Connecting Radicals and Exponents:

Time to continue our development of the properties of radicals...

What is the value of each of the following:

$\sqrt{5} \bullet \sqrt{5} = \sqrt{25} = 5^1$

$\sqrt{12}$

$\sqrt{4} \times \sqrt{3}$

$\sqrt{7} \times \sqrt{7} = 7^1$

$\sqrt[3]{7} \times \sqrt[3]{7} \times \sqrt[3]{7}$

$= \sqrt[3]{7^3} = 7^1$

$\sqrt[3]{3} \times \sqrt[3]{3} \times \sqrt[3]{3} =$

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

$\sqrt[3]{27}$

$= 3$

How about the following:

$x^{\frac{1}{2}} \bullet x^{\frac{1}{2}} = x^1$

$\sqrt{x} \cdot \sqrt{x} = x^1$

$7^{?} \times 7^{?} \times 7^{?} = 7^1$

$\pi^{\frac{1}{3}} \bullet \pi^{\frac{1}{3}} \bullet \pi^{\frac{1}{3}} =$

Quiz

$3^{\frac{1}{2}} = \sqrt{3}$

$16^{\frac{1}{2}} = 4 = \sqrt{16}$

Based on the previous slide it would seem that...

$\sqrt{x} = x^{\frac{1}{2}}$ $\sqrt[3]{x} = x^{\frac{1}{3}}$

Generally then... $\sqrt[n]{x} = x^{\frac{1}{n}}$

Powers with Rational Exponents with Numerator 1

When n is a natural number and x is a rational number, $x^{\frac{1}{n}} = \sqrt[n]{x}$

ex. $\sqrt[4]{7} = 7^{\frac{1}{4}}$

What about when numerator is NOT a 1??

ie. Something like $8^{\frac{5}{3}}$??

$\frac{5}{1}\left(\frac{1}{3}\right) = \frac{5}{3}$

Let's relate back to exponent laws...which one would help?

$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$ ---> $\left(8^{1/3}\right)^5 = \left(\sqrt[3]{8}\right)^5 = 2^5 = 32$

OR

$\left(8^5\right)^{\frac{1}{3}} = \sqrt[3]{32768} = 32$

$10^{\frac{4}{3}} = \left(\sqrt[3]{10}\right)^4 = \underline{\underline{21.54}}$

$\boxed{a^{b/c}}$

$10 \; \boxed{\wedge} \; \boxed{y^x} \; (4 / 3)$ 4, 3

$= \underline{21.54}$

$\frac{d}{c}$ $\boxed{a^{b/c}}$

$\frac{3}{4} + \frac{2}{5}$

$\frac{15}{20} + \frac{8}{20} = \frac{23}{20}$

$1\frac{3}{20}$

1 ⌴ 3 ⌟ 20

$\frac{23}{20}$

Important Property!!

Powers with Rational Exponents

When m and n are natural numbers, and x is a rational number,

$$x^{\frac{m}{n}} = \left(x^{\frac{1}{n}}\right)^m = \left(\sqrt[n]{x}\right)^m \quad \text{and} \quad x^{\frac{m}{n}} = (x^m)^{\frac{1}{n}} = \sqrt[n]{x^m}$$

ex. $x^{7/8} = \left(\sqrt[8]{x}\right)^7$ or $\sqrt[8]{x^7}$

Practice Problems...

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