

students clarify ideas that are often confused in a purely symbolic mode. Sometimes it is useful to do the same activity with two quite different models; from the viewpoint of the students, the activity is quite different. In this chapter we will distinguish among three types of models: area or region models, length models, and set models.

### Region or Area Models

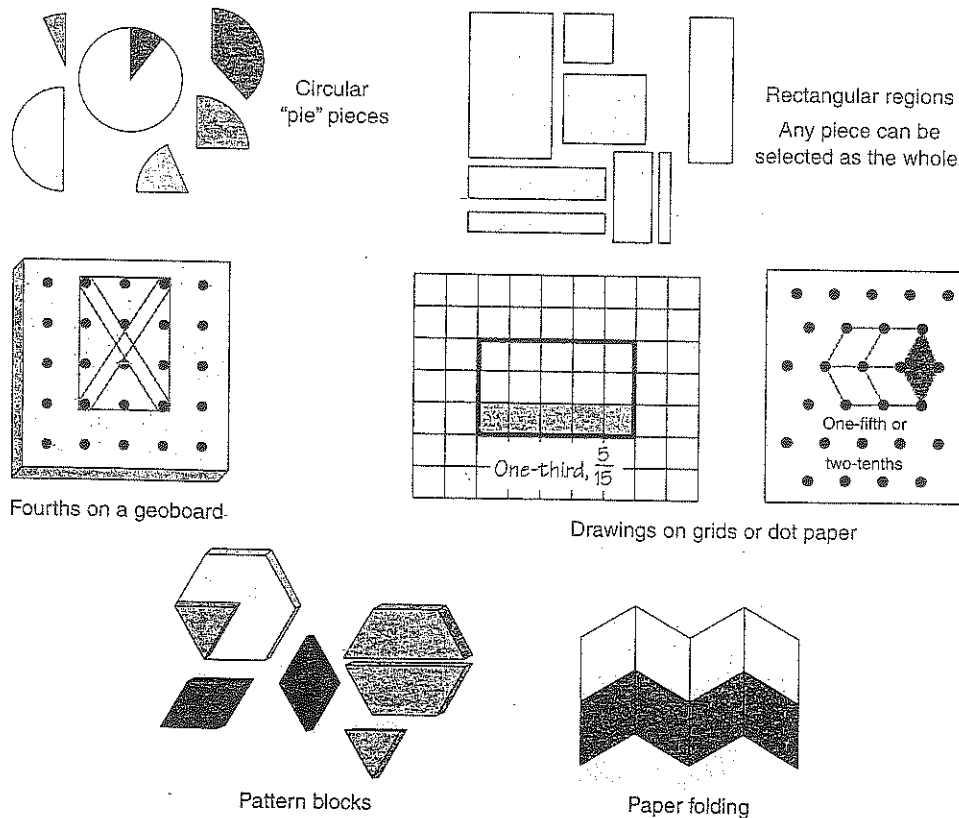
In the discussion of sharing, all of the tasks involved sharing something that could be cut into smaller parts. The fractions are based on parts of an area or region. This is a good place to begin and is almost essential when doing sharing tasks. There are many good region models, as shown in Figure 5.3.

Circular "pie" piece models are by far the most commonly used area model. (See the Blackline Masters for masters of pie models.) The main advantage of the circular region is that it emphasizes the amount that is remaining to make up a whole. The other models in Figure 5.3 are more flexible and allow for different-sized units or wholes. Paper grids, several of which can be found in the Blackline Masters, are especially flexible and do not require management of materials.

### Length or Measurement Models

With measurement models, lengths are compared instead of areas. Either lines are drawn and subdivided or physical materials are compared on the basis of length, as shown in Figure 5.4. Manipulative versions provide more opportunity for trial and error and for exploration.

**FIGURE 5.3** .....  
Area or region models for fractions.



Fraction strips are a teacher-made version of Cuisenaire rods. Both the strips and the rods have pieces that are in lengths of 1 to 10 measured in terms of the smallest strip or rod. Each length is a different color for ease of identification. Strips of construction paper or adding-machine tape can be folded to produce equal-sized subparts.

