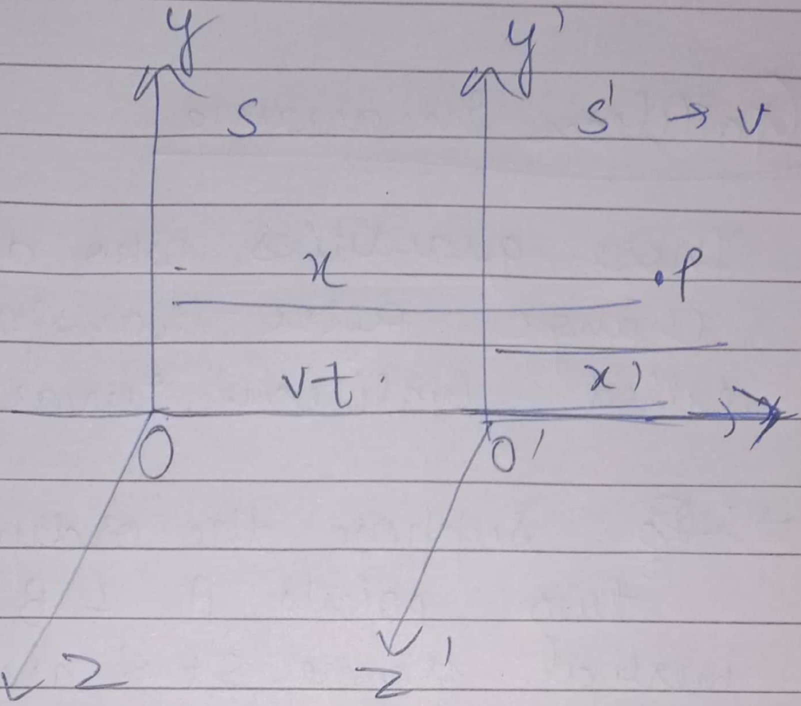
Section-7

Gallilean Transformation Equation are those equations which Relate the coordinate of a particle.



S & S' are two inertial frame of Reference.

S' → moving with velocity v along x.

O & O' → two observers.

$$OO' = vt$$

from figure

$$\underbrace{\begin{aligned} x' &= x - vt \\ y' &= y \\ z' &= z \end{aligned}}_{\text{Galilean Transformation eq}^n}$$

$\left.\begin{aligned} y' &= y \\ z' &= z \end{aligned}\right\}$ as no motion along y & z axis.

$\boxed{t' = t}$

$$\left.\begin{aligned} x &= x' + vt \\ y &= y' \\ z &= z' \\ t &= t' \end{aligned}\right\}$$ Gallilean Inverse Transformation equations.

→ <u>Gallilean Invariance</u>

Those quantities who does not change after transformation are called Galilean Invarient.

→ ~~Of~~ suppose the ordinates of two points A & B in 2 inertial frames S & S' are (x_1, y_1, z_1), (x_2, y_2, z_2), (x_1', x_2', x_3'), (x_2', y_2', z_2') respectively.

If S' moves with velocity v relative to S along x' axis, then Acc. to G.T.

$$\boxed{\begin{aligned} x_1' &= x_1 - vt \\ y_1' &= y_1 \\ z_1' &= z_1 \end{aligned}}$$

→ Distance B/w points A & B in S'

$$= D = \sqrt{(x_2' - x_1')^2 + (y_2' - y_1')^2 + (z_2' - z_1')^2}$$

$$= \sqrt{\left[\{(x_2 - vt) - (x_1 - vt)\}^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2\}\right]}$$

$$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

= Distance B/w the points in S.

$$\boxed{DS' = DS}$$

Length is invarient.

~~velo~~ velocity Transformation

$\downarrow$

$v = dx/dt$.

$x' = x - vt$

$$\frac{dx'}{dt} = \frac{dx}{dt} - v \Rightarrow \boxed{u'x = ux - v}$$

lly $\boxed{u'y = uy}$

lly $\boxed{u'z = uz}$

$$\boxed{\text{Acceleration} = du/dt \text{ or } \frac{d^2x}{dt^2}}$$

from above equations.

$$\frac{\partial u'x}{dt} = \frac{\partial ux}{\partial t} \Rightarrow \boxed{a'x = ax}$$

$$\frac{\partial u'y}{\partial t} = \frac{\partial uy}{\partial t} \quad \boxed{a'y = ay}$$

$$\frac{\partial u'z}{\partial t} = \frac{du z}{\partial t} \quad \boxed{a'z = az}$$

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Hence, length & acceleration are invarient under G.T.