Fractional Exponents

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

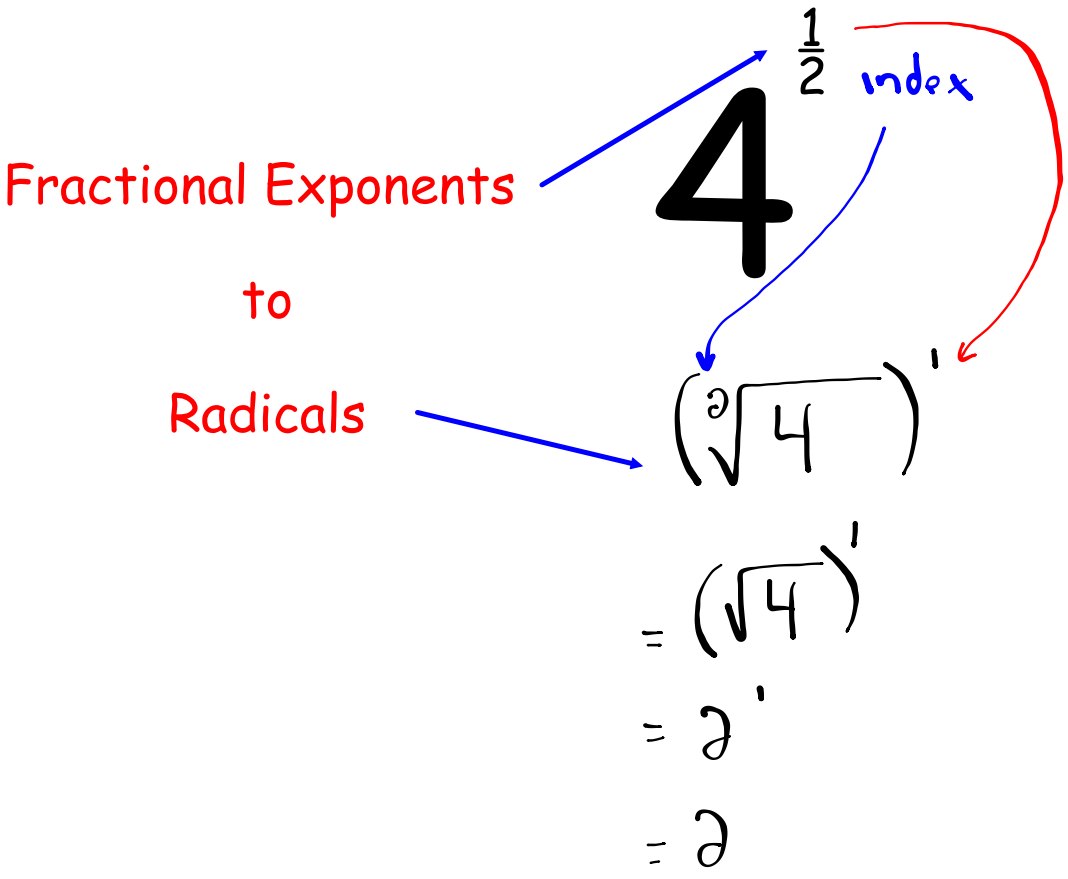
Fractional Exponent?

$$4^{0.5}$$

Fractional Exponents

to

Radicals



$= (\sqrt{4})'$

$= 2'$

$= 2$

Fractional Exponents

to

Radicals

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

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

$= (2)^{1}$

$= 2$

Fractional Exponents

to

Radicals

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

$\left(\sqrt[4]{81}\right)^{1}$

$= (3)^{1}$

$= 3$

What if...

Fractional Exponents

to

Radicals

Exponent button:

^ or y^x or x^y

$125^{\frac{2}{3}}$ exponent / index

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

$=(5)^2$

$=25$

Express the radical as a power.

$\sqrt[3]{15}^{1}$ $\sqrt[2]{25}^{7}$ $\sqrt[5]{9}^{2}$

$15^{1/3}$ $25^{7/2}$ $9^{2/5}$

radicand = base

exponent = numerator

index = denominator

Let's Take a Closer Look!!

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

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

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

What do you notice?

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!

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

Practice Questions

Calculate each of the following without using a calculator:

$27^{1/3}$

$= (\sqrt[3]{27})^1$

$= \sqrt[3]{27}$

$= 3$

$100^{1/2}$

$= (\sqrt[2]{100})^1$

$= \sqrt{100}$

$= 10$

$16^{1/4}$

$= (\sqrt[4]{16})^1$

$= \sqrt[4]{16}$

$= 2$

Calculate each of the following without using a calculator:

$36^{0.5}$

$= 36^{5/10}$

$= 36^{1/2}$

$= \sqrt{36}$

$= 6$

$32^{0.2}$

$= 32^{2/10}$

$= 32^{1/5}$

$= \sqrt[5]{32}$

$= 2$

$625^{0.25}$

$= 625^{25/100}$

$= 625^{1/4}$

$= \sqrt[4]{625}$

$= 5$

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:

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

Write as a power:

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

$$625^{\frac{9}{4}}$$

Calculate the following without using a calculator:

$128^{1/7}$

$= (\sqrt[7]{128})^1$

$= \sqrt[7]{128}$

$= 2$

$343^{2/3}$ (Power)

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

$= (7)^2$

$= 49$

Calculate the following
without using a calculator:

$289^{3/2}$

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

$= (17)^3$

$= 4913$

$625^{3/4}$

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

$= (5)^3$

$= 125$

Stop....

Check out page 227.

Questions:

5, 6,

7a,b, f

8,

10a,c,f,

11, 15

* anything to the power of 0 equals 1

Ex: $5^0 = 1$

$26^0 = 1$

$\left(\frac{1}{2}\right)^0 = 1$

$x^0 = 1$

Check out page 227 of your text book.

Questions:

5, 6, 7a,b, f 8,10a,c,f,11

To **multiply powers** with the same base you **add.**

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

Examples:

x $5^2 = 5^5$

x $8^2 = 8^7$

x $4^2 = 4^6$

$$5^{1/2} \times 5^{1/2} = 5$$

1/2 + 1/2 = 2/2 = 1

This can also be written like:

$$\sqrt{5} \times \sqrt{5} = \sqrt{25} = 5$$

$2^{1/3} \times 2^{1/3} \times 2^{1/3} = 2$

$1/3 + 1/3 + 1/3 = 3/3 = 1$

This can also be written like:

$$\sqrt[3]{2} \times \sqrt[3]{2} \times \sqrt[3]{2} = \sqrt[3]{8}$$

$$= 2$$