RelativityChallenge.Com Podcast Episode 2

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This page is no longer used,
but is retained to maintain the numbering of the remaining pages.

Einstein's transformation equations takes a set of input values and produces a set of output values.

Input Values	Transformation Equations	Output Values
x, y, z, t	$\xi = \dfrac{x - vt}{\sqrt{1 - \dfrac{v^2}{c^2}}}$ $\eta = y$ $\zeta = z$ $\tau = \dfrac{t - \dfrac{vx}{c^2}}{\sqrt{1 - \dfrac{v^2}{c^2}}}$	ξ, η, ζ, τ

Einstein performs several steps to create the equations that are then "normalized" to produce his final transformation equations.

1

Einstein performs several steps to create the transformation equations. These steps are given in Section 3 of his 1905 paper.

2

$$\xi = \frac{x - vt}{1 - \frac{v^2}{c^2}}$$

$$\eta = \frac{y}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\zeta = \frac{z}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\tau = \frac{t - \frac{vx}{c^2}}{1 - \frac{v^2}{c^2}}$$

3

Equations are normalized by multiplying each equation by:

$$\sqrt{1 - \frac{v^2}{c^2}}$$

4

$$\xi = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\eta = y$$

$$\zeta = z$$

$$\tau = \frac{t - \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Einstein performs four algebraic steps to produce his ξ transformation.

1

Begin with:

$\xi = c\tau$

$$\xi = c\tau$$

2

Since

$\tau = \alpha(t - \frac{vx'}{c^2 - v^2})$

Substitute τ *with:*

$\alpha(t - \frac{vx'}{c^2 - v^2})$

$$\xi = c\tau$$

$$= c\alpha(t - \frac{vx'}{c^2 - v^2})$$

3

Since

$t = \frac{x'}{c - v}$

Substitute t *with:*

$\frac{x'}{c - v}$

$$\xi = c\tau$$

$$= c\alpha(t - \frac{vx'}{c^2 - v^2})$$

$$= \alpha \frac{c^2 x'}{c^2 - v^2}$$

4

Since

$x' = x - vt$

Substitute x' *with:*

$x - vt$

$$\xi = c\tau$$

$$= c\alpha(t - \frac{vx'}{c^2 - v^2})$$

$$= \alpha \frac{c^2 x'}{c^2 - v^2}$$

$$= \alpha \frac{x - vt}{1 - \frac{v^2}{c^2}}$$

Since each statement must produce the same result, we can test the equality of each of Einstein's algebraic substitutions to determine if a problem exists.

Input Values

$x = 50$

$y = 0$

$z = 0$

$t = 10$

$v = 5$

$\alpha = 1$

	Statement		Results
1	$\xi = \alpha \frac{x - vt}{1 - \frac{v^2}{c^2}}$		$\xi = 0$
2	$= \alpha \frac{c^2 x'}{c^2 - v^2}$	*Note: x'=x-vt*	$= 0$
3	$= c\alpha(t - \frac{vx'}{c^2 - v^2})$	*Note: x'=x-vt*	$= 10c$ *or* $2{,}997{,}924{,}580$
4	$= c\tau$		$= 10c$ *or* $2{,}997{,}924{,}580$

Mathematically, a variable cannot <u>simultaneously</u> be both a dependent variable and an independent variable.

Einstein Says:

If we place x'=x-vt, it is clear that a point at rest in the system k must have a system of values x', y, z, independent of time.

Mathematically correct interpretation

If we place x'=x-vt, it is clear that a point at rest in the system k must have a system of values x', y, z, independent of time, ***where time is represented by t'.***

Mathematically incorrect interpretation

If we place x'=x-vt, it is clear that a point at rest in the system k must have a system of values x', y, z, independent of time, ***where time is represented by t.***

To correct Einstein's derivation, t is replaced with t' (in his partial differential equation) followed by performing the four algebraic steps, resulting in the ξ transformation.

1

Begin with:

$\xi = c\tau$

2

Since

$\tau = \alpha(t' - \frac{vx'}{c^2 - v^2})$

Substitute τ with:

$\alpha(t' - \frac{vx'}{c^2 - v^2})$

3

Since

$t' = \frac{x'}{c - v}$

Substitute t' with:

$\frac{x'}{c - v}$

4

Since

$x' = x - vt$

Substitute x' with:

$x - vt$

Step 1:

$$\xi = c\tau$$

Step 2:

$$\xi = c\tau$$

$$= c\alpha(t' - \frac{vx'}{c^2 - v^2})$$

Step 3:

$$\xi = c\tau$$

$$= c\alpha(t' - \frac{vx'}{c^2 - v^2})$$

$$= \alpha \frac{c^2 x'}{c^2 - v^2}$$

Step 4:

$$\xi = c\tau$$

$$= c\alpha(t' - \frac{vx'}{c^2 - v^2})$$

$$= \alpha \frac{c^2 x'}{c^2 - v^2}$$

$$= \alpha \frac{x - vt}{1 - \frac{v^2}{c^2}}$$

While the problem occurs during the ξ derivation, it shows up in Einstein's τ equation. Einstein's original time transformation simplification is provided in column one and the corrected simplification is provided in column two.

1

When

$$\tau = \alpha(t - \frac{vx'}{c^2 - v^2})$$

it simplifies as:

$$\tau = \alpha(t - \frac{vx'}{c^2 - v^2})$$

$$= \alpha \frac{t - \frac{vx}{c^2}}{1 - \frac{v^2}{c^2}}$$

2

When

$$\tau = \alpha(t' - \frac{vx'}{c^2 - v^2})$$

it simplifies as:

$$\tau = \alpha(t' - \frac{vx'}{c^2 - v^2})$$

$$= \frac{\alpha}{c}\left[\frac{x - vt}{1 - \frac{v^2}{c^2}}\right]$$