_m, B_m

Repeat for right bndy

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

multiply both by $\sin\left(\frac{m\pi y}{b}\right)$ & integrate

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

2 eqn in 2 unks A_n & B_n

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

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

Schrodinger eqn: $i\hbar \frac{\partial \psi(x,y,z,t)}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\psi + V\psi$

potential energy

spherical coords

$\ominus$

$\oplus$

assume

$$\psi(r,\theta,\varphi,t) = R(r)\,\Theta(\theta)\,\Phi(\varphi)\,T(t)$$

$$\psi = \sum_{nlm} R_n(r)\,\Theta_l(\theta)\,\Phi_m(\varphi)\,T_n(t)$$