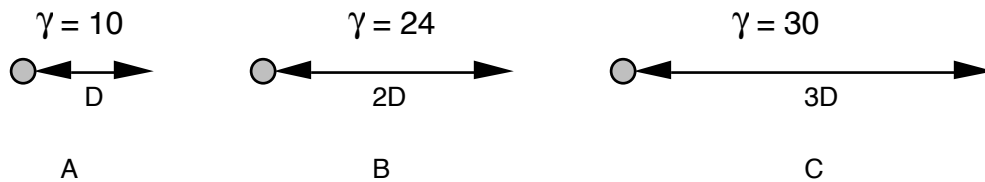


Relativity Problems II

1.
 - a. What is the Lorentz factor for an object moving at 35 m/s?
 - b. What is the Lorentz factor for an object moving at $0.5c$?
 - c. What is the Lorentz factor for an object moving at 2.9×10^8 m/s?
 - d. How fast does something have to travel for the Lorentz factor to be 3?
 - e. How fast does something have to travel for the Lorentz factor to be 10?
2. Sketch the Lorentz factor vs the speed factor. (γ vs β)
3.
 - a. Who measures the proper time (t_0) between two events?
 - b. Who measures a time-dilated time (t) between two events?
 - c. Who measures the proper length of an object?
 - d. Who measures a length-contracted length of an object?
 - e. Who measures the proper distance between two objects in space that are not moving with respect to each other?
4. A spaceship flies by the earth with a relative speed of v . On the ship, there is a blinking light.
 - a. On the ship, the time between flashes of light is 1 second. If the ship flies by the earth at $0.9c$, what is the time interval between flashes as seen on the earth?
 - b. If the flashes are 0.01 seconds apart on the ship, and 0.1 seconds apart on the earth, how fast is the ship traveling?

Relativity Problems II

- c. The ship flies by at $0.95c$. If the flashes are 2 seconds apart on earth, how far apart are they on the ship?
5. A stick goes past an observer with a speed of v .
- If the stick has a proper length of 2 meters, and has a speed of $0.98c$, what is its length as measured by the observer.
 - If the stick has a speed of $0.99c$, and the observer measures it to be 0.5 meters long, what is the proper length of the stick?
 - If the proper length of the stick is 10 meters, but the observer measures it to be 7 meters long, how fast is the stick traveling?
6. A spaceship makes three different round trips from the earth. The diagram shows the distances the ship travels as measured by the earth. The diagram also shows the Lorentz factors for each of the three trips.



- From the earth's reference frame, rank the trips in order of total time traveled, from least time to greatest time. (Ignore any time for accelerations.)
- From the ships' reference frame, rank the trips in order of total time traveled, from least time to greatest time. (Ignore any time for accelerations.)

Answers: 1. a) 1 b) 1.15 c) 3.91 d) $0.94c$ e) $0.995c$ 3. a) the RF with the 2 events at the same coordinates b) the RF with the 2 events at different coordinates c) the RF @rest w/respect to object d) the RF moving w/respect to object e) the RF @ rest w/respect to objects

4. a) 2.29 sec b) $0.995c$ c) 0.62 sec 5. a) 0.4 m b) 3.54m c) $0.71c$ 6. a) ABC b) BCA