

Dragt 99 cont. Let us compute the total energy of the string. At $t=0$ it is all potential, which gives

$$E = V = \frac{\tau}{2} \int_0^L \left(\frac{\partial q}{\partial x}\right)^2 dx \quad \text{with } t=0.$$

But the shape



$$\Rightarrow \frac{\partial q}{\partial x}$$



$$-D/(L/2) = -\frac{2D}{L}$$

$$\Rightarrow E = \frac{\tau}{2} \int_0^L \left(\frac{2D}{L}\right)^2 dx \Rightarrow E = \frac{2\tau D^2}{L}$$

When the string is

displaced by an amount Y the vertical restoring force is

$$F = \tau \frac{Y}{L/2} + \tau \frac{Y}{L/2} = \frac{4\tau Y}{L}$$

and energy to pluck

$$\text{is } \int_0^D F(Y) dY = \frac{4\tau}{L} \int_0^D Y dY = \frac{2\tau D^2}{L} = E.$$

← Energies agree

