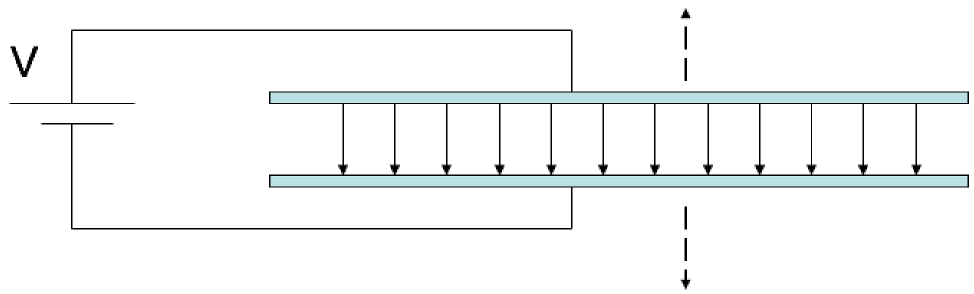
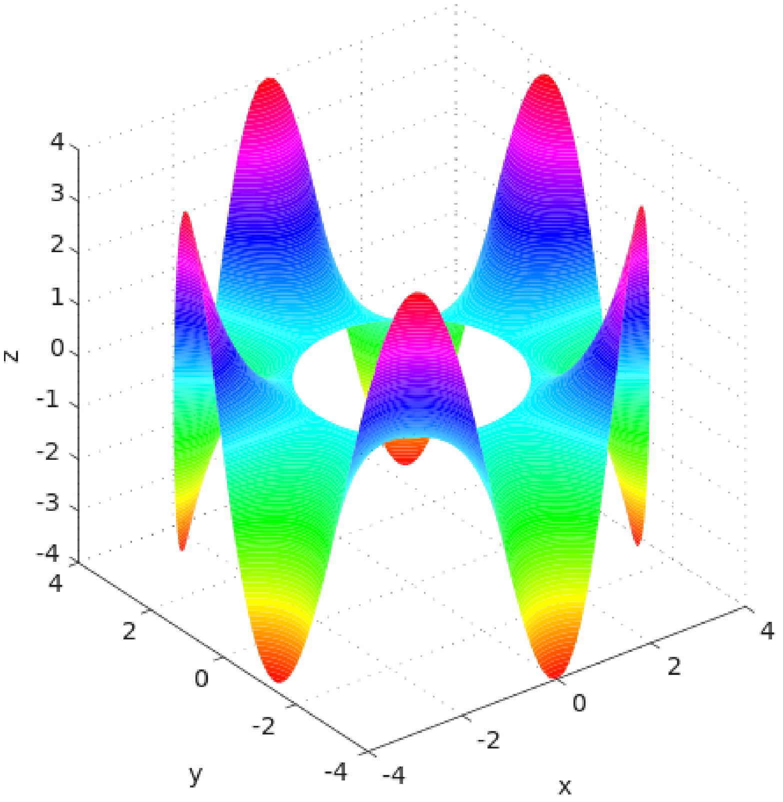
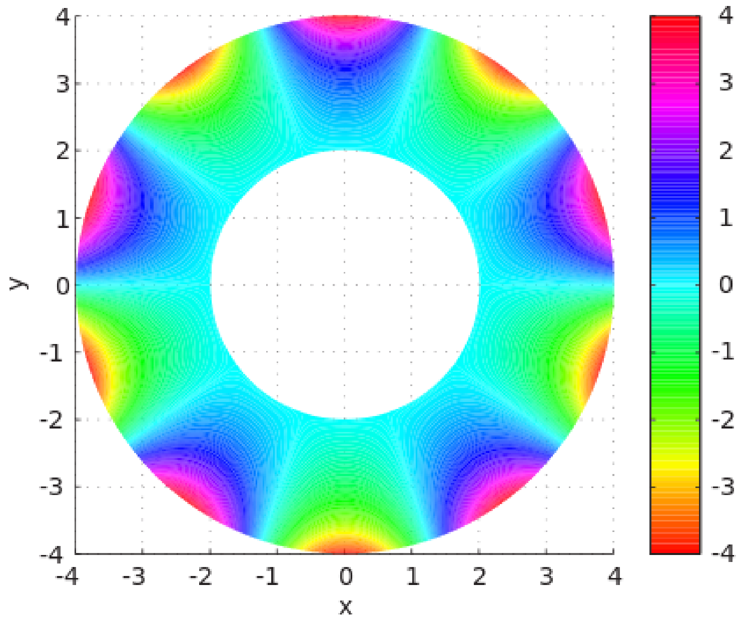


