

Day 2: Properties of Rational Exponents

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1) Okay, so we have the properties down with integer exponents. Sometimes, our exponents are

ratio meaning there are fraction.

Before we work with rational exponents, we need to practice operations with fractions.

2) When adding or subtracting fractions, you need a Common denominator, then add the numerator.

When multiplying fractions, multiply Straight across then simplify.

When dividing fractions, find the reciprocal of the second fraction, then multiply according to multiplication rules.

$$3) \frac{2}{3} + \frac{5}{9}$$

$$\frac{6}{9} + \frac{5}{9} = \frac{11}{9}$$

$$5) \frac{2}{5} - \frac{1}{6}$$

$$\frac{12}{30} - \frac{5}{30} = \frac{7}{30}$$

$$7) \frac{2}{3} \cdot \frac{2}{5} = \frac{4}{15}$$

$$9) \frac{2}{3} \div \frac{1}{2} = \frac{2}{3} \cdot \frac{2}{1} = \frac{4}{3}$$

$$4) \frac{1}{4} + \frac{3}{5}$$

$$\frac{5}{20} + \frac{12}{20} = \frac{17}{20}$$

$$6) \frac{11}{12} - \frac{1}{3}$$

$$\frac{11}{12} - \frac{4}{12} = \frac{7}{12}$$

$$8) \frac{1}{6} \cdot \frac{3}{7} = \frac{3}{42} = \frac{1}{14}$$

$$10) \frac{4}{7} \div \frac{14}{1} = \frac{4}{7} \cdot \frac{1}{14} = \frac{4}{98} = \frac{2}{49}$$

11) Now apply the same properties as above, but with rational exponents (fraction exponents)

Simplify. Your answer should only contain positive exponents.

$$12) r r^{\frac{3}{2}} = r^1 \cdot r^{\frac{3}{2}} = r^{\frac{5}{2}}$$

$$\frac{1}{2} + \frac{3}{2} = \frac{4}{2} = 2$$

$$13) m^{\frac{1}{3}} \cdot m^{\frac{3}{3}} = m^{\frac{4}{3}}$$

$$14) x^0 x^{\frac{1}{2}} x^{\frac{2}{7}}$$

$$x^{\frac{10}{2}} \cdot x^{\frac{1}{2}} \cdot x^{\frac{4}{2}}$$

$$x^{\frac{15}{2}}$$

$$15) \left(n^{\frac{2}{3}} \right)^{\frac{9}{5}}$$

$$= n^{\frac{18}{5}}$$

$$= n^{\frac{3 \cdot 6}{5}}$$

$$16) x^{\frac{1}{3}} x^{\frac{2}{7}}$$

$$= x^{\frac{1}{3}} x^{\frac{4}{14}}$$

$$= x^{\frac{2}{7}}$$

$$17) \left(x^{\frac{2}{7}} x^{\frac{1}{3}} \right)^2$$

$$= \left(x^{\frac{6}{21}} x^{\frac{7}{21}} \right)^2$$

$$= \left(x^{\frac{13}{21}} \right)^2$$

$$= x^{\frac{26}{21}}$$

$$18) \left(x^{\frac{1}{2}} \cdot x^{\frac{1}{4}} \right)^3$$

$$= \left(x^{\frac{2}{4}} \cdot x^{\frac{1}{4}} \right)^3$$

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

$$= x^{\frac{9}{4}}$$

$$19) \left(x^{\frac{4}{6}} \right)^3$$

$$= \left(x^{\frac{2}{3}} \right)^3$$

$$= x^{\frac{12}{6}} = x^2$$

$$20) \frac{n^{\frac{3}{2}}}{n^{\frac{3}{4}}}$$

$$= n^{\frac{3}{2} - \frac{3}{4}}$$

$$= n^{\frac{6}{4} - \frac{3}{4}}$$

$$= n^{\frac{3}{4}}$$

$$21) \frac{a^2}{a^{\frac{3}{2}}}$$

$$= a^{2 - \frac{3}{2}}$$

$$= a^{\frac{4}{2} - \frac{3}{2}}$$

$$= a^{\frac{1}{2}}$$

$$22) \frac{m^{\frac{5}{3}}}{m^{\frac{1}{3}}} = m^{\frac{5}{3} - \frac{1}{3}}$$

$$= m^{\frac{4}{3}}$$

$$= m^{\frac{2}{3/2}}$$

$$23) \frac{r^{\frac{7}{4}}}{r^{\frac{3}{4}}} = r^{\frac{7}{4} - \frac{3}{4}}$$

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

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

$$24) \left(\frac{x}{x^4 \cdot x} \right)^{\frac{3}{4}} = \left(\frac{x}{x^5} \right)^{\frac{3}{4}}$$

