

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?

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**!

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

index (root)

Practice Questions

Calculate each of the following without using a calculator:

$$27^{1/3} \leftarrow \text{index}$$
$$\sqrt[3]{27}$$
$$= 3$$

$$100^{1/2} \leftarrow \text{index}$$
$$\sqrt{100}$$
$$= 10$$

$$16^{1/4}$$
$$\sqrt[4]{16}$$
$$= 2$$



Calculate each of the following without using a calculator:

$$36^{0.5}$$

$$36^{\frac{1}{2} \leftarrow \text{index}}$$

$$\sqrt{36}$$

$$= 6$$

$$32^{0.2} \frac{2}{10}$$

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

$$\sqrt[5]{32}$$

$$= 2$$

$$625^{0.25} \frac{25}{100}$$

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

$$\sqrt[4]{625}$$

$$= 5$$

Calculate each of the following
without using a calculator:

$4^{3/2}$ exp index(root)

$$\left(\sqrt{4}\right)^3$$
$$2^3$$
$$= 8$$



$27^{2/3}$ root

$$\left(\sqrt[3]{27}\right)^2$$
$$(3)^2$$
$$= 9$$

Therefore:

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

Write as a power:



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

$$625^{9/4}$$

9 ← exp
4 ← root

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

$$128^{1/7}$$

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

$$= 2$$

$$343^{2/3}$$

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

$$7^2 = 49$$

$$289^{3/2}$$

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

$$(17)^3$$

$$= 4913$$

$$625^{3/4}$$

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

$$5^3$$

$$= 125$$



Stop....

Check out page 227.

#4, #5, #7, #10
#12

In Grade 9

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

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

$$\begin{aligned} 1/2 + 1/2 &= 2/2 \\ &= 1 \end{aligned}$$

This can also be written like:

$$\begin{aligned} \sqrt{5} \times \sqrt{5} &= \sqrt{25} \\ &= 5 \end{aligned}$$



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

$$\begin{aligned} 1/3 + 1/3 + 1/3 &= 3/3 \\ &= 1 \end{aligned}$$

This can also be written like:

$$\begin{aligned} \sqrt[3]{2} \times \sqrt[3]{2} \times \sqrt[3]{2} &= \sqrt[3]{8} \\ &= 2 \end{aligned}$$

