Given the two diff. eq's :

$$\frac{1}{X}\frac{d^2X}{dx^2} = C_1 \qquad \frac{1}{Y}\frac{d^2Y}{dy^2} = C_2$$

where $C_1 + C_2 = 0$. Given the boundary conditions in the figure, which coordinate should be assigned to the negative constant (and thus the sinusoidal solutions)?

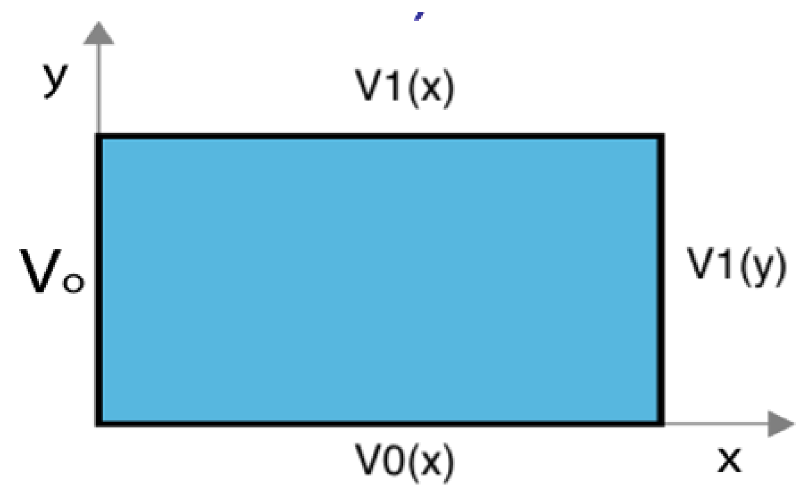
A. x

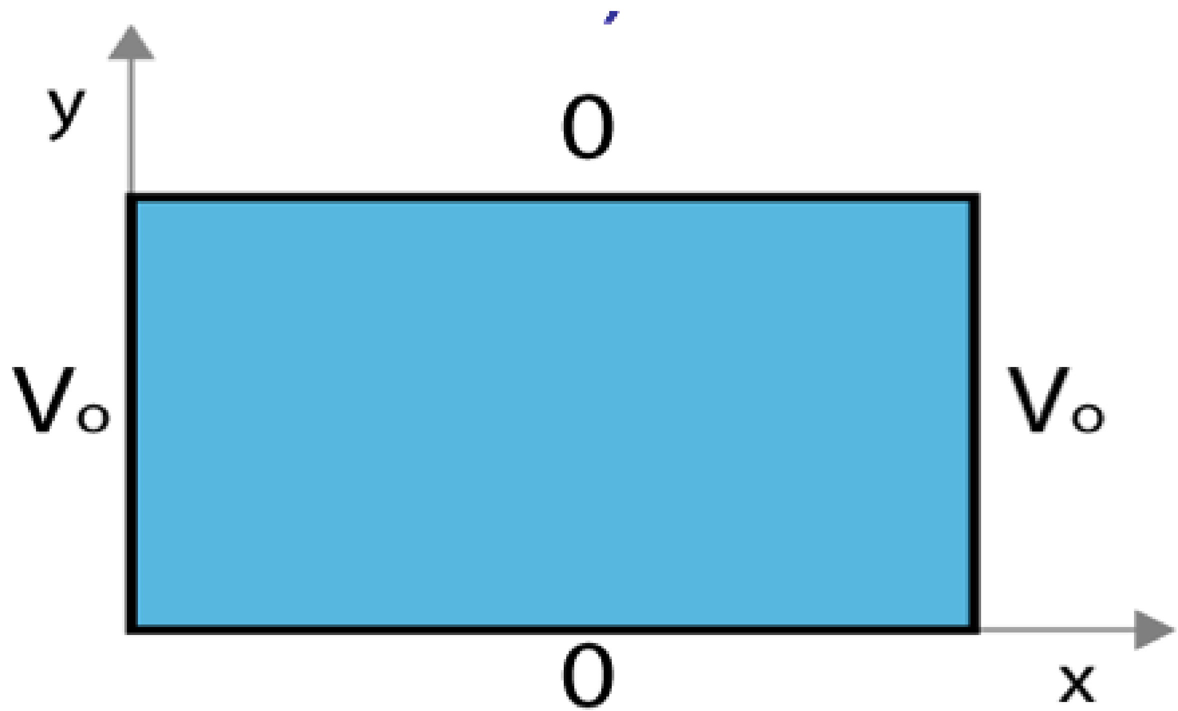
B. y

C. $C_1 = C_2 = 0$ here

D. It doesn't matter.

E. I don't know.



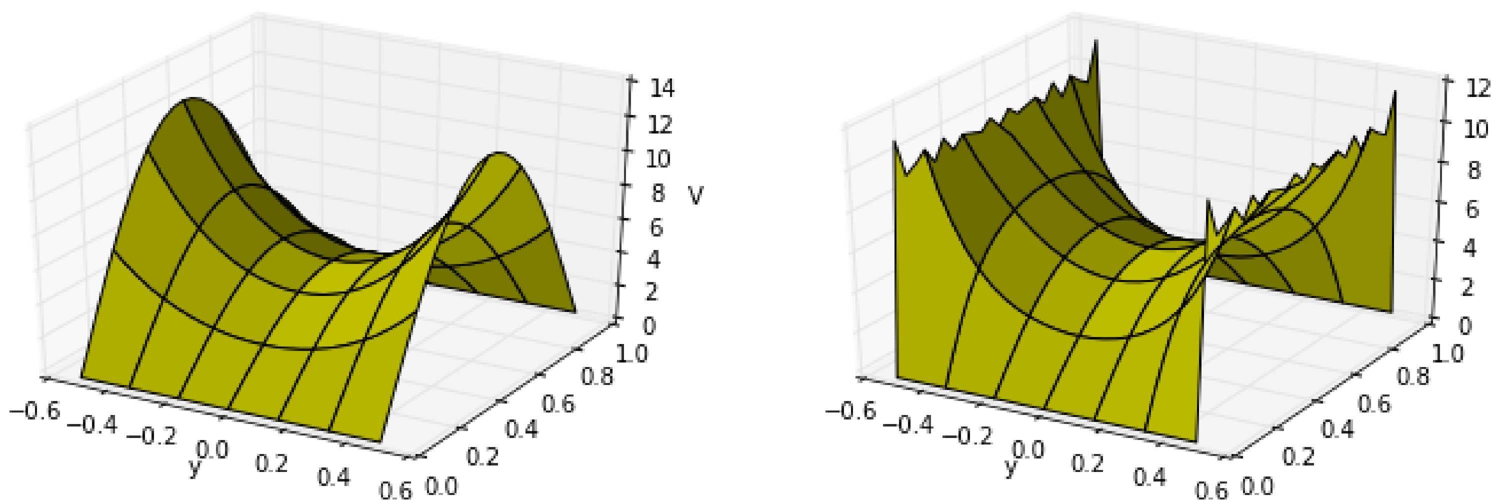

y
0
Vo
Vo
0
x

EXACT SOLUTIONS:

$$V(x, y) = \sum_{n=1}^{\infty} \frac{4V_0}{n\pi} \frac{1}{\cosh\left(\frac{n\pi}{2}\right)} \cosh\left(\frac{n\pi x}{a}\right) \sin\left(\frac{n\pi y}{a}\right)$$

APPROXIMATE SOLUTIONS:

(1 TERM; 20 TERMS)



Given that we want to solve Laplace's equation in 2D and that we have a description for the numerical second derivative of one variable,

$$f''(x) \approx \frac{f(x+a) - 2f(x) + f(x-a)}{a^2}$$

what is the appropriate numerical partial derivative for $V(x, y), \partial V/\partial x \approx$,

