March 13, 2017

8-3 Rational Exponents

I can write rational exponents as radicals and vice versa

fraction

I can simplify rational exponents

fraction

Plug in the list of values for "a" and determine what the rational exponent does to "a."

1, 4, 9, 16, 25, 36

$\sqrt{a} = a^{\left(\frac{1}{2}\right)} =$ $1^{1/2}=1, 4^{1/2}=2, 9^{1/2}=3, 16^{1/2}=4$

square root

1, 8, 27, 64, 125, 216

$\sqrt[3]{a} = a^{\left(\frac{1}{3}\right)} = 1, 2, 3, 4, 5, 6$

cube root

1, 8, 27, 64, 125, 216

$\sqrt[3]{a^2} = a^{\left(\frac{2}{3}\right)} =$ $1^2, 2^2, 3^2, 4^2, 5^2, 6^2$ $= 1, 4, 9, 16, 25, 36$

1, 16, 81, 256, 625, 1296

$a^{\left(\frac{3}{4}\right)} = \sqrt[4]{a^3}$

Fractional exponent

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

n is an integer bigger than or equal to 2

$a^{\frac{1}{2}} = \sqrt{a}$ $a^{1/3} = \sqrt[3]{a}$ $a^{\frac{1}{9}} = \sqrt[9]{a}$

Write each of the following as a radical and simplify, if possible.

$9^{\frac{1}{2}}$

$\sqrt{9} = 3$

$(-64)^{\frac{1}{3}} = -4$

$\sqrt[3]{-64}$

8 8

4 2 4 2

2 2 2 2

$100^{\frac{1}{2}}$

$\sqrt{100} = 10$

10 10

$z^{\frac{1}{2}}$

$\sqrt{z}$

$25^{\frac{1}{2}} = \sqrt{25} = 5$

$(-27)^{\frac{1}{3}} = \sqrt[3]{-27} = -3$

$-27 = 9 \cdot 3$

$9 = 3 \cdot 3$

$b^{\frac{1}{2}} = \sqrt{b}$

Rewrite in exponent form

$\sqrt[7]{x}$ $x^{\frac{1}{7}}$

$\sqrt[4]{b}$ $b^{\frac{1}{4}}$

$\sqrt[12]{r}$ $r^{\frac{1}{12}}$

$\sqrt[5]{d}$ $d^{\frac{1}{5}}$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$$

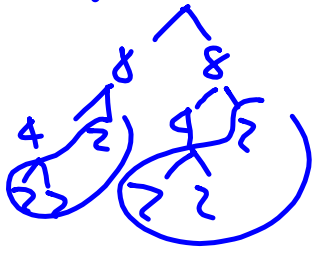
a is real, m/n is a rational number in lowest terms with n bigger or equal to 2

POWER TO THE SKY,
ROOTS IN THE GROUND

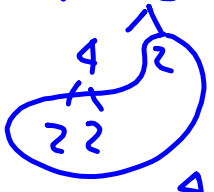
Write each of the following as a radical and simplify, if possible.

$25^{\frac{3}{2}} = \sqrt{25}^{3} = 5^{3} = 125$

$64^{\frac{2}{3}} = \sqrt[3]{64}^{2} = 4^{2} = 16$



$(-8)^{\frac{4}{3}} = \sqrt[3]{-8}^{4}$



$= -2^{4} = -2 \cdot -2 \cdot -2 \cdot -2$

$4 \cdot 4 = 16$

Write each of the following as a radical and simplify, if possible.

$27^{\frac{2}{3}}$

$\sqrt[3]{27}^{2}$

3^{2}

9

$16^{\frac{3}{2}}$

$\sqrt{16}^{3}$

4^{3}

64

Rewrite in exponent form

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

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

$\left(\sqrt[4]{r}\right)^2$

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

$\sqrt[8]{a^3}$

$a^{\frac{3}{8}}$

$\left(\sqrt[3]{h}\right)^9$ SKV

$h^{\frac{9}{3}} = h^3$

Just a reminder.

Exponent Rules

$$a^0 = 1 \qquad \text{if } a \neq 0$$

$$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n \qquad \text{if } a \neq 0$$

$$a^m \cdot a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n} \quad \text{if } a \neq 0$$

$$(a^m)^n = a^{m \cdot n}$$

$$(a \cdot b)^n = a^n \cdot b^n$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad \text{if } b \neq 0$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \quad \text{if } a \neq 0,\ b \neq 0$$

$$r^{\frac{3}{4}} \cdot r^{\frac{1}{6}} = r^{\frac{11}{12}} = \sqrt[12]{r^{11}}$$

$$\frac{x^{\frac{2}{3}}}{x^{\frac{1}{5}}} = x^{7/15}$$

Simplify using properties of exponents. Leave answers with rational exponents

$$x^{\frac{1}{2}} \cdot x^{\frac{1}{3}} = x^{5/6}$$

$$\frac{x^{\frac{1}{3}}}{x^{\frac{5}{3}}} = x^{-4/3} = \frac{1}{\sqrt[3]{x^4}}$$

$$\sqrt[3]{(10n)^{3/2}}$$