LESSON MAKER PRO

Roots Meet Exponents

Use rational exponents to name and evaluate roots.

HIGH SCHOOL · HSN-RN.A.1

CCSS.Math.Content.HSN-RN.A.1 "Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example..."

NAME _____ DATE _____

EXPONENT ROOTS

For a positive number a, $a^{1/n}$ means the n-th root of a because $(a^{1/n})^n = a$. More generally, $a^{m/n}$ = (n-th root of a)^m, so take the root named by the denominator and then use the numerator as the power.

WORKED EXAMPLE

Evaluate $10000^{3/4}$.

1. The denominator 4 means take the fourth root first.
2. The fourth root of 10000 is 10.
3. Raise 10 to the third power: $10^3 = 1000$.

Answer: $10000^{3/4} = 1000$

PRACTICE 6 problems

1 Write $16^{1/4}$ as a fourth root. Then evaluate.

ANSWER _____

2 Evaluate $27^{2/3}$.

ANSWER _____

3 Evaluate $64^{5/6}$.

ANSWER _____

4 Write the cube root of 125 using rational exponent notation. Then evaluate.

ANSWER _____

5 Explain why $49^{1/2} = 7$ by using the meaning of a rational exponent.

ANSWER _____

6 Evaluate $(1/32)^{2/5}$.

ANSWER _____

APPLY IT Show your work

1 A student is building a cube-shaped storage box for music equipment. The box has a volume of 343 cubic inches. The side length s can be written as $343^{1/3}$. Find s.

WORK SPACE

ANSWER _____

2 The drama club paints a square backdrop with an area of 441 square feet. The side length can be written as $441^{1/2}$. Find the side length.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Evaluate $1296^{5/4}$. Then explain why the fourth root is found before raising the result to the fifth power.

WORK SPACE AND ANSWER

ANSWER KEY

Roots Meet Exponents

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write $16^{1/4}$ as a fourth root. Then evaluate.	**fourth root of 16 = 2**
2	Evaluate $27^{2/3}$.	**9**
3	Evaluate $64^{5/6}$.	**32**
4	Write the cube root of 125 using rational exponent notation. Then evaluate.	**$125^{1/3} = 5$**
5	Explain why $49^{1/2} = 7$ by using the meaning of a rational exponent.	**$(49^{1/2})^2 = 49$, and $7^2 = 49$, so $49^{1/2} = 7$.**
6	Evaluate $(1/32)^{2/5}$.	**1/4**

PART 2 · APPLY IT

1. **s = 7 inches** The exponent 1/3 means take the cube root. Since $7^3 = 343$, $343^{1/3} = 7$.
2. **21 feet** The exponent 1/2 means take the square root. Since $21^2 = 441$, $441^{1/2} = 21$.

CHALLENGE

$1296^{5/4} = 7776$. The denominator 4 means take the fourth root first: the fourth root of 1296 is 6. Then the numerator 5 means calculate $6^5 = 7776$.

Accept equivalent root notation, such as $\sqrt{441}$ for $441^{1/2}$, when it is mathematically correct. For explanations, accept statements that identify the denominator as the root and the numerator as the power.