NAMING RODS

NUMBER

- Fractions
- Comparing
- Looking for patterns

Getting Ready

What You'll Need

Cuisenaire Rods, 1 set per pair

Overhead Cuisenaire Rods and/or 1-centimeter grid paper transparency (optional)

Overview

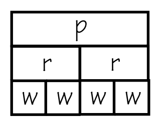
Children assign a value of one whole unit to a Cuisenaire Rod of their choice. They then identify each of the other rods as a number based on its relationship to the unit rod. In this activity, children have the opportunity to:

- explore the meaning of rational numbers
- see that the same fraction can name rods of different lengths
- see that the same rod can be named with different fractions

The Activity

Introducing

- Invite children to use their Cuisenaire Rods to build the one-color trains that are the same length as the purple.

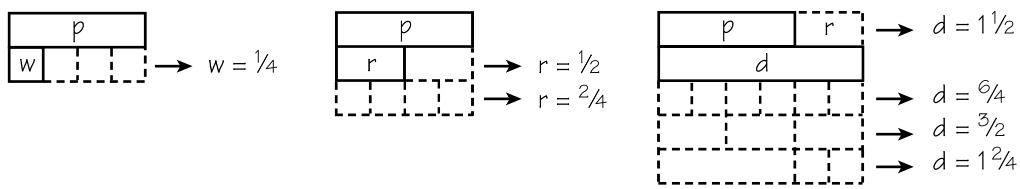


- Ask children to think of the purple rod as one whole unit and to name the fractions described by each of the red and white rods. Establish that if p = 1, w = $\frac{1}{4}$, and r = $\frac{1}{2}$ or $\frac{2}{4}$.
- Have children find a fractional name for the light green rod based on the purple unit rod. Elicit the fact that since 1 light green = 3 whites and w = $\frac{1}{4}$, then g = $\frac{1}{4}$ + $\frac{1}{4}$ + $\frac{1}{4}$, or $\frac{3}{4}$.
- Have children find the names for the yellow rod. Establish that it has two fractional names: $1\frac{1}{4}$, since it is the same length as one purple and one white rod, and $\frac{5}{4}$, since it is as long as five white rods.

On Their Own

If you give a Cuisenaire Rod the value of 1, what are the numerical names for each of the other rods?

- Work with a partner. Choose a purple rod and assign it a value of 1.
- Find all the names of each of the other rods based on the fact that purple equals 1 whole. The names for the other rods may be fractions, mixed numbers, or whole numbers. Here are some solutions:



- Record all the solutions and look for patterns.
- Now choose a rod of another color and assign it the value of 1. Again, find and record all the numerical names for each of the other rods.
- Choose a different-colored rod and repeat the process.
- Be ready to explain how you know you have found all the possible solutions for the rods you chose to be 1.

The Bigger Picture

Thinking and Sharing

Have children share their solutions based on the purple rod and explain their methods. Then invite volunteers to share their solutions for other unit rods. Create a class chart with a column of solutions for each unit rod.

Use prompts such as these to promote class discussion:

- What is a good answer to this question: "How big is $\frac{1}{2}$?"
- How can you explain calling different rods by the same fractional names?
- How can you explain calling the same rod by so many different fractional names?
- What do you notice about names of rods shorter than 1? longer than 1?
- How can you explain that one fractional name can be represented by different rods?
- When you studied all your results, what did you notice?

Extending the Activity

1. Have children pick a rod and make trains in which that rod represents each of the following fractions: 1/2, 1/3, 1/4, 1/6, and 3/4.

Teacher Talk

Where's the Mathematics?

Naming Rods deepens children's understanding of the meaning of "fraction." As they place one Cuisenaire Rod next to another and decide how one may be expressed in terms of the other, they analyze part-to-whole relationships and form ratios to express the relationships. Children also begin to understand the reasoning behind fraction names: For example, they see that because it takes three light greens to make one blue, a light green rod can be named 1/3 when the blue rod is the unit.

