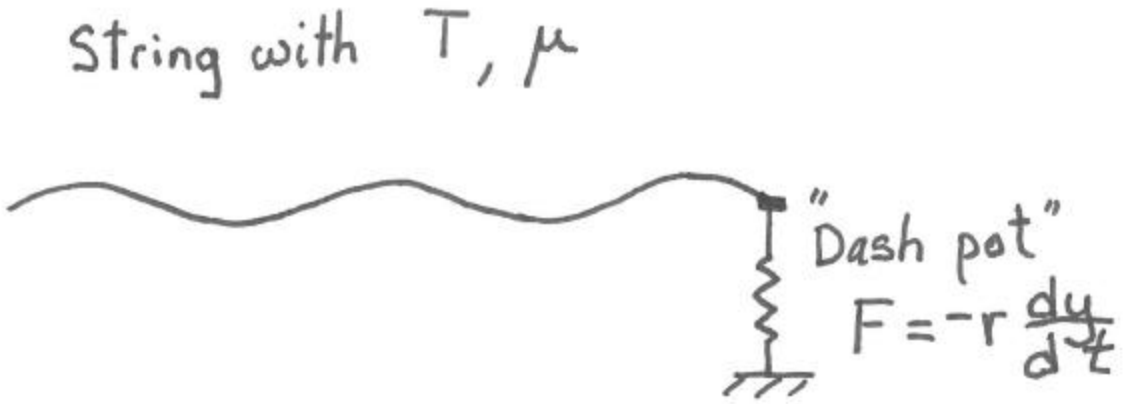
Physics III Homework Problem

Reflection from a dash pot at the end of a string.

Consider waves on a string that has one end connected to a "dash pot". The dash pot is a device that is defined by its viscosity **r** so that to produce a velocity **v** of the dash pot requires a force **F**. In other words, it is a device with mechanical impedance equal to **r**. An incident wave of known amplitude **A** and frequency **w** moving in the positive **x** direction on the string will typically have some of the wave energy reflected and some absorbed by the dash pot. To find make the algebra easier you may find it easier to define the location of the dash pot as **x=0,** to use complex exponentials to represent the wave functions, and to define the dash pot y-coordinate by a variable (such as $\mathbf{y_0(t)=Y*e^{-iwt}}$).



a) Write down the two boundary conditions that you need to apply at the end of the string in order to determine the two unknowns (the amplitude of the reflected wave **B** and the amplitude of the dash pot motion **Y**).
b) Determine the amplitude of the reflected wave in terms of the incident wave amplitude **A**, the string wave impedance, and the dashpot impedance **r**. Under what condition, if any, will the reflected power be zero?
c) Show that the difference between the incident wave energy and the reflected wave energy is equal to the power absorbed by the dash pot.