A parallel plate capacitor is attached to a battery which maintains a constant voltage difference V between the capacitor plates. While the battery is attached, the plates are pulled apart. The electrostatic energy stored in the capacitor

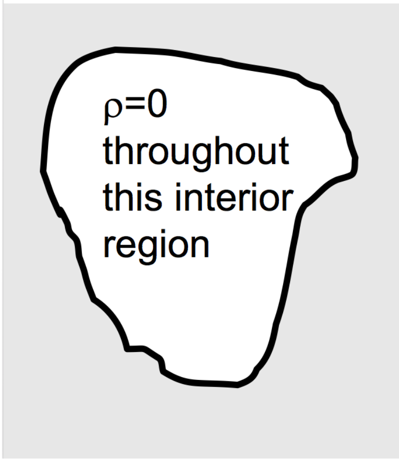
A. increases.
B. decreases.
C. stays constant.

LAPLACE'S EQUATION





A region of space contains no charges. What can I say about V in the interior?

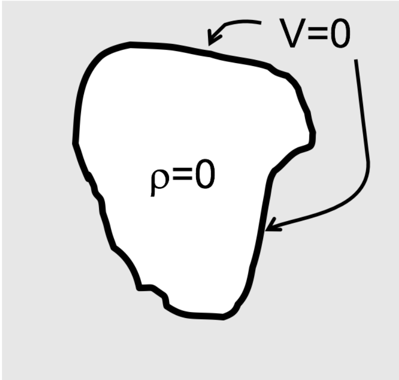


A. Not much, there are lots of possibilities for $V(r)$ in there

B. $V(r) = 0$ everywhere in the interior.

C. $V(r)$ =constant everywhere in the interior

A region of space contains no charges. The boundary has V=0 everywhere. What can I say about V in the interior?



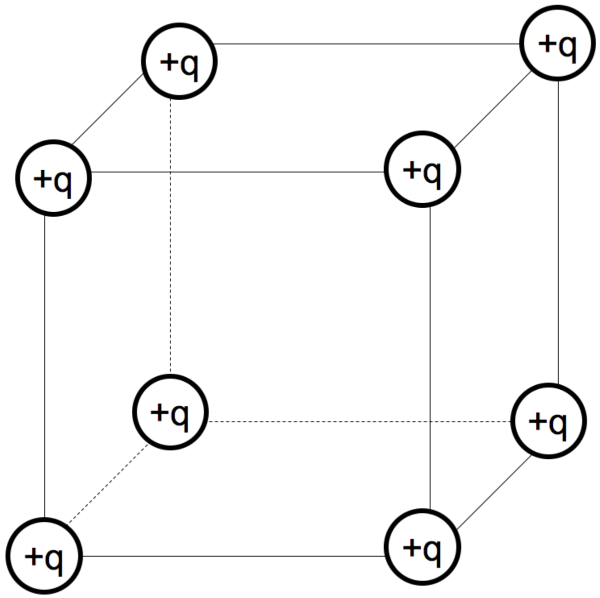
A. Not much, there are lots of possibilities for $V(r)$ in there

B. $V(r) = 0$ everywhere in the interior.

C. $V(r)$ =constant everywhere in the interior

For the 1D Laplace problem ($\nabla^2 V = \partial^2 V/\partial x^2 = 0$), we can choose the following ansatz:

