Unit 1, Lesson 9

Speaking of Scaling

Let's practice moving back and forth between scale factors for lengths, surface areas, and volumes.

9.1 What Do You Want to Know?

A cylinder was dilated. Your partner has some information about the dimensions, surface area, and volume of the original and dilated cylinders.

Draw the original cylinder, labeling its height and radius.

What specific information do you need to be able to solve the problem?

9.2 Info Gap: Originals and Dilations

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.

If your teacher gives you the problem card:

1. Silently read your card and think about what information you need to answer the question.
2. Ask your partner for the specific information that you need. "Can you tell me _____?"
3. Explain to your partner how you are using the information to solve the problem. "I need to know _____ because _____."
   Continue to ask questions until you have enough information to solve the problem.
4. Once you have enough information, share the problem card with your partner, and solve the problem independently.
5. Read the data card, and discuss your reasoning.

If your teacher gives you the data card:

1. Silently read your card. Wait for your partner to ask for information.
2. Before telling your partner any information, ask, "Why do you need to know _____?"
3. Listen to your partner's reasoning, and ask clarifying questions. Give only information that is on your card. Do not figure out anything for your partner!
   These steps may be repeated.
4. Once your partner has enough information to solve the problem, read the problem card, and solve the problem independently.
5. Share the data card, and discuss your reasoning.

9.3 Jumbo Can

A beverage company manufactures and fills juice cans. The company spends $0.04 on materials for each can, and fills each can with $0.27 worth of juice.

The marketing team wants to make a jumbo version of the can that's a dilated version of the original. They can spend at most $0.16 on materials for the new can. There's no restriction on how much they can spend on the juice to fill each can. The team wants to make the new can as large as possible given their budget.

1. By what factor will the height of the can increase? Explain your reasoning.

2. By what factor will the radius of the can increase? Explain your reasoning.

3. Create drawings of the original and jumbo cans.

4. What geometric solid do the cans resemble? What are some possible differences between the geometric solid and the actual can?

5. What will be the total cost for materials and juice fill for the jumbo can? Explain or show your reasoning.

6. Describe any other factors that might cause the total cost to be different from your answer.

Are you ready for more?

The Leshan Giant Buddha, located in China, is the tallest premodern statue in the world. Suppose a scale model of the statue is 30 inches tall.

1. To what scale is this model? You will need to use the internet or another resource to find the actual height of the statue.

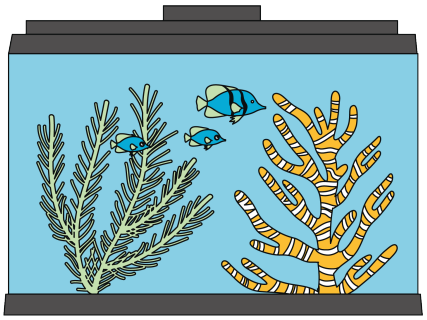
2. How tall would a model of the Spring Temple Buddha be at this scale?

Use the internet or another resource to find the additional information that you need.

Lesson 9 Summary

Suppose a solid is dilated. If we know the factor by which the surface area or volume scale changed, we can work backward to find the scale factor of dilation. Then we can use that information to solve problems.

A company sells 10 inch by 10 inch by 14 inch 5-gallon aquariums, but a museum wants to buy a 135-gallon aquarium with the same shape. The company needs to know the dimensions of the new tank and by what factor the surface area will change.



Gallons are a measure of volume. So, the volume of the tank increases by a factor of $135 \div 5 = 27$. To find the scale factor for the dimensions of the tank, calculate the cube root of 27, or 3. This tells us that the height, length, and width of the tank will each be multiplied by 3. Next, we can square the scale factor of 3 to find that the tank's surface area will increase by a factor of $3^2 = 9$.

	original aquarium	dilated aquarium
height (inches)	10	$10 \cdot 3 = 30$
length (inches)	14	$14 \cdot 3 = 42$
width (inches)	10	$10 \cdot 3 = 30$
surface area (square inches)	760	$760 \cdot 9 = 6{,}840$
volume (gallons)	5	$5 \cdot 27 = 135$