The rod or strip model provides the most flexibility while still having separate pieces for comparisons. To make fraction strips, cut 11 different colors of poster board into strips 2 cm wide. Cut the smallest strips into 2-cm squares. Other strips are then 4, 6, 8, . . . , 20 cm, producing lengths 1 to 10 in terms of the smallest strip. Cut the last color into strips 24 cm long to produce a 12 strip. If you are using Cuisenaire rods, tape a red 2 rod to an orange 10 rod to make a 12 rod. In this chapter's illustrations, the colors of the strips will be the same as the corresponding lengths of the Cuisenaire rods:

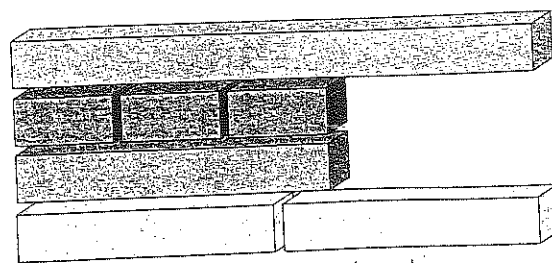
- |               |                       |
|---------------|-----------------------|
| 1 White       | 7 Black               |
| 2 Red         | 8 Brown               |
| 3 Light green | 9 Blue                |
| 4 Purple      | 10 Orange             |
| 5 Yellow      | 12 Pink or red-orange |
| 6 Dark green  |                       |

The number line is a significantly more sophisticated measurement model. From a student's vantage point, there is a real difference between putting a number on a number line and comparing one length to another. Each number on a line denotes the distance of the labeled point from zero, not the point itself. This distinction is often difficult for students.

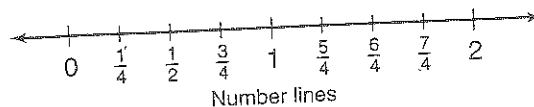
### Set Models

In set models, the whole is understood to be a set of objects, and subsets of the whole make up fractional parts. For example, three objects are one-fourth of a set of 12 objects. The set of 12, in this example, represents the whole or 1. It is the idea of referring to a collection of counters as a single entity that makes set models difficult for some students. However, the set model helps establish important connections with many real-world uses of fractions and with ratio concepts. Figure 5.5 illustrates several set models for fractions.

Counters in two colors on opposite sides are frequently used. They can easily be flipped to change their color to model various fractional parts of a whole set.



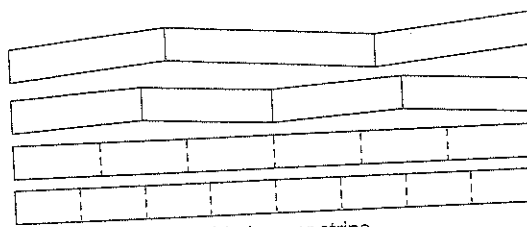
Fraction strips or Cuisenaire rods



Number lines



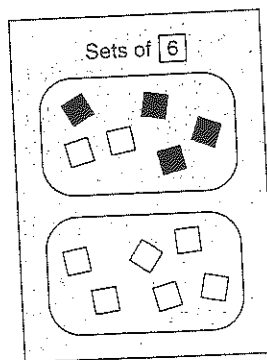
Line segment drawings



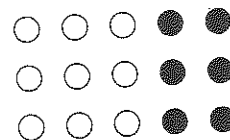
Folded paper strips

FIGURE 5.4

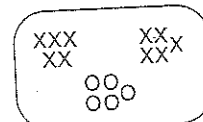
Length or measurement models for fractions.



Two-color counters in loops drawn on paper. Shows  $1\frac{2}{6}$ .



Two-color counters in arrays. Rows and columns help show parts. Each array makes a whole. Here  $\frac{3}{5} = \frac{9}{15}$ .



Drawings using Xs and Os. Shows  $\frac{2}{3} = \frac{10}{15}$ .

FIGURE 5.5

Set models for fractions.