

P5

$$K = E - mc^2$$

$$= mc^2 \left( \left( 1 - \frac{v^2}{c^2} \right)^{-1/2} - 1 \right) \stackrel{!}{=} mc^2$$

$$\rightarrow \left( 1 - \frac{v^2}{c^2} \right)^{-1/2} = 2$$

$$\rightarrow \left( 1 - \frac{v^2}{c^2} \right) = \frac{1}{4}$$

$$\rightarrow \frac{v}{c} = \frac{\sqrt{3}}{2} \approx 0.866$$

P6

$$u_\mu u^\mu = \gamma^2 (c^2 - \vec{v}^2) = c^2$$

$$\frac{d}{d\tau} u_\mu u^\mu = 0 = \eta_{\mu\nu} \frac{d}{d\tau} (u^\nu u^\mu)$$

↑ metrischer Tensor

$$\begin{aligned} \rightarrow 0 &= 2 \eta_{\mu\nu} u^\nu \frac{d}{d\tau} u^\mu = 2 u_\mu \frac{d}{d\tau} u^\mu \\ &= 2 u_\mu b^\mu \end{aligned}$$

$$\text{also: } u_\mu b^\mu = 0$$