

8.2

Ex 2 page 1

9.

Event	t'	x'
A	0 ms	0 ms
B	1,33 ms	1,33 ms
C	1,33 ms	0,87 ms
D	2,66 ms	0 ms

$$L' = x_A' = 1,33 \cdot 10^{-3} \text{ s}$$

$$\Delta t'_{AB} = \Delta t'_{BD} = 1,33 \cdot 10^{-3} \text{ s}$$

10.

Event	t	x
A	0	0
B	t_B	x_B
C	t_c	0
D	t_D	$t_D - 2t_B$

11.

$$\Delta S_{AB}^2 = t_B^2 - x_B^2$$

$$\Delta S_{AB}'^2 = 1,33^2 - 1,33^2 = 0$$

$$t_B^2 - x_B^2 = 0$$

$$t_B = \pm x_B$$

$$\underline{\underline{t_B = x_B}}$$

$x_B = t_B$ makes sense, since it is the event of light travelling a certain distance, and then the distance and time must be the same.

12. $\Delta S_{AC}^2 = t_c^2 - 0 = t_c^2$

$$\Delta S_{AC}'^2 = (1,33 \cdot 10^{-3} \text{ s})^2 - (0,87 \cdot 10^{-3} \text{ s})^2 =$$

$$1,77 \cdot 10^{-6} \text{ s}^2 - 0,76 \cdot 10^{-6} \text{ s}^2 = 1,01 \cdot 10^{-6} \text{ s}^2$$

$$t_c^2 = 1,01 \cdot 10^{-6} \text{ s}^2 \quad t_c = 1 \cdot 10^{-3} \text{ s} = \underline{\underline{1 \text{ ms}}}$$

13. $\Delta S_{BC}^2 = (t_c - t_B)^2 - (-t_B)^2$

$$\Delta S_{BC}'^2 = 0 - (0,87 - 1,33) \cdot 10^{-3} \text{ s})^2 =$$

$$-0,21 \cdot 10^{-6} \text{ s}^2$$

$$t_c^2 - 2t_c t_B + \cancel{t_B^2} - \cancel{t_B^2} = -0,21 \cdot 10^{-6} \text{ s}^2$$

$$t_B = \frac{-0,21 \cdot 10^{-6} \text{ s}^2 - t_c^2}{-2t_c}$$

$$t_B = \frac{-0,21 \cdot 10^{-6} \text{ s}^2 - 1,01 \cdot 10^{-6} \text{ s}^2}{-2 \cdot 10^{-3} \text{ s}}$$

$$\underline{\underline{t_B = 0,61 \cdot 10^{-3} \text{ s}}}$$

14. $\Delta s_{AD}^2 = t_D^2 - (t_D - 2t_B)^2$

$$\Delta s_{AD}^2 = (2,66 \cdot 10^{-3} \text{ s})^2 = 7,11 \cdot 10^{-6} \text{ s}^2$$

$$\cancel{t_D^2} - \cancel{t_D^2} + 4t_D t_B - 4t_B^2 = 7,11 \cdot 10^{-6} \text{ s}^2$$

$$t_D = \frac{7,11 \cdot 10^{-6} \text{ s}^2 + 4t_B^2}{4t_B}$$

$$t_D = \frac{7,11 \cdot 10^{-6} \text{ s}^2 + 1,49 \cdot 10^{-6} \text{ s}^2}{2,44 \cdot 10^{-3} \text{ s}}$$

$$\underline{t_D = 3,52 \cdot 10^{-3} \text{ s}}$$

15. The time to the first reflection in the space station frame was $t_B \approx 0,61 \text{ ms}$.

16. The time between first and second reflections was $\Delta t_{BD} = 3,52 \text{ ms} - 0,61 \text{ ms} =$
 $2,91 \text{ ms}$

17. $t_B \approx 0,61 \text{ ms} < t_C \approx 1,0 \text{ ms}$, so event B happened first. This is also what we found by using logic.