

Remember the definitions of negative and rational exponents you learned earlier, as well as the properties of exponents (summarized below).

Properties of n th Roots

Know it!

Note

For positive real numbers a and b :

WORDS	NUMBERS
Product Property of Roots The n th root of a product is equal to the product of the n th roots.	$\sqrt[4]{32} = \sqrt[4]{16} \cdot \sqrt[4]{2} = 2\sqrt[4]{2}$

Know it!

Note

Properties of Rational Exponents

For all nonzero real numbers a and b and rational r

WORDS	NUMBERS
Product of Powers Property To multiply powers with the same base, add the exponents.	$7^{\frac{1}{2}} \cdot 7^{\frac{3}{2}} = 7^{\frac{1}{2} + \frac{3}{2}}$
Quotient of Powers Property To divide powers with the same base, subtract the exponents.	$\frac{8^{\frac{2}{3}}}{8^{\frac{1}{3}}} = 8^{\frac{2}{3} - \frac{1}{3}}$
Power of a Power Property To raise one power to another, multiply the exponents.	$\left(6^{\frac{3}{4}}\right)^4 = 6^{\frac{3}{4} \cdot 4}$

Rewrite the following expressions using rational exponent notation.

1.) $\sqrt[3]{7}$

2.) $(\sqrt[3]{6})^2$

3.) $\frac{\sqrt{10}}{\sqrt{2}}$

Rewrite the following expressions using radical notation in simplest form.

4.) $17^{\frac{1}{3}}$

5.) $8^{\frac{1}{2}}$

6.) $(-32)^{\frac{3}{5}}$

Evaluate without using a calculator.

7.) $\sqrt[4]{1}$

8.) $\sqrt[3]{125}$

9.) $\sqrt[3]{-1000}$

Continued on the back

Evaluate without using a calculator.

10.) $-\sqrt[6]{64}$

11.) $\left(\sqrt[3]{-27}\right)^2$

12.) $(-8)^{\frac{5}{3}}$

13.) $81^{\frac{3}{2}}$

14.) $64^{\frac{2}{3}}$

15.) $(81)^{\frac{3}{2}}$

16.) $(25)^{-\frac{3}{2}}$

17.) $(100)^{-\frac{5}{2}}$

18.) $(27)^{-\frac{4}{3}}$

9.) $\left(\frac{8}{27}\right)^{\frac{1}{3}}$

20.) $\left(\frac{4}{25}\right)^{-\frac{3}{2}}$

21.) $\left(\frac{49}{64}\right)^{\frac{1}{2}}$

Simplify the following expressions using properties of exponents:

22.) $(4x^3y^5)(-2xy^{-3})$

23.) $(-3x^2y^{-2})^3$

24.) $-3(2x)^2(-x)^3$

25.) $\frac{(-4x^3y^{-1})^2}{5x^3y}$

26.) $\frac{10x^3z}{(5xz^2)^2}$

27.) $\frac{-x^3y(-xy)^4}{(x^3y^2)^2}$

28.) $y^{3n} \cdot y^{1-n}$

29.) $(a^{n+1})^3 \cdot a^{n-3}$

30.) $(x^{2n}y^0)^2 \cdot (x^{-3}y^2)^n$

31.) $\frac{k^{x+2}}{k^{2-x}}$

32.) $\left(\frac{x^{2n-1}}{x^{n-3}}\right)^2$

33.) $\left(\frac{(a^{4x})(a^x)}{(a^{x-2})^2}\right)^2$

Express in **simplest radical form**: (Hint: you may want to convert to rational exponents first)

34.) $\sqrt[3]{-56a^7b^9}$

35.) $\sqrt[4]{16a^3b^8}$

36.) $\sqrt[3]{5^3x^4y^2z^{15}}$

Evaluate/simplify without using a calculator:

37.) $36^{\frac{3}{4}} \div 36^{\frac{1}{4}}$

38.) $a^{\frac{2}{3}} \cdot a^{\frac{1}{4}}$

39.) $\frac{a^{\frac{4}{3}}}{(125a)^{\frac{2}{3}}}$