Lorentz transformation

none

February 25, 2025

Abstract

Generated by the Physics Derivation Graph. source: [?], page 21; see also https://en.wikipedia.org/wiki/I and https://en.wikipedia.org/wiki/Derivations_of_the_Lorentz_transformations

Eq. 1 is an initial equation. equation 1-13 on page 21 in [?]

$$x' = \gamma(x - vt) \tag{1}$$

Eq. 2 is an initial equation. equation 1-14 on page 21 in [?]

$$x = \gamma(x' + vt') \tag{2}$$

Substitute LHS of Eq. 1 into Eq. 2; yields Eq. 3. solve output expr for t'

$$x = \gamma(\gamma(x - vt) + vt') \tag{3}$$

Simplify Eq. 3; yields Eq. 4.

$$x = \gamma(\gamma x - \gamma vt + vt') \tag{4}$$

Simplify Eq. 4; yields Eq. 5.

$$x = \gamma^2 x - \gamma^2 vt + \gamma vt' \tag{5}$$

Subtract $\gamma^2 x$ from both sides of Eq. 5; yields Eq. 6.

$$x - \gamma^2 x = -\gamma^2 vt + \gamma vt' \tag{6}$$

Factor x from the LHS of Eq. 6; yields Eq. 7.

$$x(1 - \gamma^2) = -\gamma^2 vt + \gamma vt' \tag{7}$$

Add $\gamma^2 vt$ to both sides of Eq. 7; yields Eq. 8.

$$x(1 - \gamma^2) + \gamma^2 vt = \gamma vt' \tag{8}$$

Divide both sides of Eq. 8 by γv; yields Eq. 9.

$$\frac{x(1 - \gamma^2)}{\gamma v} + \frac{\gamma^2 vt}{\gamma v} = t' \tag{9}$$