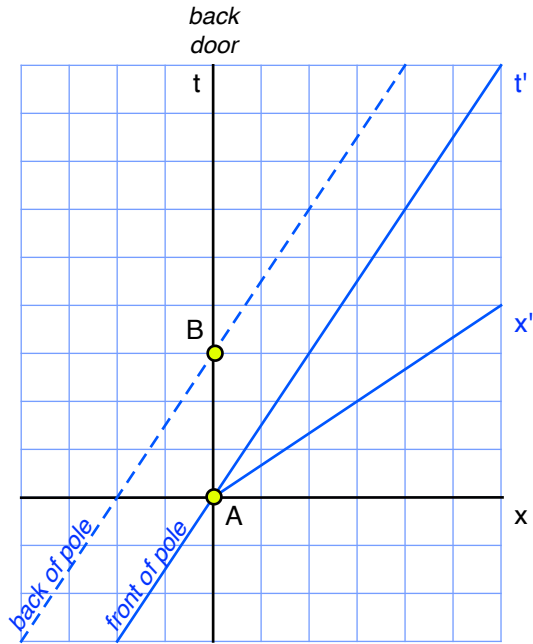


Barn-Pole Worksheet

Let's step through the spacetime diagram for the barn-pole paradox a piece at a time. First, consider the diagram shown to the right. It shows three worldlines: the back door of the barn, the back of the pole and the front of the pole. In addition, there are two labeled events, A and B.

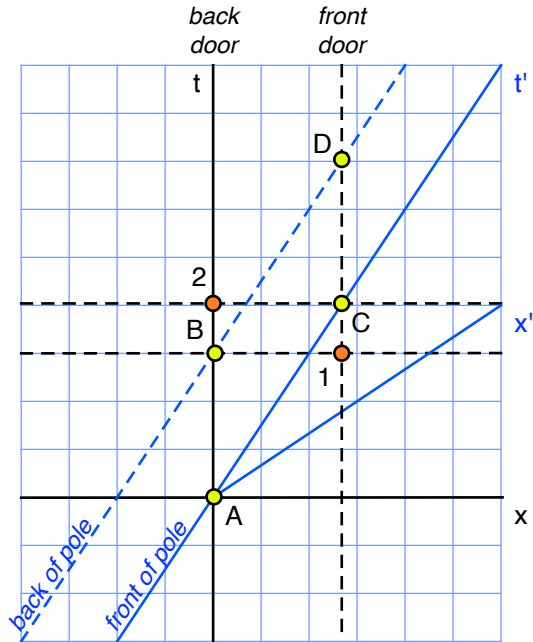


1. Which is at rest, the barn or the pole and how do you know?
2. What is happening at event A?
3. What is happening at event B?
4. How fast is the pole moving?
5. From the diagram, you can determine the length of the pole according to the barn. What is that length?
6. Calculate the proper length of the pole.
7. To make a barn the same proper length as the pole, draw in the correct worldline of the front door of the barn in the diagram above.
8. Draw and label event C which will be the front of the pole reaching the front door.
9. Draw and label event D which will be the back of the pole reaching the front door.
10. Draw and label event 1, which will be the front door closing simultaneous with the back of the pole reaching the back door, which is when the back door will close.
11. Draw and label event 2, which will be the back door opening simultaneous with the front of the pole reaching the front door, which is when the front door will open.

Barn-Pole Worksheet

Hopefully, your diagram from the other side looks like the one to the right. (Notice that both events B and C are actually two things happening at the same place and same time.)

In the S frame it is easy to see that the doors could potentially close and open simultaneously, thus “trapping” the pole inside the barn. You drew it that way. To see what happens in the S' frame, we need to see where those events are on the t' axis.



12. Draw in 4 lines parallel to the x' axis, with 1 line going through each of the events B, C, 1 and 2.
13. What do the dashed lines you just drew represent?

14. Starting with A, describe what happens according to the pole.

Answers:

1. barn is at rest – the back door is in the S frame.
2. front of the pole is at the back door.
3. back of the pole is at the back door.
4. $\beta = 2/3$
5. $L = 2$
6. $L_0 = 2.68$
13. they are lines of constant time in the S' frame, i.e. they are the t' coordinates of events
14. A – front of pole at back door
 1 – front door closes
 C – front of pole at front door & front door opens
 B – back of pole at back door & back door closes
 2 – back door opens
 D – back of pole at front door