Rational Exponents

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

Rational Exponent?

$$4^{0.5}$$

Rational Numbers: Any number that can be written in fraction form is a rational number. This includes integers, terminating decimals, and repeating decimals as well as fractions. ... So, any terminating decimal is a rational number.

$\boxed{y^x}$ or $\boxed{x^y}$ or $\boxed{\wedge}$

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

$\boxed{x^{\square}}$

Rational Exponents

to

Radicals

$\sqrt{4}$

$= 2$

Rational Exponents

to

Radicals

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

exponent

index

$$\left(\sqrt[3]{8}\right)^1$$

$= 2$

Rational Exponents

to

Radicals

$$81^{\frac{1}{4}}$$ (index)

$$\sqrt[4]{81}$$

$$= 3$$

What if...

Rational Exponents

to

Radicals

$$125^{\frac{2}{3}}$$

2 (exponent)
3 (index)

$$= \left(\sqrt[3]{125}\right)^2$$

$$= (5)^2$$

$$= 25$$

Express the radical as a power.

$\left(\sqrt[3]{15}\right)^{1}$ $= 15^{\frac{1}{3}}$

$\left(\sqrt[2]{25}\right)^{7}$ $= 25^{\frac{7}{2}}$

$\left(\sqrt[5]{9}\right)^{2}$ $= 9^{\frac{2}{5}}$

Let's Take a Closer Look!!

Fill in the chart. (You can use your calculator!!)

x	$x^{\frac{1}{2}} = \sqrt{x}$
1	$1^{\frac{1}{2}} = \sqrt{1} = 1$
4	$4^{\frac{1}{2}} = \sqrt{4} = 2$
9	$9^{1/2} = \sqrt{9} = 3$
16	$16^{1/2} = \sqrt{16} = 4$
25	$25^{1/2} = \sqrt{25} = 5$

perfect cubes

x	$x^{\frac{1}{3}} = \sqrt[3]{x}$
1	$1^{1/3} = \sqrt[3]{1} = 1$
8	$8^{1/3} = \sqrt[3]{8} = 2$
* 27	$27^{1/3} = \sqrt[3]{27} = 3$
64	$64^{1/3} = \sqrt[3]{64} = 4$
125	$125^{1/3} = \sqrt[3]{125} = 5$

What do you notice?

$$\sqrt[3]{27} = \sqrt[3]{\underline{3 \cdot 3 \cdot 3}}$$
$$= 3$$

Our Conclusion

- Raising a number to an exponent of 1/2 is equivalent to taking the square root!
- Raising a number to an exponent of 1/3 is equivalent to taking the cube root!

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

$$x^{m/n} = \left(\sqrt[n]{x}\right)^{m}$$

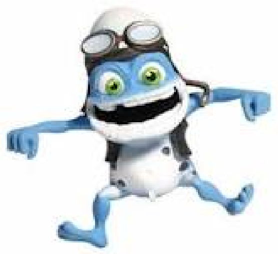
Practice Questions

Calculate each of the following without using a calculator:

$27^{1/3}$ $100^{1/2}$ $16^{1/4}$

$= \sqrt[3]{27}$ $= \sqrt{100}$ $= \sqrt[4]{16}$

$= 3$ $= 10$ 2



Calculate each of the following without using a calculator:

$36^{0.5}$

$= 36^{1/2}$

$= \sqrt{36}$

$= 6$

$32^{0.2}$

$= 32^{2/10}$

$= 32^{1/5}$

$= \sqrt[5]{32}$

$= 2$

$625^{0.25}$

$= 625^{25/100}$

$= 625^{1/4}$

$= \sqrt[4]{625}$

$= 5$

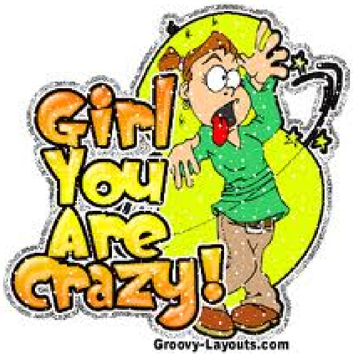
Calculate each of the following without using a calculator:

$4^{3/2}$

$= (\sqrt{4})^3$

$= (2)^3$

$= 8$



$27^{2/3}$

$= (\sqrt[3]{27})^2$

$= (3)^2$

$= 9$

Therefore:

$$x^{m/n} = (\sqrt[n]{x})^m$$

Write as a power:

$$(\sqrt[4]{625})^{9}$$

$$= 625^{9/4}$$

Calculate the following **without using a calculator:**

$128^{1/7}$

$= \sqrt[7]{128}$

$= 2$

$343^{2/3}$

$= \left(\sqrt[3]{343}\right)^2$

$= (7)^2$

$= 49$

Calculate the following **without using a calculator:**

$289^{3/2}$

$= \left(\sqrt{289}\right)^3$

$= (17)^3$

$= 4913$

$625^{3/4}$

$= \left(\sqrt[4]{625}\right)^3$

$= (5)^3$

$= 125$

Stop....

Check out page 227.

Questions:

5, 6,

7a,b, f

8,

10a,c,f,

11, 15

$2.\underline{5}$

$= 2\frac{1}{2}$ mixed number

$= \frac{5}{2}$ improper fraction