

# Power Roots

*Use roots and powers to simplify rational exponents.*

**HIGH SCHOOL • HSN-RN.A**

**CCSS.Math.Content.HSN-RN.A** "Extend the properties of exponents to rational exponents."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## RATIONAL EXPONENT RULES

For a positive base  $a$ ,  $a^{(m/n)}$  means take the  $n$ th root of  $a$ , then raise the result to the  $m$ th power. A negative rational exponent means take the reciprocal, so  $a^{(-m/n)} = 1/a^{(m/n)}$ .

## WORKED EXAMPLE

Evaluate  $625^{(3/4)}$ .

1. Rewrite  $625^{(3/4)}$  as  $(625^{(1/4)})^3$ .
2. Find the fourth root:  $625^{(1/4)} = 5$ .
3. Cube the result:  $5^3 = 125$ .

**Answer: 125**

## PRACTICE 6 problems

**1** Evaluate  $81^{(1/2)}$ .

**ANSWER** \_\_\_\_\_

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

**ANSWER** \_\_\_\_\_

**3** Evaluate  $64^{(-1/3)}$ .

**ANSWER** \_\_\_\_\_

**4** Evaluate  $(1/49)^{(1/2)}$ .

**ANSWER** \_\_\_\_\_

**5** Simplify  $x^{(1/2)} x^{(3/2)}$ , where  $x \geq 0$ .

**ANSWER** \_\_\_\_\_

**6** Simplify  $(32a^5)^{(1/5)}$ .

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** A student is designing a square cover image with an area of 196 square centimeters. Its side length is modeled by  $s = A^{1/2}$ . What is the side length?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** In a sandbox video game, a cube-shaped build has a volume of 343 cubic blocks. Its edge length is modeled by  $L = V^{1/3}$ . What is the edge length?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

For  $b > 0$ , simplify  $(b^{3/4})^{-2/3}$ . Explain why your exponent is correct.

---

---

## PART 1 • PRACTICE

| # | PROBLEM                                         | ANSWER                  |
|---|-------------------------------------------------|-------------------------|
| 1 | Evaluate $81^{1/2}$ .                           | <b>9</b>                |
| 2 | Evaluate $27^{2/3}$ .                           | <b>9</b>                |
| 3 | Evaluate $64^{-1/3}$ .                          | <b><math>1/4</math></b> |
| 4 | Evaluate $(1/49)^{1/2}$ .                       | <b><math>1/7</math></b> |
| 5 | Simplify $x^{1/2} x^{3/2}$ , where $x \geq 0$ . | <b><math>x^2</math></b> |
| 6 | Simplify $(32a^5)^{1/5}$ .                      | <b><math>2a</math></b>  |

## PART 2 • APPLY IT

- 14 centimeters** Substitute  $A = 196$  into  $s = A^{1/2}$ . The square root of 196 is 14.
- 7 blocks** Substitute  $V = 343$  into  $L = V^{1/3}$ . The cube root of 343 is 7.

## CHALLENGE

**$1/b^{1/2}$ . Multiply the exponents:  $(3/4)(-2/3) = -1/2$ , then use the negative exponent rule.**

Accept equivalent radical forms, such as  $1/\sqrt{b}$  for the challenge. For problem 5,  $x^2$  is valid because the problem states  $x \geq 0$ .