

The Method of Relaxation also works for Poisson's equation (i.e., when there is charge!).

$$\text{Given, } \nabla^2 V \approx \frac{V(x+a) - 2V(x) + V(x-a)}{a^2}$$

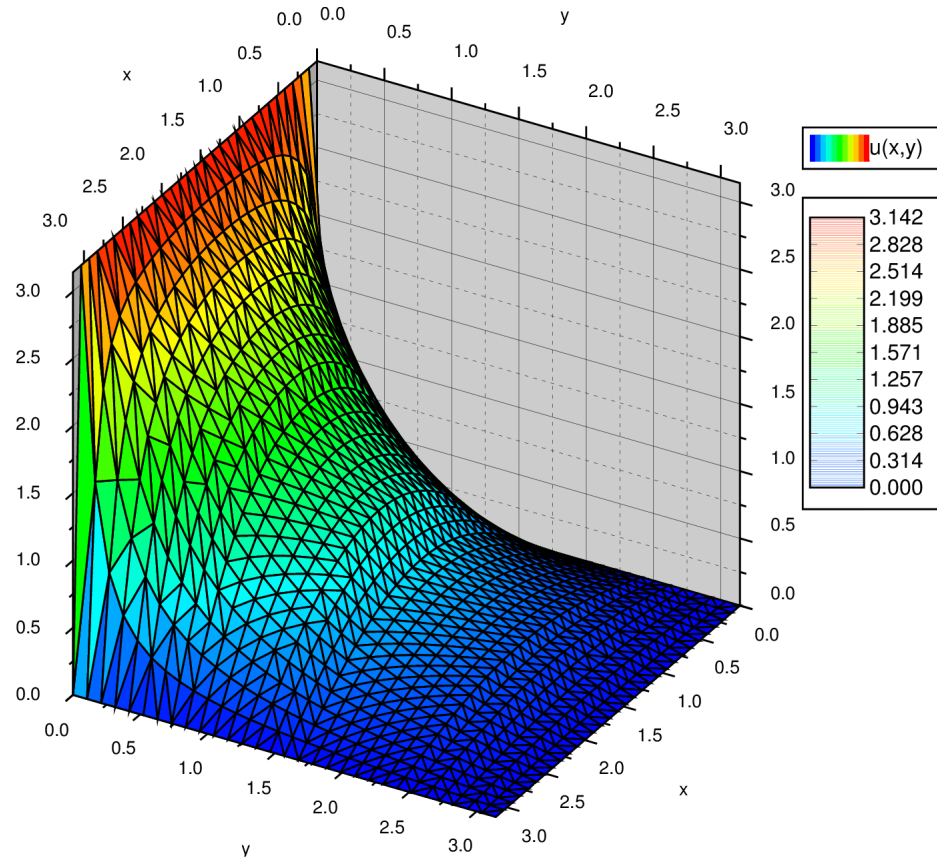
Which equations describes the appropriate "averaging" that we must do:

$$\text{A. } V(x) = \frac{1}{2}(V(x+a) - V(x-a))$$

$$\text{B. } V(x) = \frac{\rho(x)}{\epsilon_0} + \frac{1}{2}(V(x+a) + V(x-a))$$

$$\text{C. } V(x) = \frac{a^2 \rho(x)}{2\epsilon_0} + \frac{1}{2}(V(x+a) + V(x-a))$$

# SEPARATION OF VARIABLES (CARTESIAN)



Say you have three functions  $f(x)$ ,  $g(y)$ , and  $h(z)$ .  $f(x)$  depends on  $x$  but not on  $y$  or  $z$ .  $g(y)$  depends on  $y$  but not on  $x$  or  $z$ .  $h(z)$  depends on  $z$  but not on  $x$  or  $y$ .

If  $f(x) + g(y) + h(z) = 0$  for all  $x, y, z$ , then:

- A. All three functions are constants (i.e. they do not depend on  $x, y, z$  at all.)
- B. At least one of these functions has to be zero everywhere.
- C. All of these functions have to be zero everywhere.
- D. All three functions have to be linear functions in  $x, y$ , or  $z$  respectively (such as  $f(x) = ax + b$ )

If our general solution contains the function,

$$X(x) = Ae^{\sqrt{c}x} + Be^{-\sqrt{c}x}$$

What does our solution look like if  $c < 0$ ; what about if  $c > 0$ ?

- A. Exponential; Sinusoidal
- B. Sinusoidal; Exponential
- C. Both Exponential
- D. Both Sinusoidal
- E. ???

Our example problem has the following boundary conditions:

- $V(0, y > 0) = 0; V(a, y > 0) = 0$
- $V(x_{0 \rightarrow a}, y = 0) = V_0; V(x, y \rightarrow \infty) = 0$

If  $X'' = c_1 X$  and  $Y'' = c_2 Y$  with  $c_1 + c_2 = 0$ , which is constant is positive?

A.  $c_1$

B.  $c_2$

C. It doesn't matter either can be