A. $[V(x+a) - 2V(x) + V(x-a)]\,/a^2$

B. $[V(x+a, y) - 2V(x, y) + V(x-a, y)]\,/a^2$

C. $[V(y+a) - 2V(y) + V(y-a)]\,/a^2$

D. $[V(x, y+a) - 2V(x, y) + V(x, y-a)]\,/a^2$

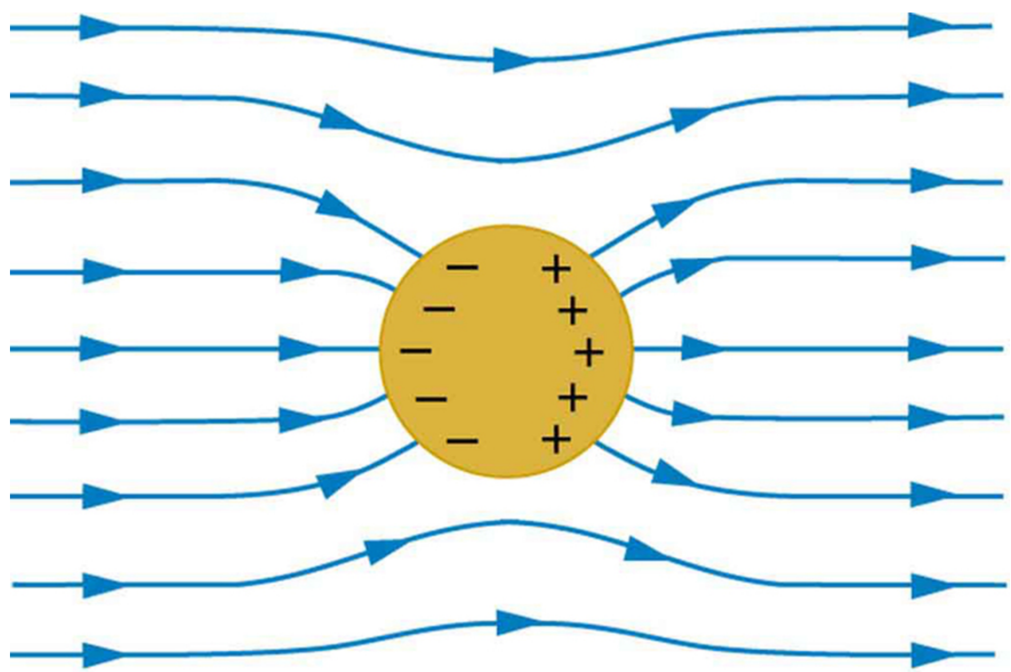
E. More than one is correct

Given that the potential at any point is given by the average of the surrounding points,

$$V(x,y) \approx \frac{1}{4}[V(x+a,y) + V(x,y+a)$$
$$+V(x-a,y) + V(x,y-a)]$$

Draft the psuedocode for finding the approximate potential.

SEPARATION OF VARIABLES (SPHERICAL)



Given $\nabla^2 V = 0$ in Cartesian coords, we separated $V(x, y, z) = X(x)Y(y)Z(z)$. Will this approach work in spherical coordinates, i.e. can we separate $V(r, \theta, \phi) = R(r)\Theta(\theta)\Phi(\phi)$?

A. Sure.
B. Not quite - the angular components cannot be isolated, e.g.,$f(r, \theta, \phi) = R(r)Y(\theta, \phi)$
C. It won't work at all because the spherical form of Laplace's Equation has cross terms in it (see the front cover of Griffiths)