

## RATIONAL EXPONENTS

$$\begin{array}{l}
 2^3 = 8 \\
 2^2 = 4 \\
 2^1 = 2 \\
 2^{1/2} = \sqrt{2} \\
 2^0 = 1 \\
 2^{-1} = 1/2
 \end{array}$$

Fraction Exponents

$$\frac{\text{top}}{\text{bottom}} = \frac{\text{inside}}{\text{outside}(\text{root\#})}$$

Examples: Change each rational (fraction) exponent ***into radical form***.

1)  $5^{1/4}$

$$\sqrt[4]{5^1}$$

2)  $x^{2/5}$

$$\sqrt[5]{x^2}$$

3)  $64^{1/3}$

$$\sqrt[3]{64^1} = 4$$

4)  $(2y^5)^{1/2}$

$$\sqrt{2y^5} = y^2 \sqrt{2y}$$

5)  $(w^3)^{2/7}$

$$\sqrt[7]{(w^3)^2} = \sqrt[7]{w^6}$$

6)  $9^{1/5} j^{2/5} k^{4/5}$

$$\sqrt[5]{9j^2k^4}$$

Examples: Write each radical using rational (***fraction***) exponents.

1)  $\sqrt[3]{11}$

$$11^{1/3}$$

2)  $\sqrt[5]{y^3}$

$$y^{3/5}$$

3)  $\sqrt{81w^5}$

$$9w^{5/2}$$

square root of 81 is 9,  
no reason to write a  
fraction exponent

4)  $\sqrt[4]{8xy^2}$

$$8^{1/4} x^{1/4} y^{2/4} = 8^{1/4} x^{1/4} y^{1/2}$$

fourth root of 8 doesn't  
exist, so we do need a  
fraction exponent

5)  $\sqrt[3]{-27a^6b^7}$

$$-3a^{6/3}b^{7/3} = -3a^2b^{7/3}$$

6)  $\sqrt[9]{r^3}$

$$r^{3/9} = r^{1/3}$$

Examples: ***Evaluate***. (Find an actual answer)

1)  $289^{1/2}$

$$\sqrt{289} = 17$$

negative  
exponents; move  
to bottom

3)  $27^{-5/3}$

$$\frac{1}{\sqrt[3]{27^5}} = \frac{1}{3^5} = \frac{1}{243}$$

2)  $243^{3/5}$

$$\sqrt[5]{243^3} = 3^3 = 27$$

or  $= \sqrt[5]{14348907} = 27$

you can do either  
the "fifth root" of  
243 or 243  
"cubed" first, but  
which looks  
easier?

4)  $\frac{8^{4/3}}{2}$

$$\frac{\sqrt[3]{8^4}}{2} = \frac{2^4}{2} = \frac{16}{2} = 8$$

Simplify each expression.

1)  $g^{2/5} \cdot g^{2/5}$

$$g^{4/5}$$

follow the rules for exponents, in this case "add" them

2)  $(b^{-2/3})^{9/2}$

$$b^{-18/6} = b^{-3} = \frac{1}{b^3}$$

follow the rules for exponents, in this case "mult." them

3)  $\frac{j^{7/10}}{j^{3/10}}$

$$j^{4/10} = j^{2/5}$$

follow the rules for exponents, in this case "subt." them

4)  $\frac{x^{4/5}}{2x^{-1/3}}$

$$\frac{x^{4/5} \cdot x^{1/3}}{2} = \frac{x^{12/15} \cdot x^{5/15}}{2} = \frac{x^{17/5}}{2}$$

move the negative exponent, then add them

5)  $y^{-1/3}$

$$\frac{1}{y^{1/3}} = \frac{1}{y^{1/3}} \cdot \frac{y^{2/3}}{y^{2/3}} = \frac{y^{2/3}}{y}$$

move the negative exponent then rationalize the denominator

6)  $(r^{-3/5})(r^{-3/10})$

$$r^{-6/10} \cdot r^{-3/10} = r^{-9/10} = \frac{1}{r^{9/10}} \cdot \frac{r^{1/10}}{r^{1/10}} = \frac{r^{1/10}}{r}$$

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Simplify.

7)  $\frac{5}{y^{1/2} - 3}$

$$\frac{5}{y^{1/2} - 3} \cdot \frac{y^{1/2} + 3}{y^{1/2} + 3} = \frac{5y^{1/2} + 15}{y - 9}$$

use the "conjugate" to get rid of the fraction exp. on the bottom, remember to use just the F&L from FOIL

8)  $\sqrt[6]{8}$

$$\sqrt[6]{8} = \sqrt[6]{2^3} = 2^{3/6} = 2^{1/2} = \sqrt{2}$$

the key is to write the original number with an exponent. for instance;  $81 = 3 \times 3 \times 3 \times 3 = 3^4$

9)  $\sqrt[4]{16}$

$$\sqrt[4]{16} = \sqrt[4]{2^4} = 2^{4/4} = 2^{1/1} = \sqrt[4]{2^2} = \sqrt{2}$$