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. $\left(3^2\right)^3 = 3^?$
2. $\left(3^?\right)^4 = 3^{20}$
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 $\left(\sqrt[n]{x}\right)^n$?
3. If $\left(\sqrt[3]{5}\right)^3 = \left(5^?\right)^3$, 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
$\left(\frac{1}{8}\right)^{\frac{1}{3}}$		$\frac{1}{2}$
$27^{\frac{1}{3}}$		
$10{,}000^{\frac{1}{4}}$		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 $\left(a^{\frac{1}{n}}\right)^n = a$ because $\frac{1}{n} \cdot n = 1$.

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

Because both expressions are equal to a, this means that $\left(a^{\frac{1}{n}}\right)^n = \left(\sqrt[n]{a}\right)^n$. 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 $10^3 = 1{,}000$.

