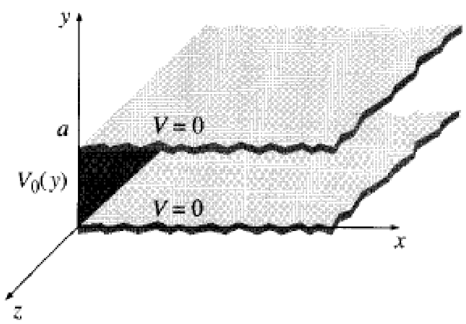
Separation of variables assignment 1: Read the first section on Separation of Variables and then work the following two problems.

1. Consider the space described by 0<y<1 and x>0. Assume that the charge density in this space is zero and that the potential at the boundaries of the space is given by the following boundary conditions:
   1. V=0 at y=o
   2. V=0 at y=a
   3. $V=V_o \sin(2\pi y/a)$
   4. V=0 for x→infinity

   Find an expression for V(x,y) by solving Laplace's equation. Work the full problem, so decide how X(x) and Y(y) look like and then apply boundary conditions 1 and 2 to determine constants in your expression forY(y) and then use boundary condition 4 to determine one of the constants in the expression for X(x). Now combine the X(x) and Y(y) expressions to form a general expression for V(x,y) and use boundary condition 3 and the Fourier trick to determine the last constant.



2. Consider the space defined by 0<y<a and –b<x<b. Furthermore assume the following values for the electric potential at the boundaries:
   1. V=0 at y=0
   2. V=0 at y=a
   3. $V=V_o$ at x=-b
   4. $V=-V_o$ at x=b

   Find an expression for V(x,y) by solving Laplace's equation for space given above.