Set #9 - for Tuesday March 11

Read RHK Ch. 18
K&K Ch. 5

Solve

From RHK **Ch. 18** Exercises 11, 12, 20, 28. Problems 8, 10
From K&K **Ch. 3** Problem 3.7

Problem 1. The wave equation according to an observer S motionless with respect to a string is

$$\frac{\partial^2 y}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 y}{\partial t^2} = 0,$$

where c is a wave speed. Show that another observer S' is moving at constant velocity v along the x-axis relative to S, will write the wave equation

$$\left(1 - \frac{v^2}{c^2}\right)\frac{\partial^2 y}{\partial x'^2} - \frac{1}{c^2}\frac{\partial^2 y}{\partial t'^2} + \frac{2v}{c^2}\frac{\partial^2 y}{\partial x' \partial t'} = 0,$$

where x' and t' are defined by the so-called Galilean transformation: $x' = x - vt,\ t' = t.$

Extra Credit. Show that the action for a simple harmonic oscillator of mass m and angular frequency ω and such that at $t = 0$ the position is x_0, and at time T the position is x_T, is given by

$$S = \frac{m\omega}{2\sin\omega T}\left[\left(x_0^2 + x_T^2\right)\cos\omega T - 2x_0 x_T\right].$$

Good Luck, Dr. B