Addition of velocities :-

Let a frame S' move with uniform velocity v relative to S along +x direction.

Let u and u' be the velocities of a particle as observed by observers in S & S'.

Inverse transformation equations are given by

$$x = \frac{x' + vt'}{\sqrt{1 - v^2/c^2}} \qquad y = y' \qquad z = z'$$

and $$t = \frac{t' + \frac{x'v}{c^2}}{\sqrt{1 - v^2/c^2}}$$

$$dx = \frac{dx' + v\,dt'}{\sqrt{1 - v^2/c^2}} \qquad dy = dy' \qquad dz = dz'$$

$$dt = \frac{dt' + \frac{v}{c^2} dx'}{\sqrt{1 - v^2/c^2}}$$

$$\Rightarrow \frac{dx}{dt} = \frac{dx' + v\,dt'}{dt' + \frac{v}{c^2} dx'} = \frac{\frac{dx'}{dt'} + v}{1 + \frac{v}{c^2}\frac{dx'}{dt'}}$$

$$\Rightarrow u_x = \frac{u_x' + v}{1 + \frac{v}{c^2} u_x'} \qquad \text{———— (1)}$$

Similarly

$$u_y = \frac{u_y'}{\beta\left(1 + \frac{v}{c^2} u_x'\right)} \quad \& \quad u_z = \frac{u_z'}{\beta\left(1 + \frac{v u_x'}{c^2}\right)}$$

where $\beta = \frac{1}{\sqrt{1 - v^2/c^2}}$

If object moves with velocity u along x axis then $u_x = u$ $\quad u_y = 0$, $u_z = 0$

$$\boxed{u = \frac{u' + v}{1 + \frac{vu'}{c^2}}} \qquad \text{Also} \quad \boxed{u' = \frac{u - v}{1 - \frac{uv}{c^2}}} \qquad (\because v \to -v)$$