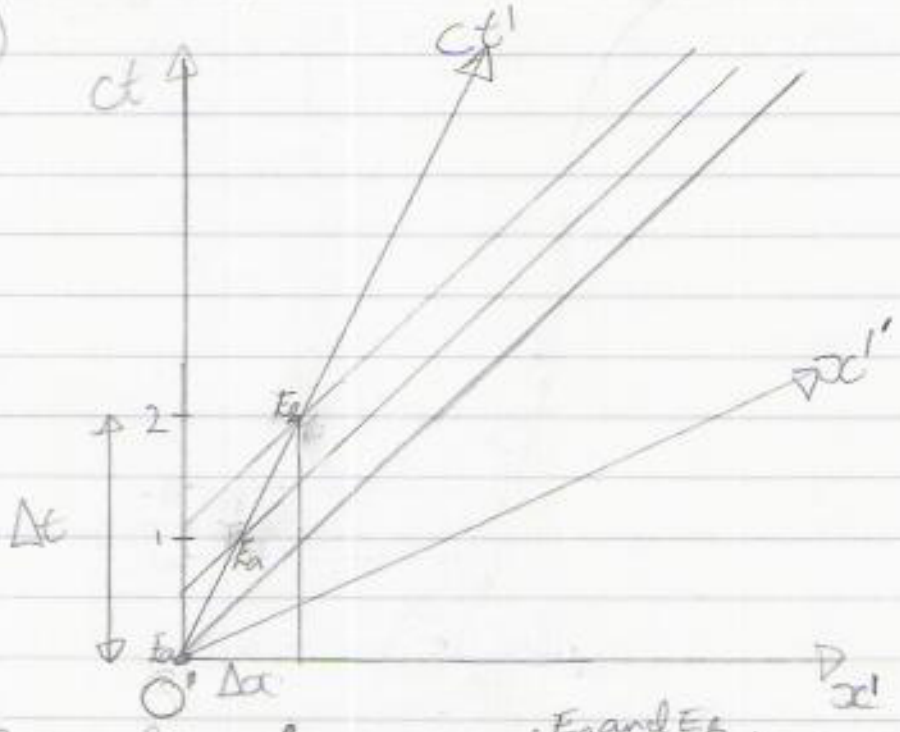
value of the time dilation factor, $\sqrt{1-v^2/c^2}$, and the smaller will be the time elapsed on the astronauts clock compared to his partners clock. If $v=c$, time doesn't pass at all for the astronaut.

4

ii)



Consider two events E_a and E_b which in inertial frame O' have the space coordinates $x^{1'}=x^{2'}=x^{3'}=0$. Suppose that the inertial frame O' moves along the x' axis of O with constant velocity v.

Then for O the two events are separated by a spacetime interval ΔS, where

$$(\Delta S)^2=(c\Delta t)^2-(\Delta x')^2$$

For an observer in O' the two events are separated by a spacetime interval

$$(\Delta S')^2=(c\Delta t')^2-(\Delta x')^2$$

But ΔS is Lorentz invariant, and has the same constant value under transformation between inertial frames.

Hence $(\Delta S)^2=(c\Delta t)^2-(\Delta x')^2=(c\Delta t')^2-(\Delta x')^2$

Consider $(c\Delta t)^2-(\Delta x)^2=(c\Delta t')^2-(\Delta x')^2$

$\Delta x'=0$, since both E_a and E_b happen