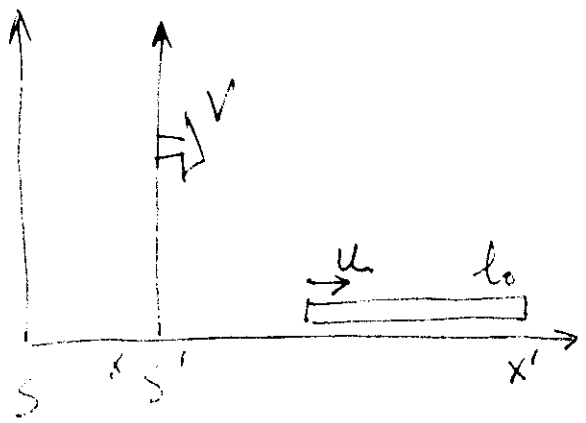
Practice Quiz — Week #7



L': length of rod observed by S'

$$L' = \frac{l_0}{\tilde{\gamma}}$$

where $\tilde{\gamma} = \frac{1}{\sqrt{1 - \frac{\tilde{v}^2}{c^2}}}$ where $\tilde{v}$ is the velocity of the rod as seen in S

Use transformation of velocities

$$v'_x = \frac{v_x - V}{1 - \frac{V}{c^2} v_x}$$ for $v_x = u$, the velocity of the rod in S

Then $\tilde{v} = \frac{u - V}{1 - \frac{Vu}{c^2}} \Rightarrow \frac{1}{\tilde{\gamma}^2} = 1 - \left(\frac{u - V}{1 - \frac{Vu}{c^2}}\right)^2 \frac{1}{c^2} =$

$$1 - \frac{c^2 (u-V)^2}{(c^2 - Vu)^2} = \frac{(c^2 - Vu)^2 - (cu - cV)^2}{(c^2 - Vu)^2} =$$

$$\frac{(c^2 - Vu + cu - cV)(c^2 - Vu - cu + cV)}{(c^2 - Vu)^2} = \frac{(c-V)(c+u)(c+V)(c-u)}{(c^2 - Vu)^2}$$

$$\Rightarrow \boxed{L' = \frac{l_0}{c^2 - Vu} \sqrt{(c^2 - V^2)(c^2 - u^2)}}$$