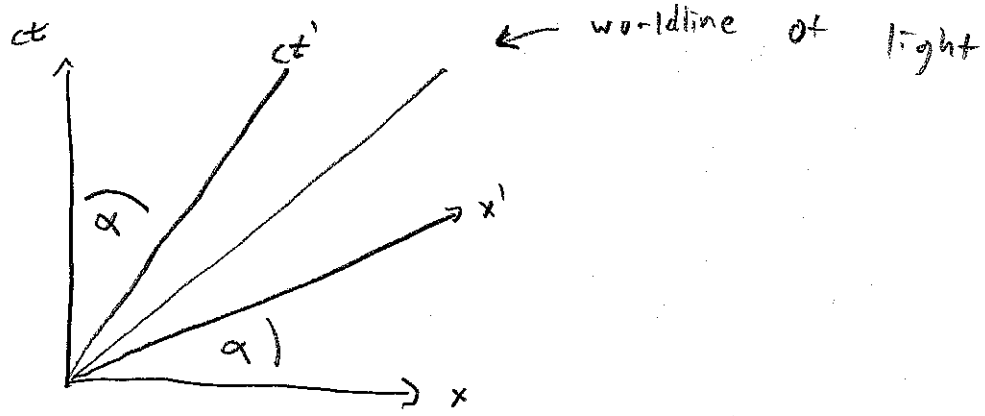
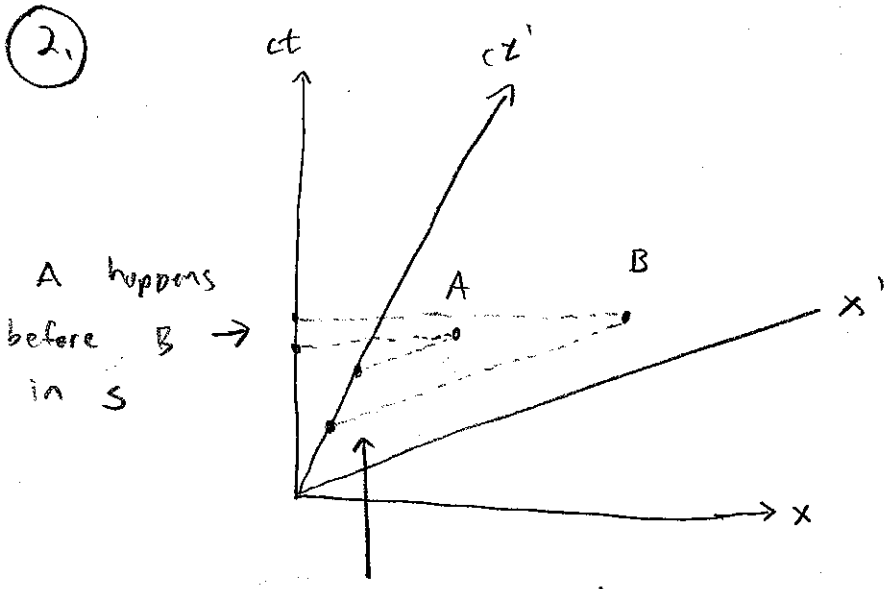
Physics 262 HW # 12 Solutions

(1.) $\alpha = 26.5^\circ$



(2.)



B happens before A in S'

This is only possible if the separation between A and B is space like

(3)

$L = 10m$

The phase difference in the two paths is given by:

$$\Delta\phi = \frac{2\pi c}{\lambda}(t_2 - t_1)$$

from class or Ohanion

$$t_2 = \frac{2L/c}{1 - v^2/c^2} \qquad t_1 = \frac{2L/c}{\sqrt{1 - \frac{v^2}{c^2}}}$$

which are calculated using the Ether theory.

$$\Delta\phi = 2\pi \frac{L}{\lambda}\frac{v^2}{c^2}$$ using $v \ll c$.

$v = 30 \text{ km/s} = 3 \times 10^4 \text{ m/s}$

$L = 10 \text{ m}$

$\lambda = 500 \text{ nm} = 5 \times 10^{-7} \text{ m}$

when rotating 90°, the total change in phase shift is then

$$\Delta\phi = 4\pi \frac{L}{\lambda}\frac{v^2}{c^2}$$

there is one fringe shift for every 2π of phase change

$$\text{fringes} = \frac{2L}{\lambda}\frac{v^2}{c^2} = \frac{2(10m)}{5\times10^{-7}m}\left(\frac{3\times10^4 m/s}{3\times10^8 m/s}\right)^2 = 0.4$$