1-4 Rational Exponents

Rational exponent Calc task

1, 4, 9, 16, 25, 36

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

1, 8, 27, 64, 125, 216

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

1, 16, 81, 256, 625, 1296

$a^{\left(\frac{3}{4}\right)} =$ _____

$$a^{\left(\frac{m}{n}\right)} = \_\_\_\_\_$$

Fractional exponent

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

n is an integer bigger than or equal to 2

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

$9^{\frac{1}{2}}$ $(-64)^{\frac{1}{3}}$

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

You try

$25^{\frac{1}{2}}$ $(-27)^{\frac{1}{3}}$

$-64^{\frac{1}{2}}$ $b^{\frac{1}{2}}$

Rewrite in exponent form

$\sqrt[4]{7a}$

$\sqrt[5]{\frac{xy^3}{4}}$

You try

$\sqrt[5]{8b}$

$\sqrt[8]{\frac{mn^5}{3}}$

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

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

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

$25^{\frac{3}{2}}$ $\quad 64^{\frac{2}{3}}$ $\quad -9^{\frac{5}{2}}$

$(-8)^{\frac{4}{3}}$ $\quad (-81)^{\frac{7}{2}}$

You try

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

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

$(-25)^{\frac{5}{2}}$

$-16^{\frac{3}{4}}$

Rewrite in exponent form

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

$\left(\sqrt[5]{10a^2b}\right)^4$

You try

$$\sqrt[8]{a^3} \qquad \left(\sqrt[4]{12ab^3}\right)^9$$

$$a^{-\frac{m}{n}} = \frac{1}{a^{\frac{m}{n}}} \quad \text{and} \quad \frac{1}{a^{-\frac{m}{n}}} = a^{\frac{m}{n}}$$

$\frac{m}{n}$ is a rational number, and a is a nonzero real number

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

$$36^{-\frac{1}{2}}$$

$$\frac{1}{27^{-\frac{2}{3}}}$$

$$(6a)^{-\frac{5}{4}}$$

You try

$$81^{-\frac{1}{2}}$$

$$\frac{1}{8^{-\frac{2}{3}}}$$

$$(13x)^{-\frac{3}{2}}$$

Simplify Expressions Using the Laws of Exponents

Just a reminder:

Rules

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

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

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

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

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

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

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

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

After you simplify you should have:

- Only positive exponents.
- Each base only occurring once.
- Have no parentheses in the expression.
- No powers written to powers.

Simplify each of the following:

$$27^{\frac{1}{2}} \cdot 27^{\frac{5}{6}}$$

$$\frac{8^{\frac{1}{3}}}{8^{\frac{5}{3}}}$$

You Try

$$5^{\frac{3}{4}} \cdot 5^{\frac{1}{6}}$$

$$\frac{32^{\frac{6}{5}}}{32^{\frac{3}{5}}}$$

Simplify each of the following:

$$\left(36^{\frac{2}{5}}\right)^{\frac{5}{4}}$$

$$\left(x^{\frac{1}{2}} \cdot y^{\frac{2}{3}}\right)^{\frac{3}{2}}$$

You Try

$$\left(100^{\frac{3}{8}}\right)^{\frac{4}{3}}$$

$$\left(a^{\frac{3}{2}} \cdot b^{\frac{5}{4}}\right)^{\frac{2}{3}}$$

Simplify the following:

$$\left(x^{\frac{2}{3}}y^{-1}\right)\cdot\left(x^{-1}y^{\frac{1}{2}}\right)^{\frac{2}{3}}$$

Use rational exponents to simplify the radicals.

$$\sqrt[8]{16^4} \qquad \sqrt[3]{64x^6y^3}$$

Use rational exponents to simplify the radicals.

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

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