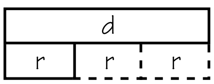
This table summarizes the fractional equivalents for each unit rod.

	w = 1	r = 1	g = 1	p = 1	y = 1	d = 1	k = 1	n = 1	e = 1	o = 1
w	1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
r	2	2/2 1	2/3	2/4 1/2	2/5	2/6 1/3	2/7	2/8 1/4	2/9	2/10 1/5
g	3	3/2	3/3	3/4	3/5	3/6 1/2	3/7	3/8	3/9 1/3	3/10
p	4	4/2 2	4/3 1 1/3	4/4 1	4/5	4/6 2/3	4/7	4/8 2/4 1/2	4/9	4/10 2/5
y	5	5/2 2 1/2	5/3 1 2/3	5/4 1 1/4	5/5 1	5/6	5/7	5/8	5/9	5/10 1/2
d	6	6/2 3	6/3 2	6/4 1 2/4 3/2 1 1/2	6/5 1 1/5	6/6 1	6/7	6/8 3/4	6/9 2/3	6/10 3/5
k	7	7/2 3 1/2	7/3 2 1/3	7/4 1 3/4	7/5 1 2/5	7/6 1 1/6	7/7 1	7/8	7/9	7/10
n	8	8/2 4	8/3 2 2/3	8/4 2	8/5 1 3/5	8/6 1 2/6 4/3 1 1/3	8/7 1 1/7	8/8 1	8/9	8/10 4/5
e	9	9/2 4 1/2	9/3 3	9/4 2 1/4	9/5 1 4/5	9/6 1 3/6 3/2 1 1/2	9/7 1 2/7	9/8 1 1/8	9/9 1	9/10
o	10	10/2 5	10/3 3 1/3	10/4 2 2/4 5/2 2 1/2	10/5 2	10/6 1 4/6 5/3 1 2/3	10/7 1 3/7	10/8 1 2/8 5/4 1 1/4	10/9 1 1/9	10/10 1

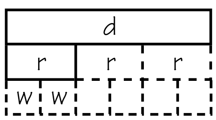
2. Have children repeat the original activity for rods longer than orange. For example, they might combine the red and orange rods to create a “rorange” rod and assign this rod a value of 1.

Organizing children's data in a table similar to the one shown may lead them to notice certain patterns. One pattern is that rods that are shorter than the unit rod are named with proper fractions (numerator smaller than the denominator) and rods that are longer than the unit rod are named with improper fractions, mixed numbers, or whole numbers. Another pattern is that the numbers within the columns increase by the amount that represents the value of the white rod in that column. For example, when light green is the unit, the white rod is $\frac{1}{3}$ and the numbers in the column are $\frac{1}{3}$, $\frac{2}{3}$, 1 or $\frac{3}{3}$, $\frac{4}{3}$ or $1\frac{1}{3}$, and so on. Children who see such patterns may be able to find errors and fill in "holes" in their data.

Children will find different names based on the combination of rods they use. In doing so, children have an opportunity to explore the concept of equivalent fractions. In the examples below, dark green is one whole unit. Placing red rods next to the dark green would lead most children to conclude that r = $\frac{1}{3}$. If children think in terms of red and white rods, however, they might also correctly conclude that r = $\frac{2}{6}$.

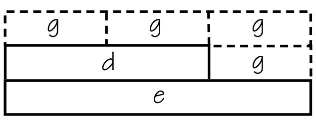


r = $\frac{1}{3}$

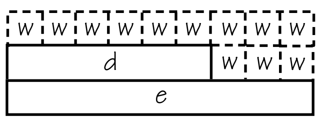


r = $\frac{2}{6}$

Similarly, children may conclude that the blue rod is $1\frac{1}{2}$ (or $\frac{3}{2}$) or $1\frac{3}{6}$ (or $\frac{9}{6}$).



e = $1\frac{1}{2}$ or $\frac{3}{2}$



e = $1\frac{3}{6}$ or $\frac{9}{6}$

As children examine their results and see that $\frac{1}{2}$ can name all the rods from red through orange, they realize that the question "How big is $\frac{1}{2}$?" leads to another question: “$\frac{1}{2}$ of what?” That is, a fraction name expresses the relationship between the part and the whole, and the larger the whole, the larger the half. Children also see that one rod can have a variety of names. For example, the red rod can be called $\frac{1}{5}$ when the orange rod is the unit rod, whereas it can be called $\frac{2}{7}$ when the black rod is the unit. Children may then conclude that the red rod is $\frac{1}{5}$ of the orange rod, and that the red rod is *also* $\frac{2}{7}$ of the black rod.
