

## Practice problems. Test 1

### 1.1 Practice Problems 2.31, 2.37 and 2.28 in the Homework.

### 1.2 Concepts

What are the fundamental distinctions between an inertial and non-inertial frame of reference.

### 1.3 Concepts

Relativity sets an upper limit on the speed that a particle can have. Are there also limits on its energy and momentum? Explain.

### 1.4 Concepts

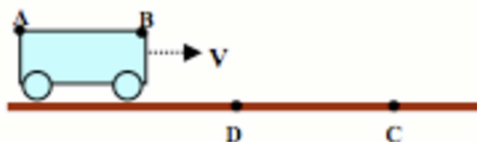
Two events occur at the same space point in a particular frame and are simultaneous in that frame. Is it possible that they may not be simultaneous in another frame?

### Problem 3:

A planet called Zilch is located **2 light-years** away from Earth (as measured in a frame at rest with respect to the Earth). At the instant a rocket heading for Earth passes planet Zilch a baby (named Sally) is born on the rocket. **(a)** According to special relativity, is it possible for Sally to reach Earth before she celebrates her first birthday (as measured in the rocket frame)? **(b)** If your answer to (a) is yes, what velocity,  $\beta = v/c$ , must the rocket travel in order that she reach Earth on her first birthday? (Note: a light-year is the distance light travels in one year travelling at speed  $c = 3 \times 10^8$  m/s).

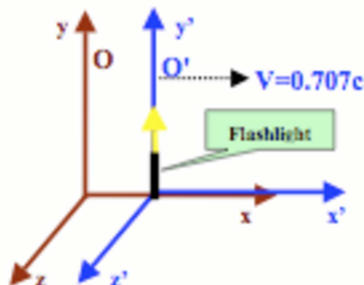
### Problem 4:

A cart moves on a track with constant velocity  $V$  as shown in the Figure. The points A and B are on the ends of the cart and points C and D are on the track. Define event AC as the occurrence of A passing C, and similarly for the others. Suppose that event BC and event AD are simultaneous in the track frame. Are they simultaneous in the cart's frame of reference? If not, which is earlier?



### Problem 5:

A flashlight at rest at the origin of the  $O'$ -frame shines light along the  $y'$ -axis (i.e.  $v_x' = 0$ ,  $v_y' = c$ ). If the  $O'$ -frame which is moving along the  $x$ -axis of the  $O$ -frame with velocity  $V = 0.707c$ , what angle (in degrees) does the light make with the  $x$ -axis as observed in the  $O$ -frame? What is the speed of the light as measured in the  $O$ -frame?



### Problem 6: