Name: ______________________________ Date: ______________

How can I solve problems with perfect and non-perfect cubes?

Review

Perfect cubes are numbers whose cube roots are integers. You can use the product property of cube roots to simplify non-perfect cubes.

The Product Property of Cube Roots states:

$$\sqrt[3]{ab} = \sqrt[3]{a} \cdot \sqrt[3]{b}$$

The first 10 perfect cubes are 1, 8, 27, 64, 125, 216, 343, 512, 729, and 1,000.

Simplify $\sqrt[3]{108}$.

Step 1: $\sqrt[3]{108} = \sqrt[3]{27 \cdot 4}$

Step 2: $\sqrt[3]{108} = \sqrt[3]{27} \cdot \sqrt[3]{4}$

Step 3: $\sqrt[3]{108} = 3\sqrt[3]{4}$

Simplifying a Non-perfect Cube

1. Factor using the greatest perfect cube factor.
2. Use the product property of cube roots.
3. Simplify the cube root of the perfect cube and leave the non-perfect cube in radical form.

$$\boxed{\sqrt[3]{108} = 3\sqrt[3]{4}}$$

The cube root of a positive number is positive, and the cube root of a negative number is negative.

Practice

Simplify each cube root. The first one has been done for you.

What number to the 3rd power is 125?

1. $\sqrt[3]{-16}$

   Step 1: $\sqrt[3]{-16} = \sqrt[3]{-8 \cdot 2}$

   Step 2: $= \sqrt[3]{-8} \cdot \sqrt[3]{2}$

   Step 3: $= -2\sqrt[3]{2}$

2. $\sqrt[3]{250}$

   Step 1: $\sqrt[3]{250} = \sqrt[3]{125 \cdot 2}$

   Step 2: = ____________

   Step 3: = ____________

3. $\sqrt[3]{-216} =$ ____

4. $\sqrt[3]{729} =$ ____

5. $\sqrt[3]{750} =$ ____

6. $\sqrt[3]{3,000} =$ ______

7. $\sqrt[3]{-1,372} =$ ______

8. $\sqrt[3]{-768} =$ ______

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Review

You can solve algebraic equations in the form $x^3 = p$, where p is a constant, by using properties of cube roots.

Solve: $x^3 = 343$.

Step 1: $x^3 = 343$

Step 2: $\sqrt[3]{x^3} = \sqrt[3]{343}$

Step 3: $x = 7$

$\boxed{x = 7}$

Solve: $x^3 = -54$.

Step 1: $x^3 = -54$

Step 2: $\sqrt[3]{x^3} = \sqrt[3]{-54}$

Step 3: $x = \sqrt[3]{-27 \cdot 2}$

$= \sqrt[3]{-27} \cdot \sqrt[3]{2}$

$= -3\sqrt[3]{2}$

$\boxed{x = -3\sqrt[3]{2}}$

Solving $x^3 = p$

1. Write the equation.
2. Take the cube root of each side.
3. Simplify.

Practice

Solve for x. The first one has been done for you.

The cube root will be negative.

1. $x^3 = 320$

Step 1: $x^3 = 320$

Step 2: $\sqrt[3]{x^3} = \sqrt[3]{320}$

Step 3: $x = \sqrt[3]{64 \cdot 5}$

$= \sqrt[3]{64} \cdot \sqrt[3]{5}$

$= 4\sqrt[3]{5}$

2. $x^3 = -160$

Step 1: $x^3 = -160$

Step 2: $\sqrt[3]{x^3} = \sqrt[3]{-160}$

Step 3: $x = \sqrt[3]{\_\_\_\_ \cdot 20}$

$= \sqrt[3]{\_\_\_\_} \cdot \sqrt[3]{20}$

$=$ ________

3. $x^3 = 512$

$x =$ ______

4. $x^3 = -1{,}331$

$x =$ ______

5. $x^3 = 56$

$x =$ ______

6. $x^3 = 1{,}125$

$x =$ ________

7. $x^3 = -1{,}296$

$x =$ ________

8. $x^3 = -640$

$x =$ ________

Why are there two answers when finding the square root of a perfect square but only one when finding the cube root of a perfect cube?