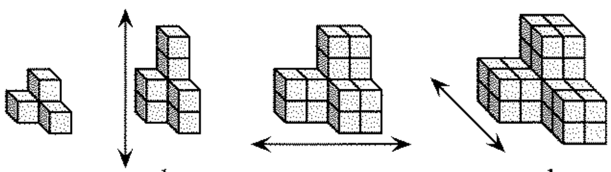
LESSON 9.12 Similar Figures

You will need:

the Lab Gear 

RATIO OF SIMILARITY

The polycubes in this figure were obtained by doubling the dimensions of the original tetracube in succession: first the height, then the length, and finally the width.



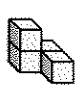
1. Find the volume and surface area of each of these polycubes.

Definitions: Two figures are *similar* if *all* the dimensions of one can be obtained by multiplying the dimensions of the other by the same number, called the *ratio of similarity.*

(In Chapter 3, similar figures were defined as being enlarged or shrunk *without distortion.* That definition is equivalent to this one.)

2. Which two of the four polycubes are similar to each other? Explain.

3. Sketch buildings similar to this tetracube, but larger, with ratio of similarity
   a. 2   b. 3



The two buildings you sketched in problem 3 are similar to each other.

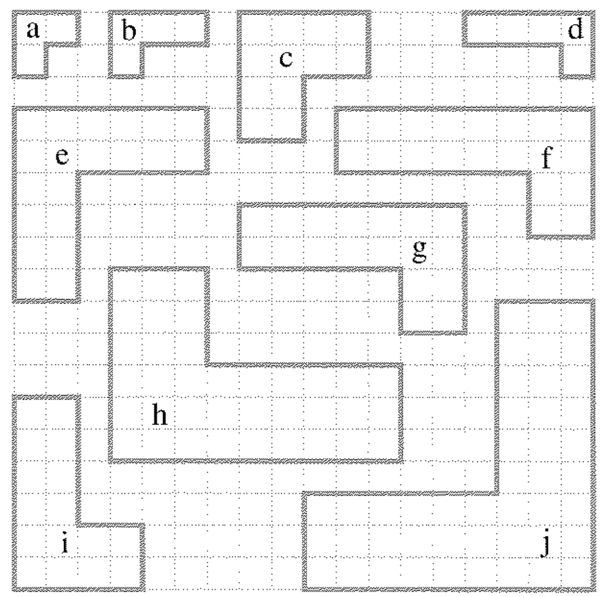
4. You could get the dimensions of the larger building by multiplying the dimensions of the smaller one by what number?

5. You could get the dimensions of the smaller building by multiplying the dimensions of the larger one by what number?

6. Either of the numbers you found in problems 4 and 5 could be considered the ratio of similarity. How are the two numbers related? Explain this.

AREA, PERIMETER

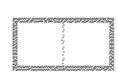
7. Make a list of pairs of similar polyominoes in this figure. (Hint: There are six pairs.)



For each pair of similar polyominoes you found, find

8. the ratio of similarity;

9. the ratio of the areas.



10. Give the dimensions of a rectangle similar to the domino shown above, but larger, such that the ratio of areas is
    a. 25;   b. 9;
    c. 2;   d. 5.

11. **Generalization**

a. If the ratio of similarity of two figures is R_S, what is the ratio of areas? Explain.

b. If the ratio of areas is R_A, what is the ratio of similarity? Explain.

12. Using the data from problems 7-8, find the relationship between the ratio of similarity and the ratio of perimeters.

13. Make a figure using three 2-D Lab Gear blocks (including some blue blocks).

a. Sketch the figure.

b. Find its perimeter and area.

c. Use blocks to make a figure similar to the original figure.

d. Predict its perimeter and area.

e. Check your prediction.

VOLUME, SURFACE AREA

14. True or False? Explain each one.

a. Any two rectangles are similar.

b. Any two squares are similar.

c. Any two cubes are similar.

15. Build the following cubes using the Lab Gear: 1^3, 5^3, $(x + 1)^3$, and y^3. Find the volume and surface area of each cube.

16. There are six pairs of similar buildings among the four cubes you built. For each pair, find

a. the ratio of similarity;

b. the ratio of surface areas;

c. the ratio of volumes.

17. **Generalization** If you know the ratio of similarity between two figures, R_S, explain how you can find

a. the ratio of surface areas, R_A;

b. the ratio of volumes, R_V.

18. What should be the dimensions of a cubical box that would hold 27 times as much as a box having dimensions 2 in.-by-2 in.-by-2 in.?

19. Repeat problem 18 for a cubical box that would hold 10 times as much as a box having dimensions 2 in.-by-2 in.-by-2 in.

TRAIN SETS

Model train sets come in different scales. The scale is the ratio of similarity between the model and the actual train that is being modeled. This table shows some of the available scales.

Name	Scale
Z	1/220
N	1/160
O	a quarter inch to one foot
HO	an eighth of an inch to one foot
LGB	half an inch to one foot

20. Order the scales from smallest to largest.

21. The LGB scale is also known as 1/25. Comment on this.

George wanted to buy an HO set that would cover an area of 15 square feet.

22. How much area would be covered by the actual train being modeled by this set?

23. How much area would be covered by a similar set in each of the other scales?

24. How many times heavier or lighter do you estimate a similar set would be in each of the other scales? (Assume that you can estimate the ratio of weights by using the ratio of volumes.)