Making Connections

$100(0.87)^{1/2}$

Coffee, Tea, and Hot Chocolate contain caffeine.

The expression $100(0.87)^{1/2}$

represents the percent of caffeine left in your body 1/2 hour after you drink a caffeine beverage

How can you estimate the value of $0.87^{1/2}$

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

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

What do you notice?

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

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

Examples:

1. $5^3 \times 5^2 = 5^5$

2. $8^5 \times 8^2 = 8^7$

3. $4^4 \times 4^2 = 4^6$

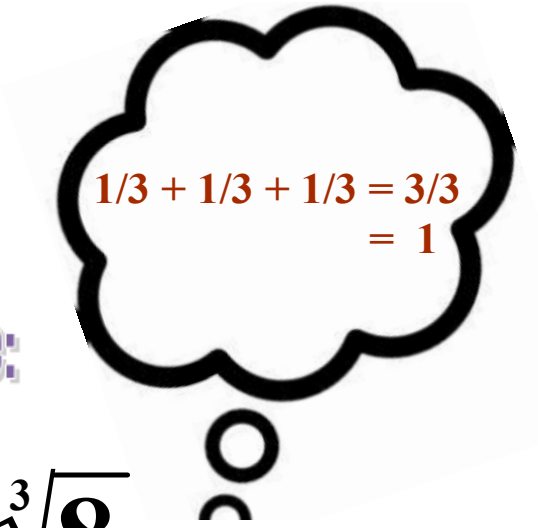
$$5^{1/2} \times 5^{1/2} = 5$$

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

This can also be written like:

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

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



This can also be written like:

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

$$= 2$$

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:

$27^{1/3}$

$\sqrt[3]{27}$

$= 3$

$100^{1/2}$

$\sqrt{100}$

$= 10$

$16^{1/4}$

$\sqrt[4]{16}$

$= 2$

Calculate each of the following without using a calculator:

$36^{0.5}$

$36^{\frac{1}{2}}$

$\sqrt{36}$

$= 6$

$32^{0.2}$

$32^{\frac{1}{5}}$

$\sqrt[5]{32}$

$= 2$

$625^{0.25}$

$625^{\frac{1}{4}}$

$\sqrt[4]{625}$

$= 5$

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:

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