Rational Exponents:

Rational #'s: #'s that can be written as a fraction

Rational Exponent: exponent written as fraction!

$x^{\frac{n}{m}}$ → n → power: how many times to multiply base

→ m → root: a # that multiplies that many times to get base ($m \geq 1$)

x = base

writing expo form to radical form

$$x^{\frac{n}{m}} \Rightarrow \sqrt[m]{x^n} \Rightarrow \left(\sqrt[m]{x}\right)^n$$

expo form → radical form

example: $\sqrt{\ }$ = understood square root

$$4^{3/2} = \sqrt{4^3} = \left(\sqrt{4}\right)^3$$

$$\sqrt{64} = (2)^3$$

$$= 8 \quad = 8 \quad = 8$$

Expo form to radical form

$$\left(4x^5y^7\right)^{1/9} = \sqrt[9]{4x^5y^7}$$

$$\left(2x^3y^4\right)^{2/5}$$

$$2^{2/5}x^{6/5}y^{8/5} = \sqrt[5]{2^2x^6y^8}$$

radical form to expo form

$$\sqrt[6]{7^5x^3y^9} = 7^{5/6}x^{3/6}y^{9/6}$$

$$7^{5/6}x^{1/2}y^{3/2}$$

$$\sqrt[4]{16^1x^5y^8z^{13}} = 16^{\frac{1}{4}}x^{\frac{5}{4}}y^{\frac{8}{4}}z^{\frac{13}{4}}$$

$16 = 4 \cdot 4 = 2 \cdot 2 \cdot 2 \cdot 2$

$$\boxed{2x^{\frac{5}{4}}y^2z^{13/4}}$$

Simplifying

ex: $(x^{\frac{3}{2}} y^{\frac{1}{3}})(2x^{\frac{9}{2}} y^{\frac{8}{3}})$

$2x^{12/2} y^{9/3} = 2x^6 y^3$

ex: $(8x^{8} y^{-15})^{1/3}$

$8^{1/3} x^{8/3} y^{-5} = \frac{2x^{8/3}}{y^5}$

Write in simpliest radical form

ex: $(2^5 x^8 y^{16})^{1/5}$

$\sqrt[5]{2^5 x^8 y^{16}}$

5 | 8 (1 outside)
−5
3 inside

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

• write in simpliest radical form

$(6x^4 y^5 z^{11})^{1/3} = \sqrt[3]{6x^4 y^5 z^{11}}$

3 | 11 (3 out)
−9
2 in

$x^1 y^1 z^3 \sqrt[3]{6x^1 y^2 z^2}$

$(2^7 x^9 y^{15} z^{23})^{1/5} = \sqrt[5]{2^7 x^9 y^{15} z^{23}}$

$2xy^3 z^4 \sqrt[5]{2^2 x^4 z^3}$

Equations with rational exponents

ex: $x^{3/2} - 8 = 19$
$+8 \quad +8$
$x^{3/2} = 27$
$(x^{3/2})^{2/3} = (27)^{2/3}$
$x = 9$

$\sqrt[3]{x^3} = \sqrt[3]{\#}^{2} = 1/3$
$(\sqrt{x})^2 = \#^2$
$\Rightarrow \sqrt[3]{27} = 3^2 = 9$

ex: $2x^{5/2} - 8 = 56$
$+8 \quad +8$
$2x^{5/2} = 64$
$x^{5/2} = 32$
$x^{2/5} = 32^{2/5}$
$x = 4$

simplest radical form

ex:

$$\sqrt[3]{4x^8y^{21}z^4}$$

$4 = 2^2$

$z^4 = z^3 \cdot z^1$

$3\overline{)4}$ R 1

-3

1

$$x^2y^7z\sqrt[3]{4x^2z}$$

Solving equations with rational exponents

ex. $x^{\frac{2}{3}} + 4 = 20$

$-4 \quad -4$

$(\sqrt[3]{x})^3$

$(x^{2/3})^{3/2} = (16)^{3/2}$

$\sqrt{x^2} = (x^2)^{1/2}$

$x = 64$

ex: $2x^{5/2} - 8 = 56$

$+8 \quad +8$

$x^{\frac{5}{2}\cdot\frac{2}{5}} = 32^{2/5}$

$\frac{2x^{5/2}}{2} = \frac{64}{2}$

$x = 4.$