

# **Rational Exponents**

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# Rational Exponents

Rational exponents, or exponents that are fractions, are another way to write and work with radicals.

$$\sqrt[n]{b^m} = b^{\frac{m}{n}}$$

Power

Root

# Rational Exponents

Simplify:

$$(16)^{\frac{3}{4}}$$

$$(4)^{-\frac{5}{2}}$$

$$(81)^{\frac{3}{4}}$$

# Rational Exponents

Simplify:

$$\left(\frac{1}{16}\right)^{-\frac{3}{4}}$$

$$\left(\frac{1}{8}\right)^{\frac{4}{3}}$$

113 Simplify:  $(81)^{\frac{1}{2}}$

**Answer**

114 Simplify:  $(27)^{-\frac{2}{3}}$

**Answer**

115 Simplify:  $\left(\frac{4}{9}\right)^{-\frac{3}{2}}$

**Answer**

116 Simplify:  $\left(-\frac{1}{32}\right)^{-\frac{1}{5}}$

**Answer**



117 Simplify:  $(-27)^{\frac{4}{3}}$

**Answer**

# Rational Exponents

Rewrite each radical as a rational exponent in the lowest terms.

$$\sqrt[3]{x}$$

$$\sqrt[4]{a^2}$$

$$\sqrt[3]{9b^5}$$

# Rational Exponents

Rewrite each radical as a rational exponent in the lowest terms.

$$\sqrt[4]{16m^4n^7}$$

$$\sqrt[6]{32x^8y^9}$$

# Combining Radicals

Rewrite each expression as a single radical. To combine more than one number or variable, the roots must be the same.

$$x^{\frac{2}{5}}$$

$$a^{\frac{1}{5}} b^{\frac{2}{5}} c^{\frac{4}{5}}$$

$$r^{\frac{2}{3}} s^{\frac{5}{3}}$$

# Combining Radicals

When the roots (denominators) are different, they must be made into a common number in order to create a single root.

