

Relativity Problems II-b

1.
 - a. Who measures the proper length of an object?
 - b. Who measures a length-contracted length of an object?
 - c. Who measures the proper distance between two objects in space that are not moving with respect to each other?

2. A stick goes past an observer with a speed of v .
 - a. 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.
 - b. 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?
 - c. 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?

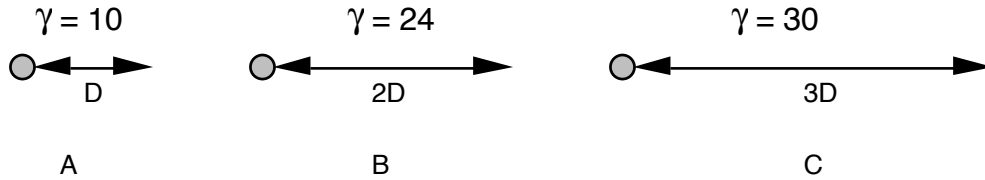
3. A spaceship flies by a station at $0.8c$. The spaceship measures the station to be 1200 meters long. How long is the station according to people on the station?

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4. An electron traveling at $0.95c$ travels down a 1500 meter accelerator tube. How far did the electron travel according to the electron?

5. You watch a rocket go by you at $0.9c$. You measure the rocket to be 120 meters long. How long is the rocket according to people on the rocket?

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.



- a. 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.)

- b. 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:

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| 1. a) the RF @rest w/respect to object | b) the RF moving w/respect to object |
| c) the RF @ rest w/respect to objects | 2. a) 0.4 m b) 3.54m c) 0.71c |
| 3) 2000 m 4) 468 m 5) 275 m | 6. a) ABC b) BCA |