Property:	Rule:	Example:
Product Rule	$n^x \bullet n^y = n^{x+y}$	- Same base - Add exponents
Quotient Rule	$\frac{n^x}{n^y} = n^{x-y}$	- Same base - subtract exponents
Power Rule	$(n^x)^y = n^{xy}$	$(\text{power})^{\text{power}}$ multiply exp
Negative Rule	$1 \cdot n^{-x} = \frac{1}{n^x}$ $\frac{1}{n^{-x}} = 1 \cdot n^x$ *Note: n≠0	- moves location - once moved neg goes away
Power of a product	$(nm)^x = n^x m^x$	distribute exponent

$$(2x^3)^4 = 2^4 x^{12}$$
$$= 16x^{12}$$

Power of a quotient	$\left(\frac{n}{m}\right)^x = \frac{n^x}{m^x}$ *Note: m≠0	-distribute to exponent in numerator & denominator
Zero exponent	$n^0 = 1$ *Note: N≠0	$\frac{2}{2} = 1$ $\frac{2^1}{2^1} = 2^{1-1} = 2^0$ $2^0 = 1$

Simplify the following

1.) $(-m^3n^3)^2 \cdot -2mn^4$

$m^6n^6 \cdot -2mn^4$

$\boxed{-2m^7n^{10}}$

2.) $-x^{-1}y^3 \cdot -xy^4 \cdot \left(-2y^3\right)^5$

$-x^{-1}y^3 \cdot -x^1y^4 \cdot (-2)^5y^{15}$

$-32x^0y^{22}$

$-32 \cdot 1 \cdot y^{22}$

$\boxed{-32y^{22}}$

3.) $\left(\dfrac{xy^{-1} \cdot -2y \cdot 2x^{-1}y^{-1}}{x^{-4}y^4}\right)^{-1}$

$\dfrac{x^{-1}y^1 \cdot (-2)^{-1}y^{-1} \cdot (2)^{-1}x^1y^1}{x^4y^{-4}}$

$\dfrac{(-2)^{-1}(2)^{-1}x^0y^1}{x^4y^{-4}}$

$\dfrac{1 \cdot y^1 \cdot y^4}{(-2)(2)x^4} = \boxed{\dfrac{y^5}{-4x^4}}$

4.) $\dfrac{\left(2nm^{-4}\right)^3 \cdot mn^3}{-m^{-2}n^4}$

$\dfrac{2^3n^3m^{-12} \cdot mn^3}{-m^{-2}n^4}$

$\dfrac{8n^6m^{-11}}{-1m^{-2}n^4}$

$\dfrac{8n^6m^2}{-1m^{11}n^4}$

$-8n^2m^{-9}$

$\boxed{\dfrac{-8n^2}{m^9}}$

Converting between Radical Form
and Rational Exponent Form

Root Index → exponent

$$\sqrt[\boxed{b}]{X^{\boxed{a}}} = X^{\frac{\boxed{a}}{\boxed{b}}}$$

exponent

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Examples: Change between radical notation and rational exponent notation.

Rewrite the expression using rational exponent notation		
Example 1: $\left(\sqrt[5]{63}\right)^3$ $(63)^{\frac{3}{5}}$	Example 2: $\left(\sqrt[3]{-25}\right)^4$ $(-25)^{\frac{4}{3}}$	Example 3: $\left(\sqrt[6]{124}\right)^7$ $(124)^{\frac{7}{6}}$
Rewrite the expression using radical notation		
Example 4: $(-57)^{\frac{4}{3}}$ $\left(\sqrt[3]{-57}\right)^4$	Example 5: $(13)^{\frac{3}{2}}$ $\left(\sqrt[2]{13}\right)^3$	Example 6: $(204)^{\frac{5}{8}}$ $\left(\sqrt[8]{204}\right)^5$

$\sqrt[3]{(-57)^4}$ $\sqrt[2]{(13)^3}$ $\sqrt[8]{(204)^5}$

$$\sqrt{x^2} = x$$

$$\left(\sqrt{x}\right)^2 = x$$

Examples: Evaluate an expression without a calculator

Example 7: $(36)^{\frac{3}{2}}$ $\left(\sqrt{36}\right)^3 = (6)^3 = 216$	Example 8: $(64)^{\frac{-1}{6}}$ $\left(\sqrt[6]{64}\right)^{-1} = (2)^{-1} = \frac{1}{2}$
Example 9: $(16)^{\frac{-1}{4}} = \left(\sqrt[4]{16}\right)^{-1} = (2)^{-1} = \frac{1}{2}$	Example 10: $(8)^{\frac{4}{3}}$ $\left(\sqrt[3]{8}\right)^4 = 2^4 = 16$

16
4 4
2 2 2 2

64
2 32
2 16
4 4
2 2 2 2

3
36
× 6
216

Example 11 Convert the following to a rational exponent	Example 12 Convert the following to a radical
$(\sqrt[5]{x^2y^3z^{10}})^1$ $(x^2y^3z^{10})^{\frac{1}{5}}$ $x^{\frac{2}{5}}y^{\frac{3}{5}}z^{\frac{10}{5}}$ $\boxed{x^{\frac{2}{5}}y^{\frac{3}{5}}z^{2}}$	$x^{\frac{1}{2}}y^{\frac{5}{2}}$ $\sqrt[2]{x^1y^5}$ $\boxed{\sqrt{xy^5}}$
Example 13 Simplify the following	**Example 14** Simplify the following
$(x^{\frac{2}{3}}y^{\frac{4}{9}})^{\frac{9}{2}}$ $x^{\frac{2}{3}\cdot\frac{9}{2}}\ y^{\frac{4}{9}\cdot\frac{9}{2}}$ $\boxed{x^3y^2}$	$x^{\frac{1}{5}}x^{\frac{2}{3}}$ $x^{\frac{1}{5}+\frac{2}{3}}$ $x^{\frac{3}{15}+\frac{10}{15}}$ $\boxed{x^{\frac{13}{15}}}$