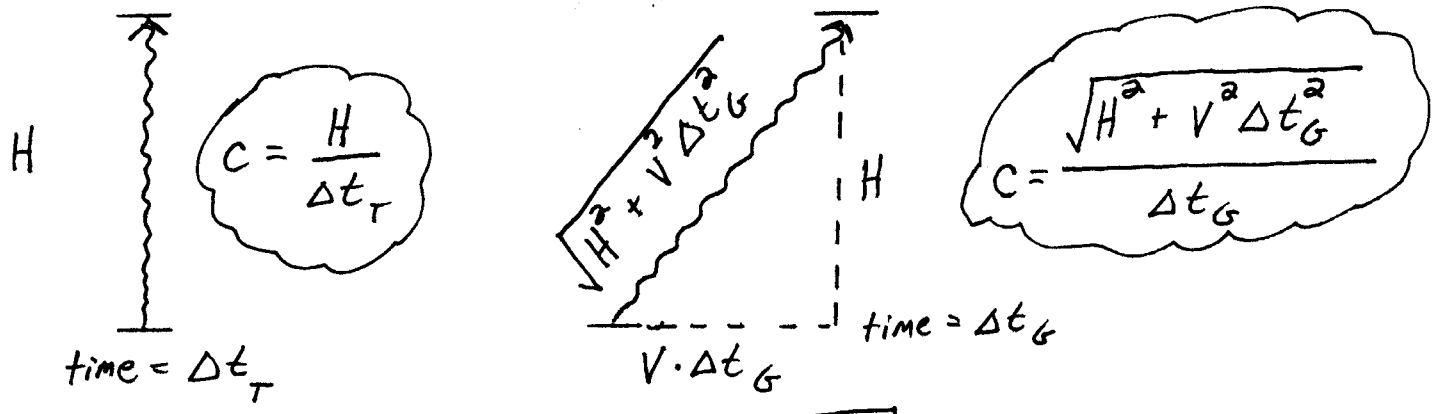
On Train ← relative speed V → on Ground



Travel of light beam from two different reference frames.

$c = \frac{H}{\Delta t_T} \rightarrow H = c\Delta t_T$, substitute this into upper right equation

$$c = \frac{\sqrt{H^2 + V^2 \Delta t_G^2}}{\Delta t_G} \rightarrow c = \frac{\sqrt{c^2 \Delta t_T^2 + V^2 \Delta t_G^2}}{\Delta t_G}$$

cross-multiply and square

$$\hookrightarrow c^2 \Delta t_G^2 = c^2 \Delta t_T^2 + V^2 \Delta t_G^2$$

$$\rightarrow \Delta t_G^2 \left[c^2 - V^2\right] = c^2 \Delta t_T^2 \quad \text{(collect } \Delta t_G^2 \text{ terms and factor)}$$

$$\rightarrow \Delta t_G^2 = \Delta t_T^2 \frac{c^2}{c^2 - V^2} \quad \text{(divide through by } c^2 - V^2\text{)}$$

$$\rightarrow \Delta t_G^2 = \Delta t_T^2 \frac{1}{1 - V^2/c^2} \quad \text{(divide top and bottom of fraction by } c^2\text{)}$$

$$\rightarrow \boxed{\Delta t_G = \frac{\Delta t_T}{\sqrt{1 - V^2/c^2}}} \quad \text{(take square root)}$$