Module 12: Perimeter, Area, and Volume
Topic 5 Content: Practical Problems Involving Similar Two- and Three-Dimensional Figures Transcript

Hi guys. Welcome to Geometry. In this topic we're going to focus on practical problems involving similar two and three dimensional figures. Now your knowledge of similar figures in general is going to come in handy for you during this topic. You ready to get started? Let's go.

Okay. Now before we dive into those practical problems, I want to review a little bit the relationship between the ratios of the perimeters, areas, and volumes of similar figures and the scale factor. Okay? Now given two similar figures, the ratio of the perimeters, we know it's equal to the scale factor. We find any ratio of corresponding lengths, anything in one dimension, the length, the width, the height, a radius, make a ratio out of those. We know that it's going to be equal to the scale factor. Now the ratio of the areas is equal to the scale factor squared. Okay? Let's keep that in mind also as we work through these. The ratio of the volumes is equal to the scale factor cubed. Okay?

These key facts are going to be so important as we work through the next couple of examples. Always keep in mind the ratio of the perimeters is equal to the scale factor, the ratio of the areas is equal to the scale factor squared, and the ratio of the volumes is equal to the scale factor cubed. All right?

Let's dive into that first example. Given two similar cylinders. The radius of the smaller cylinder is 5 cm and the radius of the larger cylinder is 7 cm. If the surface area of the larger cylinder is 441 cm squared, what is the surface area of the smaller cylinder?

Okay. The first thing I'm going to do here is use my highlighter and pull out some important information. That I have two similar cylinders is very important. I'm told the radius of the smaller one's 5 cm. The radius of the larger one is 7. The surface area of the larger one, 441 square centimeters. I'm asked to find the surface area of the smaller cylinder. Okay.

The first thing I'm going to want to do now in order to solve this problem, is I'm going to want to figure out what my scale factor is. Because I was given the radius of each cylinder, I'm going to make a ratio out of those lengths. I'm going to switch to my pen. I'm going to go from the smaller cylinder to the larger cylinder for my ratio here. My scale factor in this case is going to be 5/7. I'm going to write it as a fraction. Okay? I know for these two similar cylinders, the scale factor is 5/7.

Now, we were given measures related to the surface area and we know that the ratio of the areas is equal to our scale factor squared. Now what I'm going to do is I'm going to go ahead and square our scale factor and I'm going to use it in a proportion which is going to help me figure out the surface area of the smaller cylinder. Okay? Let's get that going. The ratio of the areas, I know it's equal to my scale factor squared. I'm going to square my scale factor. Now 5 squared is 25, 7 squared is 49. Okay? Now that I have a measure for the ratio of the areas and know that it's equal to the square of my scale factor, 25/49, I'm going to set this equal to actually the ratio of my areas.

Let me show you what I mean by that. Okay? The ratio of the areas, and I'm going to go from

the smaller cylinder to the larger cylinder because that's the direction I've kind of established here with the scale factor. You just always want to make sure you keep it consistent through this kind of problem. The ratio of my areas, the smaller cylinder I don't know the surface area of that right now. I'm going to call it X. The surface area of the larger cylinder, I know it's 441. X/441 equals 25/49. What I've done here is I've actually set up a ratio for my areas and I've set it equal to the square of my scale factor. Okay? Now all I have to do is solve this proportion and I'll have the answer to this one. All right?

Let's cross multiply. Switch to black ink this time just to show you that I'm going to cross multiply right here. 49 times X, that's 49X, equals 441 times 25. I'm going to go to the calculator for that one. 441 times 25, that is 11,025. Let's get that. 11,025. Now let's go ahead and divide both sides by 49. Go to our calculator for this. 11,025 divided by 49. 11,025 divided by 49, that equals 225. Back to our work. That tells us that X equals 225. Because X represented the surface area of this smaller cylinder, then we have our answer here. I'm going to scroll back down to the bottom. That means that the surface area of the smaller cylinder here is 225 ... Let me double check my units. Centimeters. Centimeters squared. You're all done with this one. Okay?

Just to recap. Just to kind of review so we can pull this all together. The first thing we did after we highlighted the key information in this problem, is we figured out what our scale factor was. We established a fact, or a pattern, of going from our small cylinder to our large cylinder. Now you easily could have set up a scale factor of 7 to 5, you just would have had to keep that consistent throughout your problem that you are referencing the larger cylinder over the smaller cylinder. Either way is fine as long as you keep it consistent all the way through. Okay? We ran with the small over the large, that's 5/7. Once we had our scale factor, we knew that the ratio of the areas was equal to our scale factor squared. We squared it and got 25/49. Then we went ahead and set up a proportion. We set up a ratio of our areas, X/441 equal our scale factor squared. 25/49. We cross multiplied to solve our proportion and we figured out that X equal 225. That told us that the surface area of that smaller cylinder was 225 square centimeters and we were all done with that one. Okay?

Now keep that in mind as you work through this one. Press pause, take a few minutes, work your way through this. Press play when you're ready to check your work.

All right. Let's see how you did on this one. I'm going to go ahead and switch to my highlighter so I can pull out that key information. We have an ice cream shop selling two similar ice cream cones. The ratio of the heights of the cones is 2:5. If the volume of the smaller cone's 108 cubic inches, what's the volume of the larger cone?

Okay. What I'm going to do first is figure out what my scale factor is. I was told the ratio of the heights was 2:5. My scale factor, 2/5. Now that I know that, I realize I'm dealing with volumes in this problem and I know ... Let's get that out of our way. I know that the ratio of the volume s ... Get some workspace here. The ratio of the volumes is equal to my scale factor cubed. If my scale factor's 2:5, let's cube that. 2 to the third power, that's 8. 5 to the third power, that's 125. Now I know that the ratio of my volumes is going to be equal to 8/125. Now I'm ready to go ahead and set up that proportion that'll help me solve for X and figure out the volume of

the larger cone in this case.

Okay. The small cone has a volume of 108, the larger cone's volumes unknown. 108/X equals 8/125. Like I said earlier, you could have easily had this switched. Maybe you had X/108 equals 125/8. Maybe you referenced everything going from large cone to small cone. That's perfectly okay as long as you keep it consistent all the way through. All right? Okay, so if we go ahead and cross multiply with this. Switch to black ink here just to show the cross multiplying. We have X times 8. That's 8X equals ... We need 108 times 125. Let's go to the calculator for that. 108 times 125. That is 13,500. Back to our work. 13,500. Now divide both sides by 8. X equals ... We need 13,500 divided by 8. Go to our calculator. 13,500 divided by 8. That is 1,687.5. Back to our work. 1,687.5. That means that the volume of the larger cone is 1,687.5. Let me double check our units here. That is inches cubed. Okay? You're all done with this one. All right?

See how here the same idea. When needed to figure out our scale factor. It was a volume problem so we needed to cube that scale factor, set up our proportion, and then we solved f or X. Here we figured out that the volume of that larger cone, 1,687.5 cubic inches. All right? Good job on that.

All right, guys. You've reached the conclusion of this topic on solving practical problems involving similar two and three dimensional figures. I hope we saw how your knowledge of similar figures came in handy for you during this topic. Bye.