MARKUS KLUTE: Welcome back to 8.20, Special Relativity. In this section, we want to study space-time diagrams a little bit more in detail, and also define certain regions in space-time diagrams. So let's start again with Alice's space-time diagram here in which we plot or draw Bob's space-time diagram. The relative velocity difference is 0.5 times the speed of light, and that leads to a gamma effect of 1.2. We also plotted the world line of light in here in yellow. Light is the speed of light equal to c.

I want to discuss two specific events. The first one here, event number 1, is the one where tA, the time for Alice's [INAUDIBLE], and xB, the space for Bob, is equal to 0. So this event lies on Bob's timeline. If we read off the time on Bob's clock, we see it's 0.83, 1 over gamma. And here, we can immediately [? read of ?] time dilation for this event.

Note that while xB Bob is equal to 0, xA for Alice is not 0. Similarly, we can look at the second event here, where we read off xA equals 1. [INAUDIBLE] 1, in this case, light year for Alice.

And so now we want to investigate this length in Bob's reference frame. For him, time is equal to 0. So tB equals 0. We can immediately again read off xB equals 0.83, and that indicates length contraction as of the [INAUDIBLE]. Important to note here is that those two, Alice and Bob, will not agree when the time and the measurement was made.

All right. So let's zoom out here a little bit and look at another space-time diagram. So in this space-time diagram, again, I drew light-- blurred lines, or blurred lines for light-- in yellow. And I [? wrote ?] a total of 12 different events.

Now we want to characterize those events. And we want to characterize them based on whether or not they are time-like, light-like, or space-like. As time-like, we define those events. We have c squared, t squared, minus x squared, is greater than 0. Light-like are those which are like light in a blurred line. [? ct, ?] c squared, t squared, minus x squared, equal to 0. And space-like, those were c squared, t squared, minus x squared, smaller than 0.

The first task is now to find to which of those regions the individual events correspond. And so again, stop the video, and try to figure out whether or not you can find the solutions. Because the solutions are given here. Time-like are events 2, 5, and 6. Light-like are the ones which lay on the yellow lines. 1, 7, 4, and 9. And space-like are 8, 12, 11, 10, and 2.

One of the things you can find, if you are starting here in the origin, and you're going to correspond to any event in the future, you can only do that if the events are time-like. If the events are space-like, you will not be able to correspond between those two events. That's one of the ways to read this kind of space-time diagram. And in the next section, in the next video, we'll talk about causality, meaning can a specific event cause something to happen, another event? Again, this can only happen if the events are actually time-like.