Extension
Use after Lesson 8.3

Define and Use Fractional Exponents

TEKS A.11.A

GOAL Use fractional exponents.

Key Vocabulary
- cube root

In Lesson 2.7, you learned to write the square root of a number using a radical sign. You can also write a square root of a number using exponents.

For any $a \geq 0$, suppose you want to write $\sqrt{a}$ as a^k. Recall that a number b (in this case, a^k) is a square root of a number a provided $b^2 = a$. Use this definition to find a value for k as follows.

$b^2 = a$ **Definition of square root**

$(a^k)^2 = a$ **Substitute a^k for b.**

$a^{2k} = a^1$ **Product of powers property**

Because the bases are the same in the equation $a^{2k} = a^1$, the exponents must be equal:

$2k = 1$ **Set exponents equal.**

$k = \frac{1}{2}$ **Solve for k.**

So, for a nonnegative number a, $\sqrt{a} = a^{1/2}$.

You can work with exponents of $\frac{1}{2}$ and multiples of $\frac{1}{2}$ just as you work with integer exponents.

EXAMPLE 1 Evaluate expressions involving square roots

a. $16^{1/2} = \sqrt{16}$
$= 4$

b. $25^{-1/2} = \frac{1}{25^{1/2}}$
$= \frac{1}{\sqrt{25}}$
$= \frac{1}{5}$

c. $9^{5/2} = 9^{(1/2) \cdot 5}$
$= (9^{1/2})^5$
$= (\sqrt{9})^5$
$= 3^5$
$= 243$

d. $4^{-3/2} = 4^{(1/2) \cdot (-3)}$
$= (4^{1/2})^{-3}$
$= (\sqrt{4})^{-3}$
$= 2^{-3}$
$= \frac{1}{2^3}$
$= \frac{1}{8}$

FRACTIONAL EXPONENTS You can work with other fractional exponents just as you did with $\frac{1}{2}$.