A. $k_0\, x$
B. $k_0\, x + k_1$
C. $k_0\, x^2 + k_1\, x + k_2$
D. Can't tell



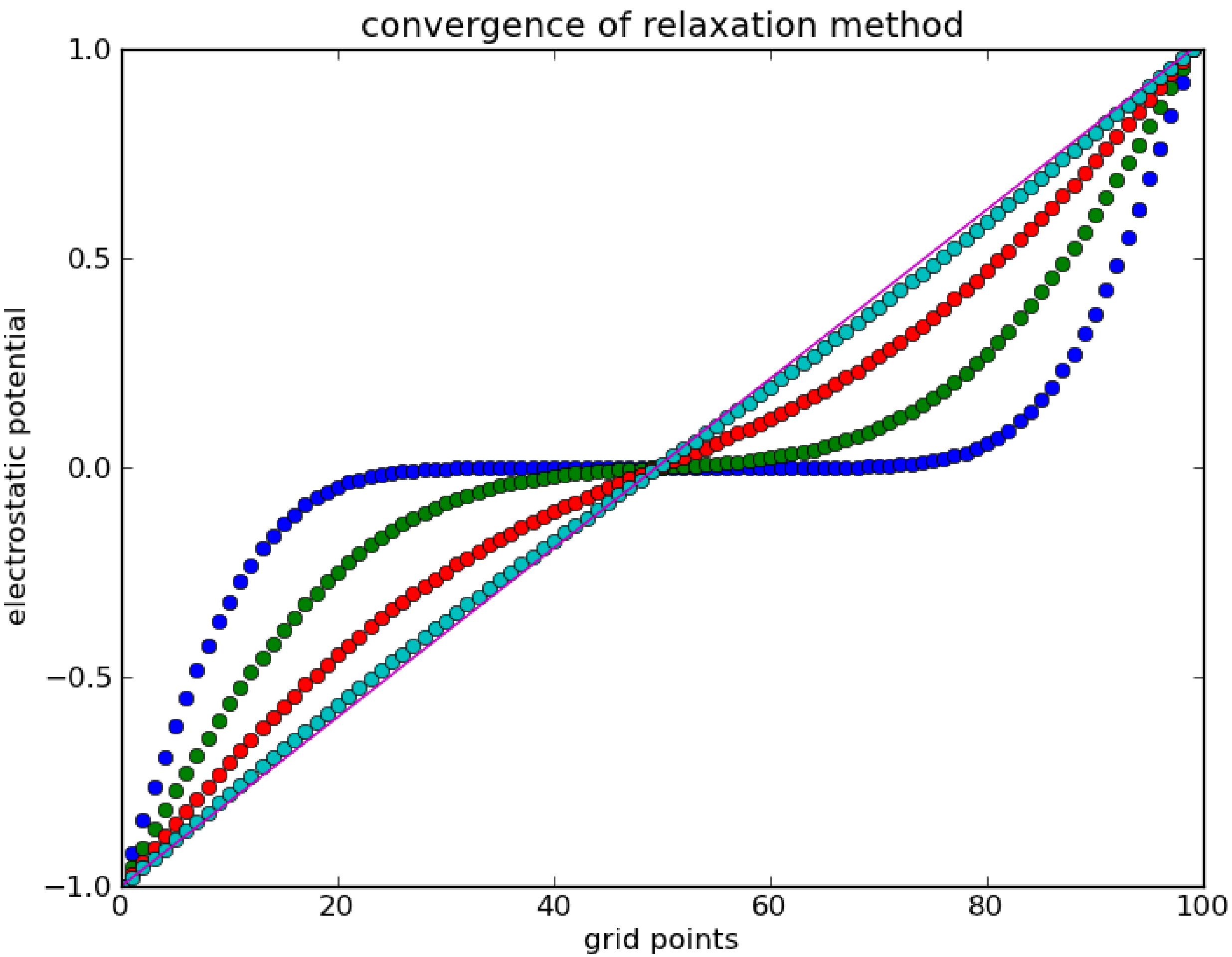
If you put a positive test charge at the center of this cube of charges, could it be in stable equilibrium?

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.