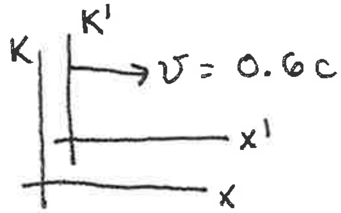
EX 31.1 Constant speed of light proof



Let us demonstrate, using Lorentz transforms, that a light pulse, emitted from the origin of both coordinate systems at the moment they pass one another (i.e. at $x = x' = 0$, and $t = t' = 0$) will expand at a speed of c according to both observers.

- The speed of the light pulse, as measured by K', is given by $\frac{x'}{t'}$, namely, the x' coordinate of the light pulse after time t' has elapsed. Using the lorentz transformations: $\frac{x'}{t'} = \frac{\gamma(x - vt)}{\gamma(t - \frac{vx}{c^2})}$
- If the pulse is traveling at speed c according to K, then the position of the pulse at time t is given by $x = ct$. We plug this into the above equation, giving

$$\frac{x'}{t'} = \frac{\cancel{\gamma}(\cancel{c}t - vt)}{\cancel{\gamma}(t - \frac{vct}{c^2})} = \frac{\cancel{t}(c - v)}{\cancel{t}(1 - v/c)} = \frac{c\,\cancel{(1 - v/c)}}{\cancel{(1 - v/c)}} = c$$

- This is what we set out to prove. Historically, Lorentz worked the other way, finding a set of transformations that preserved the constancy of the speed of light.