

Objectives:

- I can simplify expressions with rational exponents.

Vocabulary: Exponent Rules

<p>Product of Powers: $x^a \cdot x^b = x^{a+b}$</p> <p>Numerical Example: $8^{1/2} \cdot 8^{2/3} = 8^{1/2+2/3}$ $\frac{3}{6} + \frac{4}{6} = \frac{7}{6}$ $8^{7/6}$</p>	<p>Quotient of Powers: $\frac{x^a}{x^b} = x^{a-b}$</p> <p>Numerical Example: $\frac{7^{2/5}}{7^{2/3}} = 7^{2/5-2/3} = 7^{-4/15}$ $\frac{6}{15} - \frac{10}{15} = -\frac{4}{15}$</p>	<p>Negative Exponents: $x^{-a} = \frac{1}{x^a}$ OR $\frac{1}{x^{-a}} = x^a$</p> <p>Numerical Example: $9^{-1/2} = \frac{1}{9^{1/2}}$ $\frac{3x^{-2}m^2}{n^3} = \frac{3m^2}{x^2n^3}$</p>
<p>Power of a Power: $(x^a)^b = x^{a \cdot b}$</p> <p>Numerical Example: $(5^{1/2})^4 = 5^{4/2} = 5^2 = 25$ $(3^{2/3})^{3/2} = 3^{2/6} = 3^{1/3}$</p>	<p>Zero Exponents: $x^0 = 1$</p> <p>Numerical Example: $(6^{7/9})^0 = 6^0 = 1$ $\left(\frac{x^3b^9}{5}\right)^0 = \left(\frac{x^0b^0}{5^0}\right)^0 = 1$</p>	<p>Powers of a Quotient: $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$</p> <p>Numerical Example: $\left(\frac{p^3}{q^2}\right)^{2/3} = \frac{(p^3)^{2/3}}{(q^2)^{2/3}} = \frac{p^2}{q^{4/3}}$</p>

Example Set: Simplify each expression. Your answers should only include positive exponents.

1. $x \cdot x^{1/2}$

$x^{1+1/2}$
 $x^{2/2+1/2}$
 $x^{3/2}$

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2. $(p^{-1})^{-1/2}$

$\left(\frac{1}{p}\right)^{-1/2} = p^{-1 \cdot -1/2} = p^{1/2}$

3. $2x \cdot 4x^{-1/2}$

$2 \cdot 4 \cdot x^1 \cdot x^{-1/2}$
 $8x^{1+(-1/2)}$
 $8x^{1-1/2}$
 $8x^{1/2}$

4. $3v^{3/4} \cdot 2v^{1/4}$

$3 \cdot 2 \cdot v^{3/4+1/4}$
 $6v^{3/4+1/4}$
 $6v^{4/4}$
 $6v$

5. $\frac{3m^{-1/2}}{2m^{7/4}}$

$\frac{3}{2m^{7/4+1/2}}$
 $\frac{3}{2m^{7/4+2/4}} = \frac{3}{2m^{9/4}}$

6. $\frac{2p^{4/3}}{p^{2/3}}$

$2p^{4/3-2/3}$
 $2p^{2/3}$

$$7. \frac{x^{\frac{3}{4}}}{x^{-\frac{3}{2}}}$$

$$x^{\frac{3}{4}} \cdot x^{\frac{3}{2}}$$

$$x^{\frac{3}{4} + \frac{3}{2}}$$

$$x^{\frac{3}{4} + \frac{6}{4}}$$

$$x^{\frac{9}{4}}$$

$$8. \frac{(n^{\frac{1}{2}})^{\frac{1}{2}}}{n \cdot n}$$

$$= \frac{n^{\frac{1}{2} \cdot \frac{1}{2}}}{n^{1+1}}$$

$$= \frac{n^{\frac{1}{4}}}{n^2}$$

$$= n^{\frac{1}{4} - \frac{2}{1}}$$

$$n^{-\frac{7}{4}} = \frac{1}{n^{\frac{7}{4}}}$$

$$9. \frac{(x^{\frac{3}{2}})^2}{x^{\frac{1}{2}} x^{\frac{3}{2}}}$$

$$\frac{x^{\frac{3}{2} \cdot 2}}{x^{\frac{1}{2} + \frac{3}{2}}} = \frac{x^3}{x^2}$$

$$= x^{3-2} = x$$

Properties of Rational Exponents

Note: You have already learned and used all of these properties.

Product of Powers:	$a^m \cdot a^n = a^{m+n}$
Power of a Power:	$(a^m)^n = a^{m \cdot n}$
Power of a Product:	$(ab)^m = a^m b^m$
Negative Exponent:	$a^{-m} = \frac{1}{a^m}, a \neq 0$
Zero Exponent:	$a^0 = 1, a \neq 0$
Quotient of Powers:	$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$
Power of a Quotient:	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$