



# Unit Fractional Exponents

Let's connect roots and exponents.

## 9.1 Fractional Exponent

For each equality, find the missing exponent that will make the statement true. Be prepared to explain your reasoning.

1.  $(3^2)^3 = 3^?$
2.  $(3^?)^4 = 3^{20}$
3.  $\left(3^{\frac{1}{2}}\right)^2 = 3^?$

## 9.2 Connecting Roots and Exponents

1. Based on exponent rules, what is an equivalent way of writing the value of  $\left(x^{\frac{1}{n}}\right)^n$ ?
2. Based on the meaning of roots, what is true about the value of  $(\sqrt[n]{x})^n$ ?
3. If  $(\sqrt[3]{5})^3 = (5^?)^3$ , what is the value of the missing exponent? Explain your reasoning.
4. Write  $\sqrt[3]{5}$  as a number with an exponent.
5. What is the value of  $9^{\frac{1}{2}}$ ?
6. Rewrite  $\sqrt[4]{19}$  with an exponent instead of as a root.
7. Rewrite  $\left(\frac{2}{3}\right)^{\frac{1}{7}}$  as a root.



## 9.3

## Matching Exponents and Roots

Take turns with your partner to complete the table so that each row of the table has an equivalent value in all three columns.

| exponents                     | roots          | values        |
|-------------------------------|----------------|---------------|
| $64^{\frac{1}{2}}$            | $\sqrt{64}$    | 8             |
|                               | $\sqrt[3]{8}$  | 2             |
| $(\frac{1}{8})^{\frac{1}{3}}$ |                | $\frac{1}{2}$ |
| $27^{\frac{1}{3}}$            |                |               |
| $10,000^{\frac{1}{4}}$        |                | 10            |
|                               | $\sqrt[5]{32}$ |               |
|                               |                | 5             |



## Lesson 9 Summary

We can use exponent rules and the meaning of roots to rewrite certain roots as exponents and certain exponents as roots!

From an exponent rule, we know that  $(a^{\frac{1}{n}})^n = a$  because  $\frac{1}{n} \cdot n = 1$ .

Based on the meaning of roots, we know that  $(\sqrt[n]{a})^n = a$ , as well.

Because both expressions are equal to  $a$ , this means that  $(a^{\frac{1}{n}})^n = (\sqrt[n]{a})^n$ . We're using only positive base values in this unit, so the parts without the " $n$ " exponent must be equivalent. That means that  $a^{\frac{1}{n}} = \sqrt[n]{a}$ .

For example,  $1,000^{\frac{1}{3}} = \sqrt[3]{1,000} = 10$ , which is true because  $10^3 = 1,000$ .

