

ANTOINETTE VILLARIN: So what I'd like you to do now is turn and talk to your partner with the purpose of telling me how you know how many centimeters of liquid are in the bottom container, when you know how many centimeters of liquid are in the top. So if I give you the centimeters of liquid in the top container, how are you going to figure out the bottom. Okay, go ahead and turn and talk with your partner.

STUDENT: For example, if the top has four, just like subtract four from six, it's two, right? So it's six minus four is two. So in the bottom prism there will be two centimeters of liquid. How about you?

STUDENT: I think, because what's in the bottom, and there's six, and then, so then whatever, like, what is on top, you just have to minus it by six, so it'll be the answer.

STUDENT: Okay.

ANTOINETTE VILLARIN: Of the top prism, can I have a volunteer tell me, how much of height of a liquid you'll know you'll have in the bottom? Is there a volunteer that could share? Justine?

STUDENT: You know there's six, like, in all. You can just subtract the number that is given.

ANTOINETTE VILLARIN: That's given from what? From what?

STUDENT: Top.

ANTOINETTE VILLARIN: The top? Okay, from what number? From six?

STUDENT: Yeah.

ANTOINETTE VILLARIN: Okay, good. Does everybody agree with her? Okay, so that's what we call a *constraint*, because we have six centimeters. You're going to keep that idea for this entire lesson, that when we're looking at containers, we always have that constraint. Okay? All right, so we're going to go on to the next slide and you're going to do some writing. So if everybody could get their capped pen out, okay? And pull your eraser out.

I now have a graph up at the front that represents liquid flowing either from the top prism out, or flowing into the bottom prism at the bottom. Okay? So this graph right here, if you look at it, because our goal today is to interpret what it means to look...to be a graph and what that means in a real-life situation is, what do you think this is representing? Is it representing liquid flowing from the top out, or does it represent liquid flowing into the bottom?

Okay? What I'd like you to do is on your whiteboard, I'd like you to complete this sentence: "I think this graph represents..." And you're going to describe for me quietly on your whiteboard for about two minutes, what you think this graph is representing. Because now that we have the real-life situation, we're now going to start to look at what the graph says about that situation. Are there questions?

Now if you can see the scaling on the graph and you can see the quantities in your description, you're welcome to use some of those quantities if you understand it, and could share with somebody what that might mean. Okay? But right now you're just telling me what you think the graph represents.

All right, when you're done writing your sentence, I'd like you to turn and talk with your partner with the purpose -- and don't move yet because I have a couple of directions about it -- with the purpose of sharing what you wrote, and clarifying for each other what you think about this graph. Just like we always do, Partner A, you're closest to the window, okay? Partner B, you're closest to the door. And I think right now we don't have any groups of three, so we'll always have an A and a B. Okay? Questions on that?

STUDENT: I think this graph represents the height in centimeters decreased in seconds, because if you look at the graph by the amount, like, it's getting shorter because of the...because it's decreasing in seconds.

STUDENT: Yeah. So is it flowing out or is it going into the bottom?

STUDENT: It's going into the bottom.

STUDENT: But for me, because the way I see it is that, it's going down and then it ends at zero. Like, it's going to five but that's, like, in seconds. Yeah, that's how I see it. I see it as like the graph going down to zero. It goes to five seconds but it's not, like, the centimeter or height.

STUDENT: Yeah, I agree. But I said, "I think this graph represents the height in centimeters decreased in seconds or time."

ANTOINETTE VILLARIN: So, Elias, can you read yours out loud, please?

STUDENT: I think the graph represents the top liquid flowing down to the bottom container.

ANTOINETTE VILLARIN: Okay, so tell me why you think that. How do you know?

STUDENT: I think that because as you can see by the time in seconds it's going down, and it starts from five centimeters and it's slowly...the centimeters are slowly...it's slowly going down.

ANTOINETTE VILLARIN: It's slowly going down to what centimeter?

STUDENT: Zero.

ANTOINETTE VILLARIN: To zero. What does that mean when it's slowly going down to zero?

STUDENT: Uh, the seconds go up.

ANTOINETTE VILLARIN: The seconds go up, okay, good, and what does that mean, though, in the context of the real-life situation? What does it mean when you're at zero centimeters of height? What do we know in this bottle?

STUDENT: That all the liquid is at the bottom.

ANTOINETTE VILLARIN: It's all at the bottom. It's empty on top. Okay, does everybody agree with that? All right, you said it's going down. What's going down?

STUDENT: The liquid.

ANTOINETTE VILLARIN: The liquid? Okay, the liquid is going down, but then how did you know it's going down by looking at the graph?

STUDENT: Uh, the graph line is going down to the bottom.

ANTOINETTE VILLARIN: It's going down to the bottom? Okay, what does that...what does that mean when it's going down to the bottom?

STUDENT: It's decreasing.

ANTOINETTE VILLARIN: It's decreasing. Okay, so we have a graph that's decreasing. What kind of slope is that when you have a decreasing graph?

STUDENTS: A negative.

ANTOINETTE VILLARIN: A negative. Okay, negative. Okay, thank you, Elias. Can you read yours, Kristina?

STUDENT: I think this represents how the fluid decreases as it moves from the top bottle to the bottom bottle.

ANTOINETTE VILLARIN: Okay, so she's also saying top prism to the bottom prism. Okay. Because we are looking at prisms -- this is just kind of a model of what we're doing. But what word is she using that I want to highlight?

STUDENT: Decreasing.

ANTOINETTE VILLARIN: I heard it. What was it?

STUDENTS: Decreasing.

ANTOINETTE VILLARIN: Decreasing. Okay, so that idea of decreasing. So we have a decreasing rate of change, we have a decreasing graph. Okay? All right. And then thank you, Kristina. Can you read yours, Veonna?

STUDENT: I think this graph represents liquid from the top prism flowing into the bottom prism at the rate of one centimeter per second.

ANTOINETTE VILLARIN: Okay, one...at the rate of one centimeter per second. Can you explain that to the rest of the class?

STUDENT: So I looked at the graph and I took the slope, so since the line is going down, the vertical change would be negative, so it's going to be negative one. And then the horizontal change would be one, because it's only going at one second.

ANTOINETTE VILLARIN: Okay, so let's stop there. So you're saying from here it goes down one centimeter over one second, so that rate of change is negative one centimeter over one second? Okay. What did you call that earlier?

STUDENT: Rate.

ANTOINETTE VILLARIN: The rate. Okay, what else is that that she's calculating?

STUDENTS: Slope.

ANTOINETTE VILLARIN: The slope. Okay, remember we're kind of starting to make connections between slope and rate of change.