June 8, 2015

Radicals

Chp 8

8.1 – n^{th} Roots

$a^{\frac{1}{n}}$ ← Rational Exponent

a ← Base

6^{1} ← exponent $= 6$

$5^{\frac{3}{1}} = 5 \cdot 5 \cdot 5$ (3 factors)

$= 25 \cdot 5$

$= 125$

Because $125 = 5^3$

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Power Rule for Exponents

$\left(a^{\frac{1}{n}}\right)^{\frac{n}{1}} = a^{\frac{1}{n} \cdot \frac{n}{1}} = a^{\frac{n}{n}} = a^1$

Base $= a$

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

a number that when squared is 4. → 2

Because $2^2 = 4$

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

$?^3 = 8$

$2^3 = 8$

$2 \cdot 2 \cdot 2 = 8$

$64^{\frac{1}{3}} = 4$

$?^3 = 64$

$4^3 = 64$

$4 \cdot 4 \cdot 4 = 64$

$16 \cdot 4 = 64$

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Review of Rules for Exponents

① Product Rule

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

same bases; common base

$x \cdot x^4 = x^{1+4=5}$

$y^2 \cdot y^3$

$y \cdot y \cdot y \cdot y \cdot y = y^{1+1+1+1+1=5}$

$= y^5$

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② Power Rule

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

$(t^3)^4 = t^{3 \cdot 4 = 12} = t^{12}$

$t^3 \cdot t^3 \cdot t^3 \cdot t^3 = t^{3+3+3+3=12}$

same base

$= t^{12}$

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③ Quotient Rule

same bases: $\frac{a^m}{a^n} = a^{m-n}$

$\frac{x^6}{x^3} = x^{6-3=3} = x^3$

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Forms of Quotient

$\frac{x^3}{x^2} = x^{3-2=1} = x$

$\frac{x^2}{x^3} = x^{2-3=-1} = x^{-1}$

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

Don't leave negative exponents

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$\frac{x^4}{x^{-5}} = x^{4-(-5)=4+5=9} = x^9$

$\frac{x^3}{x^6} = x^{3-6=-3} = x^{-3} = \frac{1}{x^3}$

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$y^{1/4} \cdot y^{5/3} = y^{\frac{1}{4}+\frac{5}{3}=\frac{3+20}{12}=\frac{23}{12}} = y^{\frac{23}{12}}$

- Product Rule
- addition of fractions

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$\frac{s^{\frac{1}{9}}}{s^{-\frac{1}{4}}} = s^{\frac{1}{9}-(-\frac{1}{4})=\frac{1}{9}+\frac{1}{4}=\frac{4+9}{36}=\frac{13}{36}} = s^{\frac{13}{36}}$

- Quotient Rule
- Addition of fractions

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$\left(x^{2/3}\right)^{4/5} = x^{\frac{2}{3}\cdot\frac{4}{5}=\frac{8}{15}} = x^{\frac{8}{15}}$

- Power Rule
- Mult. fractions

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$\frac{\left(x^{\frac{1}{3}}\right)^{-\frac{1}{4}}}{x^5} = \frac{x^{-\frac{1}{12}}}{x^5} = x^{-\frac{1}{12}-\frac{5}{1}=\frac{-1-60}{12}=-\frac{61}{12}} = x^{-\frac{61}{12}} = \frac{1}{x^{\frac{61}{12}}}$

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* Unless requested to do so by a question, leave fractions as improper!

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Relationship Between Rational Exponents and Radicals

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

(rational exponent; base; radicand; index of the radical)

"It's all about the index"

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Let $x = 5^{\frac{1}{3}}$

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

$x^3 = 5$

There is a number, x, that when cubed is 5.

$\sqrt[3]{x^3} = \sqrt[3]{5}$

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

$x = 5^{1/3}$

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

$x^{3/3-1}$

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$7^2 = 49$

$\sqrt{49} = 7$

a $7^2 = 49$

$7^2 = 49$

$\sqrt[2]{49} = \sqrt[2]{7^2}$

$\sqrt[2]{49} = 7$

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$\sqrt{7}$, $\sqrt{49} = 7$

$?^2 = 7$

Because $7^2 = 49$

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$4^{1/2} = \sqrt[2]{4^1}$

$= \sqrt{4}$

$= 2$

$8^{2/3} = \sqrt[3]{8^2}$

$= \sqrt[3]{64}$

$= 4$

or (all form)

$8^{2/3} = \sqrt[3]{8^2}$ (move to outside)

$= \left(\sqrt[3]{8}\right)^2$

$= (2)^2 = 4$

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$$\frac{1}{16^{3/2}} = \frac{1}{\sqrt[2]{16^3}} = \left(\frac{1}{\sqrt[2]{16}}\right)^3$$

$$= \frac{1}{\sqrt[2]{4096}} \qquad = \frac{1}{(4)^3}$$

$$= \frac{1}{64}$$

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Quiz #2 - Tomorrow

Prep Algebra

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