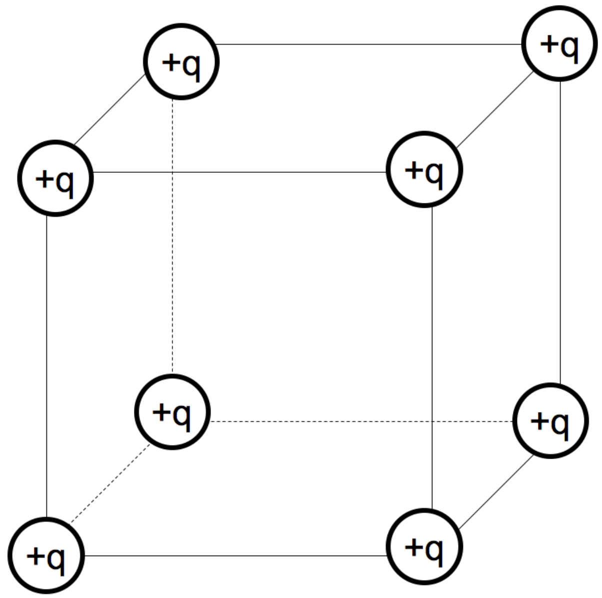
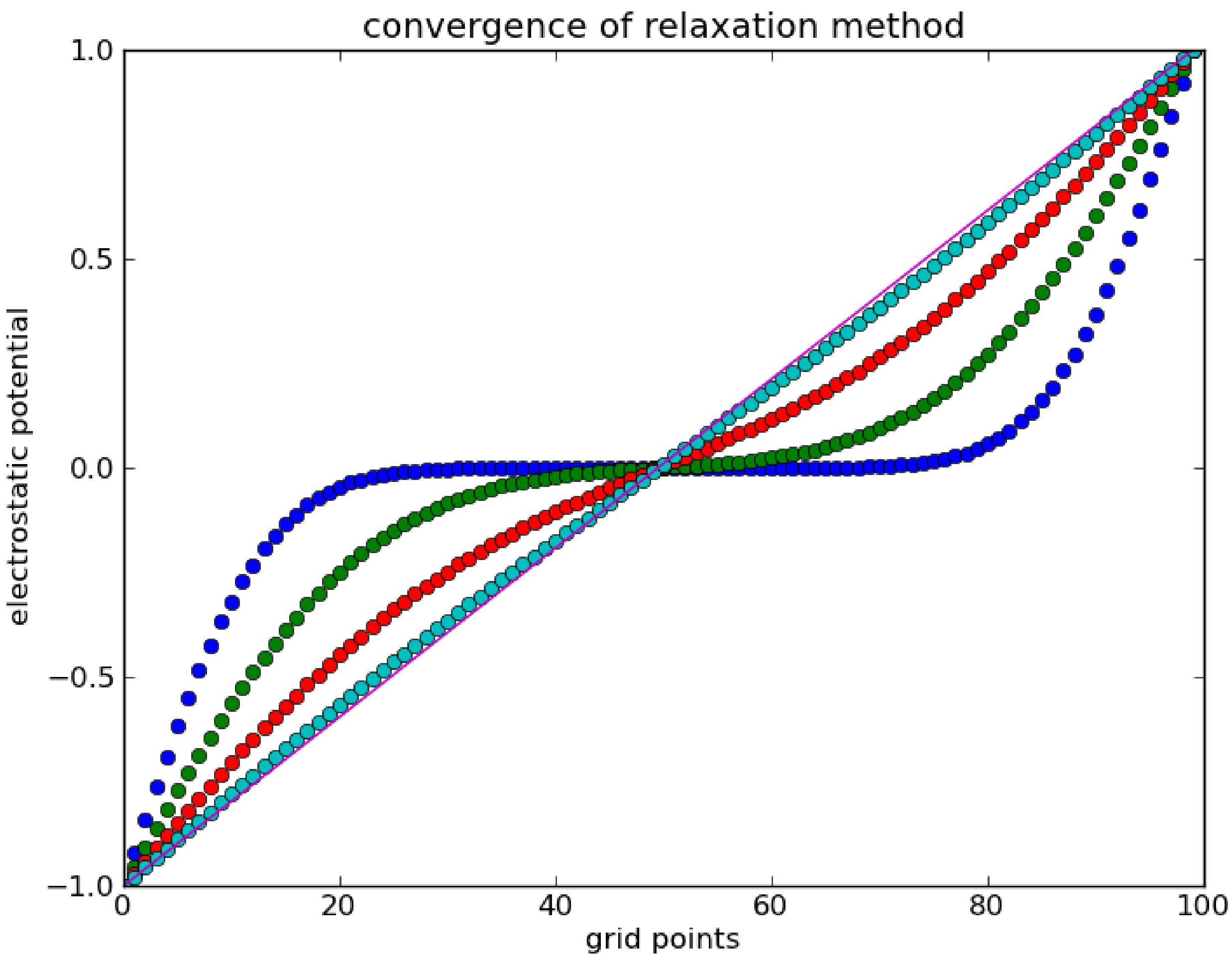


If you put a positive test charge at the center of this cube of charges, could it be in stable equilibrium?

