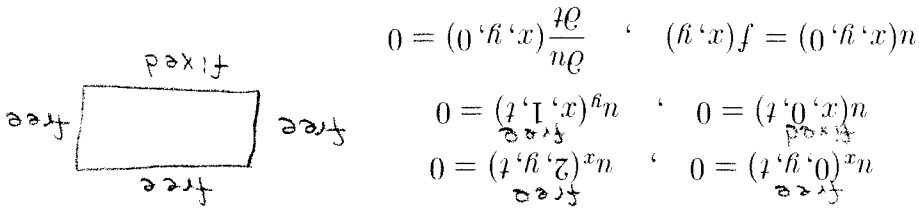


Given the 2-D wave equation for a rectangular drum with the bottom edge fixed and the other three edges free:

$$u_{tt} = 9(u_{xx} + u_{yy}), \quad 0 \leq x \leq 2, \quad 0 \leq y \leq 1, \quad 0 \leq t$$



$$n(x, y, 0) = f(x, y), \quad \frac{\partial n}{\partial t}(x, y, 0) = 0$$

$$n(x, 0, t) = 0, \quad n(x, 1, t) = 0, \quad n(0, y, t) = 0, \quad n(2, y, t) = 0$$

Recall that, in class, we separated the wave equation and got:

$$X'' + \mu X = 0, \quad Y'' + (\lambda - \mu)Y = 0, \quad T'' + \lambda T = 0,$$

- (a) What are the correct Boundary Conditions for  $X(x)$  and  $Y(y)$ ?  
 (b) Solve (you may cite the BlueBook) to get the eigenfunctions  $X_n(x)$  and  $Y_m(y)$  and find a formula for the  $\lambda_{nm}$  values.  
 (c) Find the time functions  $T_{nm}(t)$ .  
 (d) Write the general solution  $n(x, y, t)$   
 (e) Find the coefficients in terms of integrals.