

Assignment #3**Readings:**

- Moore - Chapter 6
- Moore - Chapter 7

Supplemental

- Boccio - Relativity 4 - P6
- Boccio - Relativity 5 - P6

Summary: This week we develop the Lorentz transformation equations and their representation on spacetime diagrams.

We will understand length contraction and time dilation and delve into several new so-called paradoxes.

Finally we will discuss the causal structure of spacetime and light cones.

Everyone Problems:

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| M6-3 | Spacetime diagrams and Lorentz Transformation |
| M6-7 | Relatively Crafty |
| EP-10 | The Strange World of Relativity |

Individual Problems:

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| M6-4 | Spacetime diagrams and Lorentz Transformation |
| M6-5 | Spacetime diagrams and Inverse Lorentz Transformation |
| M6-6 | Spacetime diagrams and Inverse Lorentz Transformation |
| M6-8 | Training |
| M6-9 | Two-Observer Diagrams from Both Sides Now |
| M7-2 | Lorentz Contraction |
| M7-4 | Particle Decay Paradox |
| M7-5 | Another View on Length Contraction |
| EP-9 | They are simultaneous somewhere.... |

Presentations:

- (1) Derivation of Lorentz Transformations
- (2) Construction of Spacetime Diagrams
- (3) Length Contraction and Time Dilation
- (4) The Pole in the Barn Paradox
- (5) Going Faster Than Light?

Seminar Break:**Extra Problems:****EP-9 They are simultaneous somewhere....**

The space and time coordinates of two events as measured in a frame S are as follows:

$$\text{Event 1: } x_1 = x_0, t_1 = x_0/c$$

$$\text{Event 2: } x_2 = 2x_0, t_2 = x_0/2c$$

- (a) there exists a frame in which these two events are simultaneous.

Find the velocity of that frame(S') with respect to S .

(b) What is the value of t' at which both events occur in the new frame S' ?

EP-10 The Strange World of Relativity

Solve this problem with the Lorentz transformation equations and with a spacetime diagram.

At noon a rocketship passes the earth with a velocity of $0.8c$. Observers on the ship and on earth agree that it is noon.

(a) At 12:30 PM as read by a rocketship clock, the ship passes an interplanetary navigational station that is fixed relative to the earth and whose clocks read earth time. What time is it at the station?

(b) How far from earth (in earth coordinates) is the station?

(c) At 12:30 PM rocketship time the ship reports by radio back to earth. When (earth time) does the earth receive the signal?

(d) The station on earth replies immediately. When (by rocket time) is the reply received?