A. Yes
B. No
C. ???

METHOD OF RELAXATION



Consider a function $f(x)$ that is both continuous and continuously differentiable over some domain. Given a step size of a, which could be an approximate derivative of this function somewhere in that domain? $df/dx \approx$

A. $f(x_i + a) - f(x_i)$
B. $f(x_i) - f(x_i - a)$
C. $\frac{f(x_i+a)-f(x_i)}{a}$
D. $\frac{f(x_i)-f(x_i-a)}{a}$
E. More than one of these

If we choose to use:

$$\frac{df}{dx} \approx \frac{f(x_i + a) - f(x_i)}{a}$$

Where are we computing the approximate derivative?

A. a
B. x_i
C. $x_i + a$
D. Somewhere else

Taking the second derivative of $f(x)$ discretely is as simple as applying the discrete definition of the derivative,

$$f''(x_i) \approx \frac{f'(x_i + a/2) - f'(x_i - a/2)}{a}$$

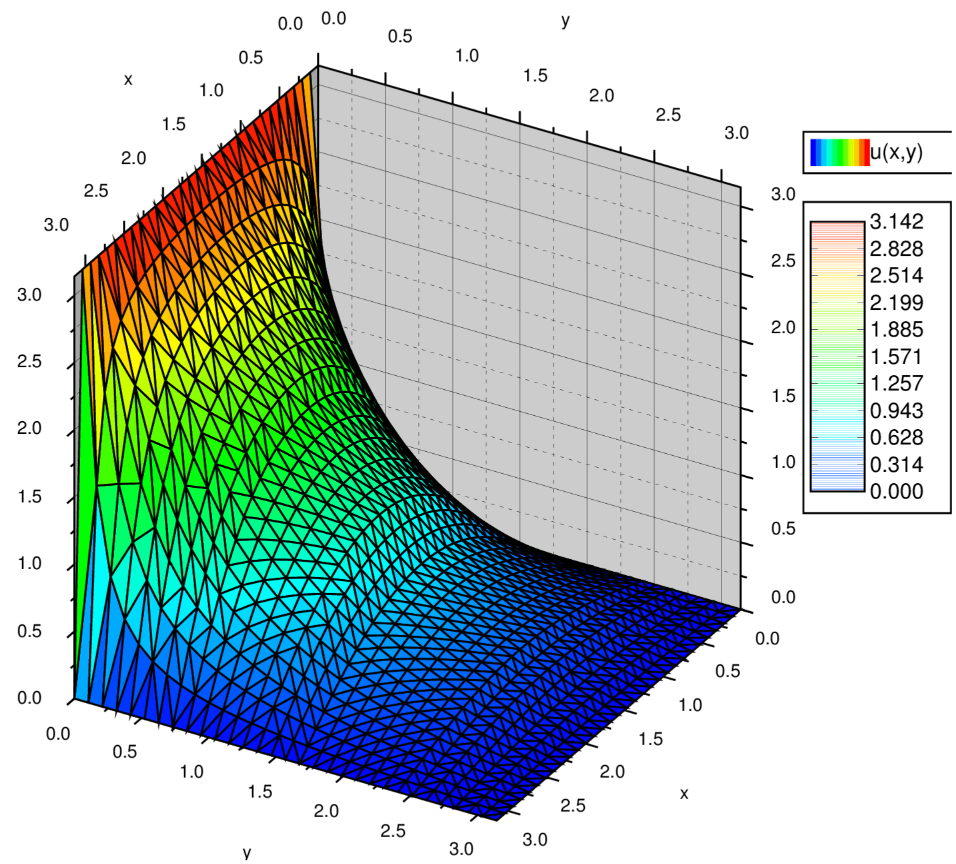
Derive the second derivative in terms of f.

To investigate the convergence, we must compare the estimate of V before and after each calculation. For our 1D relaxation code, V will be a 1D array. For the kth estimate, we can compare V_k against its previous value by simply taking the difference.

Store this in a variable called `err`. What is the type for `err`?

A. A single number
B. A 1D array
C. A 2D array
D. ???

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:

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

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