$$x^{\frac{3}{4}} y^{\frac{5}{8}}$$

$$r^{\frac{2}{5}} s^{\frac{8}{3}}$$

$$j^{\frac{1}{2}} k^{\frac{2}{3}} m^{\frac{1}{4}}$$

118 Find the expression that is equivalent to:  $\sqrt[4]{x^3}$

A  $x^{\frac{3}{4}}$

B  $x^{\frac{4}{3}}$

C  $x^{12}$

D  $x^{\frac{1}{12}}$

Answer

119 Find the simplified expression that is equivalent to:  $\sqrt[4]{x^2}$

A  $x^{\frac{2}{4}}$

B  $x^{\frac{4}{2}}$

C  $x^{\frac{1}{2}}$

D  $x^2$

**Answer**

120 Find the simplified expression that is equivalent to:  $\sqrt[3]{x^2 y^6}$

A  $x^{\frac{2}{3}} y^{\frac{6}{3}}$

B  $x^{\frac{2}{3}} y^{\frac{3}{6}}$

C  $x^{\frac{2}{3}} y^2$

D  $x^{\frac{2}{3}} y^{\frac{1}{2}}$

Answer



121 Find the simplified expression that is equivalent to:  $x^{\frac{3}{5}}$

A  $\sqrt[5]{x^3}$

B  $\sqrt[3]{x^5}$

C  $\sqrt{x^{15}}$

D  $\sqrt[15]{x}$

Answer

122 Find the simplified expression that is equivalent to:  $4g^{\frac{1}{2}}$

A  $\sqrt{4g}$

B  $4\sqrt{g}$

C  $2\sqrt{g}$

D  $\sqrt{2g}$

**Answer**

123 Simplify:  $\sqrt[3]{27 p^{10} q^4}$

A  $3 p^{\frac{3}{10}} q^{\frac{3}{4}}$

B  $3 p^{\frac{10}{3}} q^{\frac{4}{3}}$

C  $27^3 p^{\frac{3}{10}} q^{\frac{3}{4}}$

D  $27 p^{\frac{10}{3}} q^{\frac{4}{3}}$

Answer

124 Write with rational exponents:  $\sqrt[4]{8x^2y^6}$

A  $8^{\frac{3}{4}}x^{\frac{1}{2}}y^{\frac{3}{2}}$

B  $2^{\frac{4}{3}}x^2y^{\frac{2}{3}}$

C  $2x^{\frac{1}{2}}y^{\frac{3}{2}}$

D  $2^{\frac{3}{4}}x^{\frac{1}{2}}y^{\frac{3}{2}}$

Answer

125 Find the simplified expression that is equivalent to:  $j^{\frac{1}{3}} h^{\frac{1}{6}} g^{\frac{1}{2}}$

A  $\sqrt[6]{j^2 hg^3}$

B  $\sqrt[12]{j^2 hg^3}$

C  $\sqrt[6]{j^4 h^2 g^6}$

D  $\sqrt[12]{j^4 h^2 g^6}$

Answer

126 Write the following with exponents:  $\sqrt[6]{m^5 n^4 p^3}$

A  $m^{\frac{5}{6}} n^{\frac{4}{6}} p^{\frac{3}{6}}$

B  $m^{\frac{6}{5}} n^{\frac{3}{2}} p^2$

C  $m^{\frac{5}{6}} n^{\frac{2}{6}} p^{\frac{1}{6}}$

D  $m^{\frac{5}{6}} n^{\frac{2}{3}} p^{\frac{1}{2}}$

Answer

# Rational Exponents

When working with rational exponents, follow exactly the same rules as when working with other exponents.

$$\left(2a^{\frac{1}{3}}\right)^2$$

$$b^{\frac{1}{3}}b^{\frac{2}{3}}$$

$$c^{-\frac{2}{3}}$$

# Rational Exponents

Just like other problems where you must rationalize denominators, mathematicians like to have an integer power in the denominators. Therefore, if there is a fractional exponent in the denominator after simplifying, rationalize the denominator.

$$\left(a^{-\frac{3}{8}}\right)^{\frac{2}{9}}$$

$$\left(2p^{\frac{4}{3}}\right)^{-2}$$



127 Simplify:  $\left(2q^{\frac{1}{2}}\right)^6$

A  $12q^6$

B  $\frac{64}{q^{12}}$

C  $2q^{\frac{1}{12}}$

D  $64q^3$

**Answer**

128 Simplify:  $\left(m^{\frac{3}{2}}\right)\left(m^{\frac{1}{8}}\right)^4$

A  $m^{\frac{12}{16}}$

B  $m^{\frac{7}{10}}$

C  $m^{\frac{3}{2}}$

D  $m^2$

Answer

129 Simplify:  $m^{-\frac{2}{3}}$

A  $m^{\frac{1}{3}}$

B  $-m^{\frac{2}{3}}$

C  $\frac{m^{\frac{1}{3}}}{m}$

D  $-\frac{m^{\frac{1}{3}}}{m}$

Answer

130 Simplify:  $\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}x^{\frac{1}{10}}}$

A  $\frac{x^{\frac{8}{10}}}{x}$

B  $\frac{x^{\frac{3}{5}}}{x}$

C  $\frac{x^{\frac{7}{5}}}{x}$

D  $\frac{x^{\frac{1}{5}}}{x^{\frac{6}{10}}}$

Answer

131 Simplify and write as a radical:  $\left(x^{\frac{3}{4}}\right)^{\frac{2}{3}}$

A  $\sqrt{x}$

B  $\sqrt[4]{x^3}$

C  $\sqrt{x^3}$

D  $\sqrt[3]{x^2}$

**Answer**

132 Simplify. Make sure your denominator is rational.  $\left( (16m)^{-\frac{4}{5}} \right)^{\frac{15}{16}}$

A  $\frac{m^{\frac{1}{4}}}{8m}$

C  $\frac{8}{m^{\frac{3}{4}}}$

B  $\frac{8m^{\frac{1}{4}}}{m}$

D  $8m^{\frac{3}{4}}$

**Answer**