LESSON MAKER PRO

Roots and Powers

Connect rational exponents to roots.

HIGH SCHOOL · MT.PLUS.NUM.REAS.1

MT.PLUS.NUM.REAS.1 "Extend the properties of exponents to rational exponents, including converting between exponential and radical forms."

NAME _____ DATE _____

THE BIG IDEA

For a positive number a, $a^{m/n}$ means take the nth root of a, then raise the result to the mth power. A negative exponent means take the reciprocal of the corresponding positive power.

WORKED EXAMPLE

Evaluate $32^{3/5}$ using radical form.

1. $32^{3/5}$ = (5th root of 32)^3
2. 5th root of 32 = 2
3. $2^3 = 8$

Answer: 8

PRACTICE 6 problems

1 Write $169^{1/2}$ in radical form, then evaluate.

ANSWER _____

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

ANSWER _____

3 Write the cube root of 1000 as a rational exponent, then evaluate.

ANSWER _____

4 Evaluate $256^{3/4}$.

ANSWER _____

5 Write the 5th root of (243^2) as a rational exponent, then evaluate.

ANSWER _____

6 Evaluate $125^{-2/3}$.

ANSWER _____

APPLY IT Show your work

1 You build a cube in a game using 1,728 blocks. How many blocks are along each edge? Write a rational exponent and evaluate it.

WORK SPACE

ANSWER _____

2 A 64 MB video file is compressed in three rounds. Each round divides the file size by the same factor. After the third round, the file is 1 MB. What is the factor? Write a rational exponent and evaluate it.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student claims $81^{3/4} = 3$ because the fourth root of 81 is 3. Is the claim correct? Explain using radical form and find the correct value.

WORK SPACE AND ANSWER

Roots and Powers

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write $169^{1/2}$ in radical form, then evaluate.	**sqrt(169) = 13**
2	Evaluate $27^{2/3}$.	**9**
3	Write the cube root of 1000 as a rational exponent, then evaluate.	**$1000^{1/3} = 10$**
4	Evaluate $256^{3/4}$.	**64**
5	Write the 5th root of (243^2) as a rational exponent, then evaluate.	**$243^{2/5} = 9$**
6	Evaluate $125^{-2/3}$.	**1/25**

PART 2 · APPLY IT

1. **$1728^{1/3} = 12$ blocks** The edge length is the cube root of the total number of blocks. Since $12^3 = 1728$, each edge has 12 blocks.
2. **$64^{1/3} = 4$** The factor cubed is 64, so the factor is $64^{1/3} = 4$. Dividing 64 by 4 three times gives 1.

CHALLENGE

No. $81^{3/4}$ = (fourth root of 81)^3 = 3^3 = 27.

Accept equivalent radical wording, such as “square root of 169” for sqrt(169). For positive bases, students may raise to the numerator power before taking the denominator root.