

# Rational (Fraction) Exponents

$$\text{root} \sqrt{\text{base}^{\text{power}}} = \text{base} \frac{\text{power}}{\text{root}}$$

5 and -5 are SQUARE roots of 25 because  $5^2 = 25$  and  $(-5)^2 = 25$ .

2 is the CUBE root of \_\_\_ because  $2^3 = \underline{\quad}$ .

3 and -3 are FOURTH roots of \_\_\_ because  $3^4 = \underline{\quad}$  and  $(-3)^4 = \underline{\quad}$

**a is the  $n^{\text{th}}$  root of b if  $a^n = \underline{\quad}$**

$$\sqrt[3]{27} = \underline{3}$$

what # times itself 3 times = 27

$$\sqrt[5]{32} = \underline{2}$$

what # times itself 5 times = 32

Write each using EXPONENTS:

1.  $\sqrt[3]{4^5} = 4^{\frac{5}{3}}$   
Base

2.  $\sqrt[4]{7^3} = 7^{\frac{3}{4}} \approx 4.30$

3.  $\sqrt[3]{11^6} = 11^{\frac{6}{3}} = 11^2$

4.  $\sqrt[4]{25^2} = 25^{\frac{2}{4}} = 25^{\frac{1}{2}} = \sqrt{25}$

Write each in RADICAL form:

5.  $(-125)^{\frac{2}{3}} = \sqrt[3]{-125^2}$

6.  $64^{\frac{1}{3}} = \sqrt[3]{64} = \sqrt[3]{64}$

7.  $4^{\frac{5}{2}} = \sqrt{4^5} = (\sqrt{4})^5$

8.  $32^{\frac{1}{5}} = \sqrt[5]{32}$

Use your rules to write expressions in exponential form to simplify rational exponents.

9.  $\sqrt{x^8 y^5} = x^{\frac{8}{2}} \cdot y^{\frac{5}{2}} = x^4 \cdot y^2 \sqrt{y}$

10.  $\sqrt[5]{5x^{30}y^{-10}} = 5^{\frac{30}{5}} \cdot x^{\frac{30}{5}} \cdot y^{-\frac{10}{5}} = x^6 \cdot y^{-2} \sqrt[5]{5} = \frac{x^6 \sqrt[5]{5}}{y^2}$

11.  $\sqrt[3]{27x^{-12}y^9} = 27^{\frac{1}{3}} \cdot x^{-\frac{12}{3}} \cdot y^{\frac{9}{3}} = 3x^{-4}y^3 = \frac{3y^3}{x^4}$

12.  $\sqrt[4]{16x^{36}y^{10}} = 16^{\frac{1}{4}} \cdot x^{\frac{36}{4}} \cdot y^{\frac{10}{4}} = 2x^9 y^2 \sqrt{y}$

13.  $\sqrt[5]{125x^4y^{15}} = 125^{\frac{1}{5}} \cdot x^{\frac{4}{5}} \cdot y^{\frac{15}{5}} = 5x^{\frac{4}{5}}y^3 = 5y^3 \sqrt[5]{x^4}$

14.  $\sqrt[3]{49x^{36}y^{11}} = 49^{\frac{1}{3}} \cdot x^{\frac{36}{3}} \cdot y^{\frac{11}{3}} = 7x^{12}y^{\frac{11}{3}} = 7x^{12}y^3 \sqrt[3]{y}$

15.  $\sqrt[3]{8x^{-3}y^6} = 8^{\frac{1}{3}} \cdot x^{-\frac{3}{3}} \cdot y^{\frac{6}{3}} = 2x^{-1}y^2 = \frac{2y^2}{x}$

16.  $\sqrt[3]{27000x^3} = 30x$