Name____ Date__________

6.2 Radicals and Rational Exponents

For use with Exploration 6.2

Essential Question How can you write and evaluate an *n*th root of a number?

Recall that you cube a number as follows.

3rd power

$2^3 = 2 \cdot 2 \cdot 2 = 8$ 2 cubed is 8.

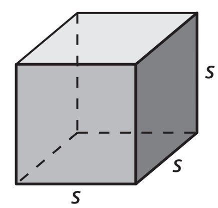
To "undo" cubing a number, take the cube root of the number.

Symbol for cube root is $\sqrt[3]{}$.

$\sqrt[3]{8} = \sqrt[3]{2^3} = 2$ The cube root of 8 is 2.

1 EXPLORATION: Finding Cube Roots

Work with a partner. Use a cube root symbol to write the side length of each cube. Then find the cube root. Check your answers by multiplying. Which cube is the largest? Which two cubes are the same size? Explain your reasoning.



a. Volume $= 27 \text{ ft}^3$

b. Volume $= 125 \text{ cm}^3$

c. Volume $= 3375 \text{ in.}^3$

d. Volume $= 3.375 \text{ m}^3$

e. Volume $= 1 \text{ yd}^3$

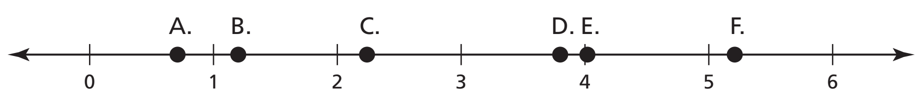
f. Volume $= \frac{125}{8} \text{ mm}^3$

2 EXPLORATION: Estimating *n*th Roots

Work with a partner. Estimate each positive *n*th root. Then match each *n*th root with the point on the number line. Justify your answers.

a. $\sqrt[4]{25}$ **b.** $\sqrt{0.5}$ **c.** $\sqrt[5]{2.5}$

d. $\sqrt[3]{65}$ **e.** $\sqrt[3]{55}$ **f.** $\sqrt[6]{20,000}$



Communicate Your Answer

3. How can you write and evaluate an *n*th root of a number?

4. The body mass m (in kilograms) of a dinosaur that walked on two feet can be modeled by

$$m = (0.00016)C^{2.73}$$

where C is the circumference (in millimeters) of the dinosaur's femur. The mass of a *Tyrannosaurus rex* was 4000 kilograms. Use a calculator to approximate the circumference of its femur.

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6.2 Notetaking with Vocabulary
For use after Lesson 6.2

In your own words, write the meaning of each vocabulary term.

nth root of a

radical

index of a radical

Core Concepts

Real nth Roots of a

Let n be an integer greater than 1, and let a be a real number.

- If n is odd, then a has one real nth root: $\sqrt[n]{a} = a^{1/n}$
- If n is even and $a > 0$, then a has two real nth roots: $\pm\sqrt[n]{a} = \pm a^{1/n}$
- If n is even and $a = 0$, then a has one real nth root: $\sqrt[n]{0} = 0$
- If n is even and $a < 0$, then a has no real nth roots.

Notes:

Rational Exponents

Let $a^{1/n}$ be an nth root of a, and let m be a positive integer.

Algebra $a^{m/n} = \left(a^{1/n}\right)^m = \left(\sqrt[n]{a}\right)^m$

Numbers $27^{2/3} = \left(27^{1/3}\right)^2 = \left(\sqrt[3]{27}\right)^2$

Notes:

Extra Practice

In Exercises 1–6, find the indicated real *n*th root(s) of *a*.

1. $n = 2, a = 64$

2. $n = 3, a = 27$

3. $n = 4, a = 256$

4. $n = 5, a = 243$

5. $n = 8, a = 256$

6. $n = 4, a = 10{,}000$

In Exercises 7–12, evaluate the expression.

7. $\sqrt[4]{625}$

8. $\sqrt[3]{-512}$

9. $\sqrt[3]{-216}$

10. $\sqrt[5]{-243}$

11. $729^{1/6}$

12. $(-81)^{1/2}$

6.2 Notetaking with Vocabulary (continued)

In Exercises 13–15, rewrite the expression in rational exponent form.

13. $\left(\sqrt[5]{4}\right)^3$ **14.** $\left(\sqrt[3]{-8}\right)^2$ **15.** $\left(\sqrt[4]{15}\right)^7$

In Exercises 16–18, rewrite the expression in radical form.

16. $(-3)^{2/5}$ **17.** $6^{3/2}$ **18.** $12^{3/4}$

In Exercises 19–24, evaluate the expression.

19. $32^{2/5}$ **20.** $(-64)^{3/2}$ **21.** $343^{2/3}$

22. $256^{7/8}$ **23.** $-729^{5/6}$ **24.** $(-625)^{3/4}$

25. The radius r of a sphere is given by the equation

$$r = \left(\frac{A}{4\pi}\right)^{1/2}$$

where A is the surface area of the sphere. The surface area of a sphere is 1493 square meters. Find the radius of the sphere to the nearest tenth of a meter. Use 3.14 for π.