

Objective

Explore the Associative Property of Addition.

Common Core State Standards

- **1.OA.2** Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.
- **1.OA.3** Apply properties of operations as strategies to add and subtract. *Examples: If $8 + 3 = 11$ is known, then $3 + 8 = 11$ is also known. (Commutative property of addition.) To add $2 + 6 + 4$, the second two numbers can be added to make a ten, so $2 + 6 + 4 = 2 + 10 = 12$. (Associative property of addition.)*

Operations and Algebraic Thinking

Associative Property

As children begin to understand addition, they explore situations in which they repeatedly add the same numbers in different contexts. Teachers can introduce strategies for adding three or more addends that can make solving a problem easier. The Associative Property of Addition allows addends to be regrouped without changing the sum, for example, $(1 + 2) + 3 = 1 + (2 + 3)$.

Try It! Perform the Try It! activity on the next page.

Talk About It

Discuss the Try It! activity.

- **Ask:** How many different number sentences did you find that added these three numbers?
- **Say:** Look at the totals for every sentence. **Ask:** Did the total change at all?
- Write $3 + 5 + 2 = 10$ on the board. **Ask:** What do you think will happen if we add $3 + 2$ first and then add 5? Will the total still be 10?

Solve It

With children, reread the problem. Have children explain how changing the order of addends affected each sum. Then have children illustrate the three number sentences by drawing pictures of the three kinds of fish in the fish tank.

More Ideas

For other ways to teach about the Associative Property of Addition—

- Give children eleven Snap Cubes® in three different colors, such as blue, red, and green. Have children make three single-color trains, then combine two of the trains first before adding the third. Have children write a number sentence modeled by the cubes, such as $3 + 3 + 5 = 11$. Then have children repeat by combining two different trains first before adding the third. Have them write a new number sentence shown by the cubes, such as $3 + 5 + 3 = 11$. Stress to children that the sum of both number sentences is the same, no matter which two numbers are added together first.
- Distribute 12 Two-Color Counters and two copies of the Ten Frame (BLM 2) to children. Write $3 + 4 + 5$ on the board. Have children model $3 + 4$ on one grid and 5 on the other. Tell children to find the sum. Then have children regroup the counters to show 3 on one grid and $4 + 5$ on the other, and find the sum again.

Formative Assessment

Have children try the following problem.

Write the addition sentence another way.

$$2 + 3 + 4 = 9$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 9$$

Try It!

30 minutes | Groups of 3

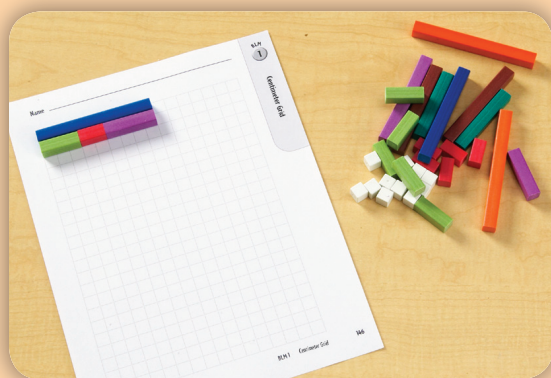
Here is a problem that relates to the Associative Property of Addition.

There are 3 goldfish, 2 catfish, and 4 guppies in a fish tank. Mrs. Kennedy asked her class to write addition problems to show the total number of fish in the tank. They wrote 3 different sentences. Were they all correct?

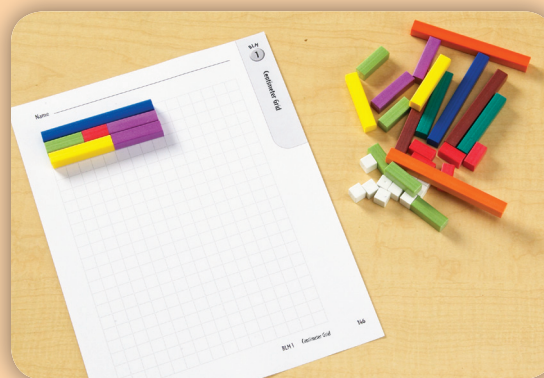
Introduce the problem. Then have children do the activity to solve the problem. Pass out materials to children. Explain that one white Cuisenaire® Rod equals one unit. Have children use the white rods to establish the values of the other rods.

Materials

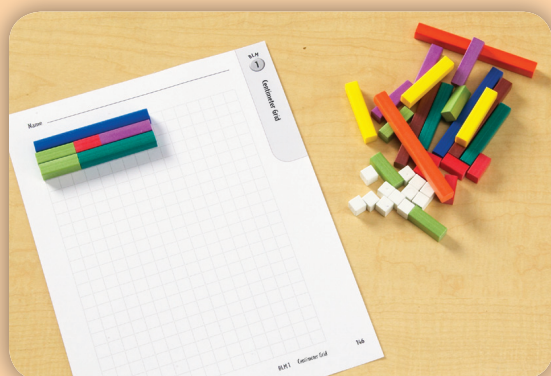
- Cuisenaire® Rods ($\frac{1}{2}$ set per group, or 11 white, 6 red, 5 light green, 3 purple, and 2 each of yellow, dark green, black, brown, blue, and orange)
- Centimeter Grid (BLM 1; 1 per child)
- crayons



1. Have children model the addition problem $3 + 2 + 4$ using rods. Ask children to find one rod the same length as the train they built and place it above. Have children draw these trains on their Centimeter Grid.



2. Have children find a rod that is the same length as the light green and red rods. Place this rod underneath to show the sum. **Ask:** What is the value of this rod? Have children complete the train with the purple rod. **Ask:** What number sentence is shown by this new train? Have children remove the yellow and purple train. Have children draw these trains on their grid.



3. Have children find a rod that is the same length as the purple and red rods. Place this rod underneath to show the sum. Complete the train with the light green rod. **Ask:** What is the value of this rod? What number sentence is shown by this new train? Have children draw these trains on their grid. Compare all the sums to confirm they are the same.

Look Out!

Some children might not see the relationship among the sizes of the rods as easily as others, and may count each rod as one unit. Have children arrange a staircase with the rods to help them see the relationship among them. Then have them stack white rods next to the taller rods to help them see how many units each rod represents.

Use Cuisenaire Rods to build the trains.
Write a number sentence for each row.

(Check students' work.)

1.

dark green		
	green	red
	yellow	

$$\underline{1} + \underline{3} + \underline{2} = \underline{6}$$

$$\underline{1} + \underline{5} = \underline{6}$$

dark green		
	green	red
	purple	red

$$\underline{1} + \underline{3} + \underline{2} = \underline{6}$$

$$\underline{4} + \underline{2} = \underline{6}$$

2.

brown		
purple	green	
purple	purple	

$$\underline{4} + \underline{3} + \underline{1} = \underline{8}$$

$$\underline{4} + \underline{4} = \underline{8}$$

brown		
purple	green	
black		

$$\underline{4} + \underline{3} + \underline{1} = \underline{8}$$

$$\underline{7} + \underline{1} = \underline{8}$$

Group 2 numbers. Add them. Then write an addition sentence with the sum and the third number.

3. 6, 1, and 3

$$\underline{7} + \underline{3} = \underline{10}$$

$$\underline{6} + \underline{4} = \underline{10}$$

4. 4, 1, and 2

$$\underline{5} + \underline{2} = \underline{7}$$

$$\underline{4} + \underline{3} = \underline{7}$$

Answer Key

Challenge! What did writing two number sentences for each set of three numbers tell you about adding three numbers?

Challenge: (Sample) The way you group three numbers does not change the sum.

Name _____

