Question #77285, Physics / Classical Mechanics

Assume that the initial density of matter along the x axis is given p(x)= e^-x kg/m. If the mass with the constant velocity v= 10m/s in the direction of x axis

Find the total mass in the segment [1,2] at the time t=60.

Solution

$$m = \int_1^2 \mathrm{e}^{-(\mathrm{x}-\mathrm{vt})}\,dx = \int_1^2 \mathrm{e}^{-(\mathrm{x}-\mathrm{vt})}\,d(x-vt) = \mathrm{e}^{-(1-\mathrm{vt})} - \mathrm{e}^{-(2-\mathrm{vt})} = e^{-vt}\left(\frac{1}{e} - \frac{1}{e^2}\right)$$

$$m(60) = e^{-(600)}\left(\frac{1}{e} - \frac{1}{e^2}\right) = 6.2 \cdot 10^{-262} kg.$$