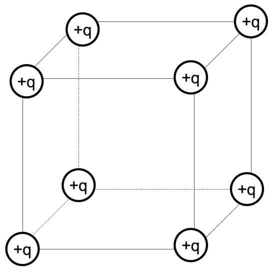
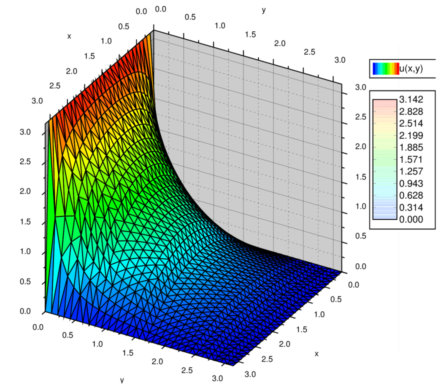


If you put a positive test charge at the center of this cube of charges, could it be in stable equilibrium?

A. Yes
B. No
C. ???

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

When does $\sin(ka)e^{-ky}$ vanish?

A. $k = 0$
B. $k = \pi/(2a)$
C. $k = \pi/a$
D. A and C
E. A, B, C

Suppose $V_1(r)$ and $V_2(r)$ are linearly independent functions which both solve Laplace's equation, $\nabla^2 V = 0$.

Does $aV_1(r) + bV_2(r)$ also solve it (with a and b constants)?

A. Yes. The Laplacian is a linear operator
B. No. The uniqueness theorem says this scenario is impossible, there are never two independent solutions!
C. It is a definite yes or no, but the reasons given above just aren't right!
D. It depends...

What is the value of $\int_0^{2\pi} \sin(2x)\sin(3x)\ dx$?

A. Zero
B. π
C. 2π
D. other
E. I need resources to do an integral like this!