

Roots Power Up

Connect rational exponents to roots and powers.

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 _____

ROOTS AS EXPONENTS

For positive a , $a^{(1/n)}$ means the positive number whose n th power is a . This keeps the exponent rule $(a^{(1/n)})^n = a$ true, and $a^{(m/n)} = (a^{(1/n)})^m$.

WORKED EXAMPLE

Evaluate $243^{(1/5)}$.

1. Let $x = 243^{(1/5)}$.
2. Then $x^5 = (243^{(1/5)})^5 = 243$.
3. Since $3^5 = 243$, $x = 3$.

Answer: 3

PRACTICE 6 problems

1 Evaluate $64^{(1/2)}$.

ANSWER _____

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

ANSWER _____

3 Write the sixth root of 729 using a rational exponent.

ANSWER _____

4 Evaluate $16^{(3/4)}$.

ANSWER _____

5 Choose $<$, $>$, or $=$ to make the statement true: $125^{(1/3)} \underline{\hspace{1cm}} 49^{(1/2)}$.

ANSWER _____

6 Evaluate $27^{(2/3)}$.

ANSWER _____

APPLY IT Show your work

- 1** A game designer is making a cube-shaped treasure chest with a volume of 512 cubic centimeters. The edge length is represented by $512^{1/3}$. What is the edge length in centimeters?

WORK SPACE

ANSWER _____

- 2** A student designs a square album cover with an area of 169 square centimeters. The side length is represented by $169^{1/2}$. What is the side length in centimeters?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without a calculator, evaluate $625^{3/4}$. Explain how the denominator and numerator guide your steps.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Evaluate $64^{(1/2)}$.	8
2	Evaluate $32^{(1/5)}$.	2
3	Write the sixth root of 729 using a rational exponent.	$729^{(1/6)}$
4	Evaluate $16^{(3/4)}$.	8
5	Choose <, >, or = to make the statement true: $125^{(1/3)}$ ___ $49^{(1/2)}$.	<
6	Evaluate $27^{(2/3)}$.	9

PART 2 • APPLY IT

1. **8 centimeters** The exponent $1/3$ means take the cube root. Since $8^3 = 512$, the edge length is 8 centimeters.
2. **13 centimeters** The exponent $1/2$ means take the square root. Since $13^2 = 169$, each side is 13 centimeters.

CHALLENGE

The denominator 4 means take the fourth root: $625^{(1/4)} = 5$. Then the numerator 3 means cube it: $5^3 = 125$, so $625^{(3/4)} = 125$.

Accept equivalent radical notation for problem 3, such as the sixth root of 729. For the challenge, accept any correct explanation that takes the fourth root first and then cubes the result.