

Postulates of Special Relativity Problems

1. In Galilean relativity, all motion is a measurement made by an observer and there is no absolute frame of reference. Describe what is meant by an absolute frame of reference and why there is no absolute frame of reference.
2. In the late 19th century, contradictory observations of light and its movement through the proposed ethereal medium led Einstein to develop the theory of special relativity.
 - a. State the two postulates of Einstein's theory of special relativity.
 - b. Describe why one of these postulates seems contradictory to the other.
3. Describe what an inertial frame is.

4. Which of the following frames of reference are inertial frames? You may consider the surface of the Earth as an approximate inertial frame.
- A train stopped at a station.
 - A passenger standing on the station.
 - The train **as** it leaves the station.
 - A train half way between two distant stations on a straight track.
 - The train as it speeds up around a bend.
 - The train as it maintains a constant speed around a bend.
 - The train as it climbs a hill at a steady speed.
5. You and a friend are inside two separate, identical round rooms. There are no windows. The rooms are placed upon smooth, noiseless merry go rounds. One of the rooms is spinning while the other is not. Describe a simple experiment or observation that would allow you to determine who is in a non-inertial frame.
6. Stuart is a passenger on a train travelling at a constant 36.0ms^{-1} relative to the ground. He sits 25.0 m back from the front of the train. Stuart rolls a ball ahead of him towards the front of the train. Jill is sitting on a park bench as the train moves past with Stuart on the train. Jane sees the ball moving at 41.0 ms^{-1} .
- What velocity will Stuart see the ball moving at?
 - How long would it take the ball to reach the front of the train according to Stuart? Use calculations to support your answer.

- c. How long does it take the ball to reach the front of the train according to Jill? Use calculations to support your answer.

- d. Why do Jill and Stuart agree on how long it takes the ball to reach the front of the train despite not agreeing on the velocity of the ball?

- e. When the same situation is repeated using a photon of light instead of a ball, Stuart and Jill disagree on the time the light reaches the front of the train. Why?