4-positive powers with rational exponents

1.4 POWERS WITH POSITIVE RATIONAL EXPOENENTS   Name: _____ Blk: ___

Recall:

> **Powers with Rational Exponents with Numerator 1**
>
> When n is as natural number and x is a rational number,
> $x^{\frac{1}{n}} = \sqrt[n]{x}$ ... for example... $16^{\frac{1}{2}} = \sqrt[2]{16} = 4$

Example 1) Write each power as a radical then evaluate without using a calculator.

a) $1000^{\frac{1}{3}}$

$= \sqrt[3]{1000}$

$= \boxed{10}$

b) $0.25^{0.5}$

$= 0.25^{\frac{1}{2}}$

$= \sqrt{0.25} \rightsquigarrow \dfrac{\sqrt{25}}{\sqrt{100}}$

$= \boxed{0.5}$

$= \dfrac{5}{10}$

$= \boxed{\dfrac{1}{2} / 0.5}$

c) $-8^{\frac{1}{3}}$

$= \sqrt[3]{-8}$

$= \boxed{-2}$

d) ~~$\dfrac{16^{\frac{1}{4}}}{81}$~~ $\left(\dfrac{16}{81}\right)^{1/4}$

$= \dfrac{16^{1/4}}{81^{1/4}}$

$= \dfrac{\sqrt[4]{16}}{\sqrt[4]{81}}$

$= \boxed{\dfrac{2}{3}}$

Example 2) Write the following radicals as a power with a rational exponent.

a) $\sqrt[4]{5.8}$

$= 5.8^{\frac{1}{4}}$

b) $\sqrt[3]{\dfrac{20}{9}}$

$= \left(\dfrac{20}{9}\right)^{\frac{1}{3}}$

c) $2\sqrt[3]{5}$

*write as an entire radical first.

$= \sqrt[3]{2^3} \cdot \sqrt[3]{5}$

$= \sqrt[3]{40}$

$= 40^{1/3}$

d) $\sqrt{6^5}$

$= 6^{\frac{5}{2}}$

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

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

The denominator of the rational exponent is the index of the radical

Example 3) Write each power as a radical, then evaluate the radical.

a) $(-8)^{\frac{2}{3}}$

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

$= \sqrt[3]{64}$

$= \boxed{4}$

b) $\left(\frac{1}{9}\right)^{\frac{3}{2}}$

$= \sqrt{\left(\frac{1}{9}\right)^3}$

$= \sqrt{\frac{1^3}{9^3}}$

$= \sqrt{\frac{1}{729}}$

$= \boxed{\frac{1}{27}}$

c) $100^{2.5}$ ← change to a fraction

$2.5 = \frac{25}{10} \left(\frac{5}{2}\right)$

$= 100^{\frac{5}{2}}$

$= \sqrt{100^5}$

$= \sqrt{10{,}000{,}000{,}000}$

$= \boxed{100{,}000}$

$\sqrt{x} = \sqrt[2]{}$

Example 4) Write each power as a radical, the evaluate.

a) $(-128)^{\frac{3}{7}}$

$= \left(\sqrt[7]{-128}\right)^3$

$= (-2)^3$

$= \boxed{-8}$

b) $\left(\frac{1}{4}\right)^{\frac{5}{2}}$

$= \left(\sqrt{\frac{1}{4}}\right)^5$

$= \frac{1}{32}$

c) $-81^{2.5}$

$= -81^{\frac{5}{2}}$

$= \left(-\sqrt{81}\right)^5$

$= \boxed{-59049}$

d) $0.01^{\frac{3}{2}}$

$= \left(\sqrt{0.01}\right)^3$

$= \boxed{0.001}$

Assignment:
- 1.4 WB questions p.41-47
- Quiz on Thursday 1.1-1.3
- Do the checkpoint for review - p.31-34