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4.150 $$T(x) = \frac{T_2(x-x_a) - T_1(x-x_b)}{(x_b-x_a)}$$

this satisfies condition $\begin{cases} T(x_b) = T_2 \\ T(x_a) = T_1 \end{cases}$

$V = \alpha\sqrt{T(x)}$ from ideal gas $\frac{1}{2}m\langle v^2\rangle \cong \frac{3}{2}k_B T$

$$\frac{dx}{dt} = \alpha\sqrt{T(x)}$$

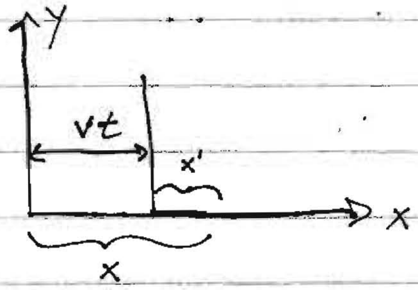
$$\frac{1}{\alpha}\int\frac{dx}{\sqrt{T(x)}} = \Delta t \qquad dT = \left(\frac{T_2-T_1}{x_b-x_a}\right)dx$$

$$\frac{1}{\alpha}\frac{x_b-x_a}{T_2-T_1}\int_{T_1}^{T_2}\frac{dT}{\sqrt{T}} = \Delta t = \frac{2}{\alpha}\,x_b-x_a\,\frac{\sqrt{T_2}-\sqrt{T_1}}{T_2-T_1}$$

$$T_2 - T_1 = \left(\sqrt{T_2}-\sqrt{T_1}\right)\left(\sqrt{T_2}+\sqrt{T_1}\right)$$

$$\Rightarrow \boxed{\Delta t = \frac{2}{\alpha}\frac{1}{\sqrt{T_2}+\sqrt{T_1}}}$$

4.153) $\xi = a\cos(\omega t - kx)$ function of t, x



$\omega/k = c$

$t' = t$

$x' = x - vt$

$\xi = a\cos(\omega t' - kx' - kvt')$ function of t', x'

$= a\cos(k[ct' - vt' - x']$

$= a\cos(k[(1-(v/c))ct' - x'])$

$$\boxed{\xi = a\cos(\omega[1-(\tfrac{v}{c})]t' - kx')}$$

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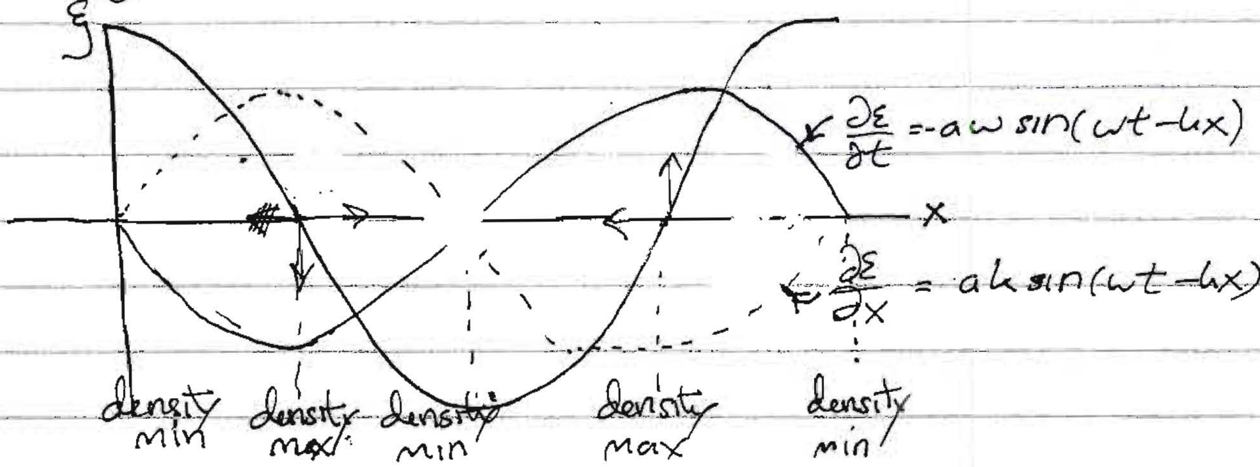
4.156) a) $\xi = a\cos(\omega t - kx)$



very bad drawing

b) (on graph)

c) $\rho(x)$ (density fluct wave = longitudinal)