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

$$= \frac{1}{x^{\frac{12}{4}}} = \frac{1}{x^3}$$

$$25) \left(\frac{n^{-\frac{7}{4}}}{n^2 n^{-2}} \right)^{-2} = \left(\frac{n^{-\frac{7}{4}}}{1} \right)^{-2} = n^{\frac{7}{2}}$$

$\frac{2 - (-2) = 0}{n^0}$

$$= n^{\frac{7}{2}}$$

$$26) \frac{\left(\frac{3}{4} \right)^{\frac{5}{3}} \cdot x^{\frac{3}{2}}}{(x^{-1})^2} = \frac{x^{\frac{15}{2}} \cdot x^{\frac{3}{2}}}{x^{-2}}$$

reduce

$$= x^{\frac{15}{2}} \cdot x^{\frac{3}{2}} \cdot x^2$$

$$= x^{\frac{21}{2}} \cdot x^{\frac{4}{2}} \cdot x^{\frac{4}{2}}$$

$$= x^{\frac{29}{2}}$$

Use Same Common Denom.

$$27) \frac{\left(\frac{5}{r^4} \right)^{\frac{3}{2}}}{r^{\frac{3}{2}} r^{-\frac{3}{2}}} = \frac{r^{\frac{15}{2}}}{r^{\frac{3}{2}} \cdot r^{\frac{3}{2}}} = \frac{r^{\frac{15}{2}}}{r^{\frac{6}{2}} \cdot r^{\frac{3}{2}}}$$

$$= \frac{r^{\frac{15}{2}}}{r^{\frac{9}{2}}} = r^{\frac{6}{2}} = r^3$$

$$28) \frac{n^{\frac{3}{2}}}{n^{\frac{1}{4}} \cdot (n^{-\frac{2}{3}})^{\frac{5}{3}}}$$

$$= \frac{n^{\frac{3}{2}}}{n^{\frac{1}{4}} \cdot n^{\frac{10}{9}}} = \frac{n^{\frac{16}{12}}}{n^{\frac{3}{12}} \cdot n^{\frac{40}{12}}}$$

$$= \frac{n^{\frac{16}{12}}}{n^{\frac{43}{12}}} = \frac{1}{n^{\frac{43}{12} - \frac{16}{12}}} = \frac{1}{n^{\frac{27}{12}}}$$

$$29) \frac{k^{\frac{5}{3}} \cdot k^{\frac{1}{3}}}{(k^{-2})^2} = \frac{k^{\frac{10}{3}} \cdot k^{\frac{1}{3}}}{k^{-4}}$$

$k^4 = k^{\frac{12}{3}}$

$$= k^{\frac{10}{3}} \cdot k^{\frac{1}{3}} \cdot k^{\frac{12}{3}}$$

$$= k^{\frac{23}{3}}$$

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Let's review what the parts of a radical expression are:

30)

31) What do the numbers mean when we are writing an expression with a rational exponent?

The numerator is the power of the radicand.

The denominator is the index of the root.

In other words, $\sqrt{3} = \sqrt{3^1}$ can be written as $3^{\frac{1}{2}}$.

Example: $4^{\frac{2}{3}} = \sqrt[3]{4^2}$

Write each expression in radical form.

32) $n^{\frac{5}{4}}$ $(\sqrt[4]{n})^5 = \sqrt[4]{n^5}$

33) $(5m)^{\frac{3}{2}}$ $(\sqrt[2]{5m})^3$
 $= \sqrt{(5m)^3} = \sqrt{125m^3}$

34) $(2x)^{\frac{5}{6}}$ $(\sqrt[6]{2x})^5$

35) $r^{\frac{1}{3}}$ $\sqrt[3]{r}$ $5\sqrt{5m^3}$

Write each expression in exponential form.

36) $(\sqrt[4]{2p})^7$ $(2p)^{\frac{7}{4}}$

37) $(\sqrt[3]{10k})^5$ $(10k)^{\frac{5}{3}}$

38) $(\sqrt[3]{7n})^1$ $(7n)^{\frac{1}{3}}$

39) $(\sqrt[2]{6x})^5$ $(6x)^{\frac{5}{2}}$