LESSON 2

Objective

Evaluate cube roots.

Common Core State Standards

- **8.EE.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

Expressions and Equations

Cube Roots

Students can build on their knowledge of square roots to understand cube roots. Geometrically, the square root of a number is the length of a side of the square with that area. Building on that concept, it follows that the cube root of a number is the length of an edge of a cube with that volume. By definition, if r is the cube root of x, then $r^3 = x$.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** *What is a cube?* Make sure students understand that the length, width, and height of a cube are the same.
- **Ask:** *What is the length of your cube? The width? The height? What is the volume?* Help students recognize that the volume is the number of cubes they started with and that the length of an edge is the cube root.
- Talk about the term *cube root*. Discuss that the length of the edge of a cube is the geometric representation of a cube root. **Ask:** *How could you write an equation to demonstrate the meaning of a cube root?* Students can write an equation such as $3 \times 3 \times 3 = 27$ or $3^3 = 27$ to show 3 is the cube root of 27, or $\sqrt[3]{27} = 3$.

Solve It

Reread the problem with students. Have students draw a cube with a volume of 27. Have them label each edge 3 to demonstrate what they discovered when they modeled the problem. Finally, have them write the equation for the cube root under their drawing.

More Ideas

For other ways to teach about cube roots—

- Have students use Snap Cubes® or Cuisenaire® Rods to build cubes of various sizes. Have students find the edge length and calculate for volume, and then use the edge length to state the cube root.
- To extend cube roots to decimals, ask students to locate cube roots on the Folding Number Line. They can use the number line to estimate irrational cube roots.

Formative Assessment

Have students try the following problem.

Lander is moving and needs to know if his sculpture will fit in a cubic box. He knows the volume is 1,000 cubic inches. What is the length of each of the box's edges?

A. 8 in. **B.** 10 in. **C.** 100 in. **D.** 333 in.

Try It! 15 minutes | Pairs

Here is a problem about cube roots.

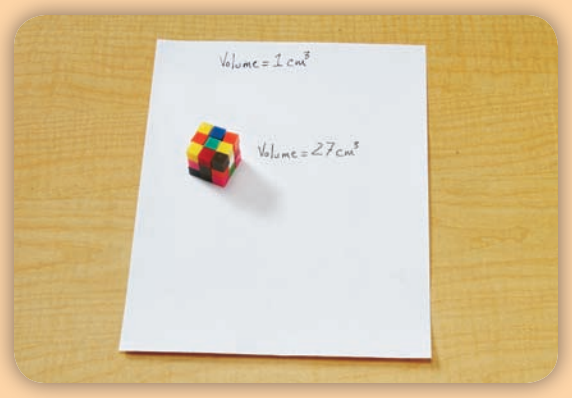
A cubic storage shed has a volume of 27 cubic meters. How long is each side of the shed?

Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

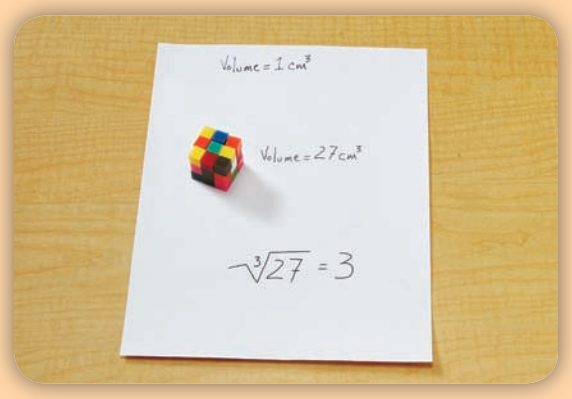
Materials

- Centimeter Cubes (at least 27 per pair)
- paper (1 sheet per pair)
- pencils (1 per pair)

1. Ask: *What is* volume*?* Discuss with students how the Centimeter Cubes are related to volume. **Ask:** *What is the volume of a Centimeter Cube?* Explain that they will model the cubic meters in the problem using Centimeter Cubes.



2. Ask: *What is the volume of the storage shed?* Have students gather 27 Centimeter Cubes. **Ask:** *How can you build a cubic space with the cubes?* Prompt students to make a cube that includes all the Centimeter Cubes. **Ask:** *What does it mean to be* cubic*?* Elicit that the length, width, and height are all the same.



3. Ask: *What is the edge length of the cube?* Elicit that the edge length 3 is the cube root of 27. Ask students to write the equation for this cube root.

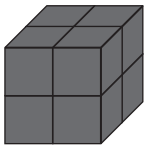
⚠ Look Out!

Students may build a rectangular prism instead of a cube. Remind them that all the edges should be the same in a cube.

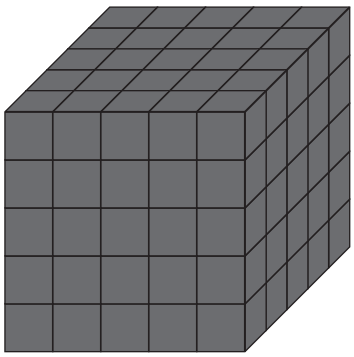
Answer Key

Use Centimeter Cubes to build the model. Write the equation. (Check students' work.)

1. Write an equation for the cube root. $\sqrt[3]{8} = 2$



2. Write an equation for the cube root. $\sqrt[3]{125} = 5$



Using Centimeter Cubes, solve the problem.

3. Leonard has a box with a volume of 1 cubic inch. What is the length of one edge? 1 inch

4. Paula tells her friend, "The cube root of 216 is the number of jobs I have lined up over summer break." How many jobs does she have? 6 jobs

Complete the equation.

5. $\sqrt[3]{1{,}728} =$ 12

6. $\sqrt[3]{729} =$ 9

Answer Key

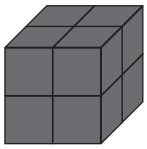
Challenge! You know that a cubic box holds 512 Centimeter Cubes. How can you use this information to find $\sqrt[3]{512}$?

Challenge: (Sample) I could line one edge of the box with Centimeter Cubes. The number of cubes is the cube root. In this case, the length, width, and height of the box are each 8 centimeters, so $\sqrt[3]{512} = 8$.

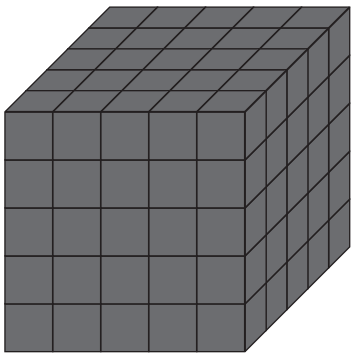
Name _____

Use Centimeter Cubes to build the model. Write the equation.

1. Write an equation for the cube root. _____



2. Write an equation for the cube root. _____



Using Centimeter Cubes, solve the problem.

3. Leonard has a box with a volume of 1 cubic inch. What is the length of one edge? _____

4. Paula tells her friend, "The cube root of 216 is the number of jobs I have lined up over summer break." How many jobs does she have? _____

Complete the equation.

5. $\sqrt[3]{1{,}728}$ = _____

6. $\sqrt[3]{729}$ = _____

Name _____

Challenge! You know that a cubic box holds 512 Centimeter Cubes. How can you use this information to find $\sqrt[3]{512}$?