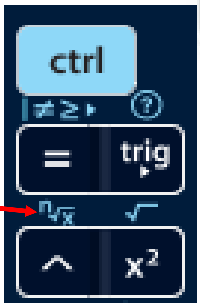
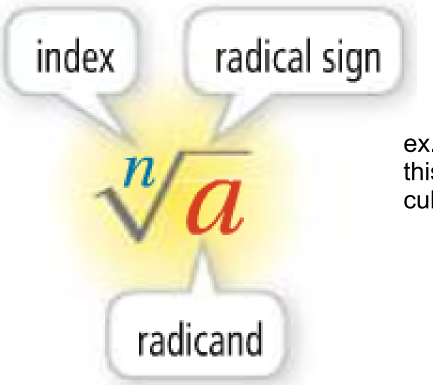
November 04, 2019

Day 1 - 3.1 - Roots & Radical Expressions

TI-nSpire:

Allows you to enter any index





TI-30X

ex. Press "3" first, then this button to do a cube root...etc.

What is each real-number root?

What is the index on this?

$\sqrt[3]{27}$ $\sqrt[2]{81}$ $\sqrt[3]{-8}$ $\sqrt[4]{625}$

3 9 -2 5

take note

Property **Combining Radical Expressions: Products**

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, then $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$.

Basically, you can only multiply like radicals! *(same index)*

Ex. 1 Simplify these radical expressions if you can.

a.) $\sqrt[3]{4} \cdot \sqrt[3]{54}$

$\sqrt[3]{216} = \boxed{6}$

b.) $\sqrt{14} \cdot \sqrt{2}$

$\sqrt{28}$

$\sqrt{4 \cdot 7}$

$\boxed{2\sqrt{7}}$

c.) $\sqrt[3]{25} \cdot \sqrt[2]{5}$

cannot multiply

Perfect Roots:

Square Roots	Cube Roots	4th Roots
$\sqrt{\ }$	$\sqrt[3]{\ }$	$\sqrt[4]{\ }$
1	1	1
4	8	16
9	27	81
16	64	256
25	125	625...
36	216	
49	343...	
64		
81		
100		
121		
144...		

Simplifying Radicals

Lets see the difference with these...

$\sqrt{24} = \sqrt{4 \cdot 6} = 2\sqrt{6}$ $\quad 2\sqrt{6}$ is in simplest form.

$\sqrt[3]{24} = \sqrt[3]{8 \cdot 3} = 2\sqrt[3]{3}$ $\quad 2\sqrt[3]{3}$ is in simplest form.

Ex 2. Simplify these radicals.

a. $3\sqrt{72}$

$3\sqrt{\underbrace{36}\cdot 2}$

$3 \cdot 6\sqrt{2}$

$\boxed{18\sqrt{2}}$

b. $\sqrt[3]{81}$

$\sqrt[3]{\underbrace{27}\cdot 3}$

$\boxed{3\sqrt[3]{3}}$

c. $\sqrt[4]{80}$

$\sqrt[4]{\underbrace{16}\cdot 5}$

$\boxed{2\sqrt[4]{5}}$

GREAT QUESTION!

When simplifying square roots, what happens if I use a perfect square factor that isn't the greatest perfect square factor possible?

You'll need to simplify even further. For example, consider the following factorization:

$$\sqrt{500} = \sqrt{25 \cdot 20} = \sqrt{25}\sqrt{20} = 5\sqrt{20}.$$

25 is a perfect square factor of 500, but not the greatest perfect square factor.

Because 20 contains a perfect square factor, 4, the simplification is not complete.

$$5\sqrt{20} = 5\sqrt{4 \cdot 5} = 5\sqrt{4}\sqrt{5} = 5 \cdot 2\sqrt{5} = 10\sqrt{5}$$

Although the result checks with our simplification using $\sqrt{500} = \sqrt{100 \cdot 5}$, **more work is required when the greatest perfect square factor is not used.**

Simplifying Radicals with Variables:

When taking the root of a variable you must divide the exponents by the index. The quotient is how many of that variable "comes out" of the radical and the remainder is how many of that variable that "stay behind" in the radical.

Ex. 3

$\sqrt{20x^4y^7}$

x: $4 \div 2 = 2$

y: $7 \div 2 = 3$ R1

$\sqrt{20}$

$\sqrt{4 \cdot 5}$

$2\sqrt{5}$

$\boxed{2x^2y^3\sqrt{5y}}$

Ex. 4

$\sqrt[3]{54x^6y^5}$

x: $6 \div 3 = 2$

y: $5 \div 3 = 1$ R 2

$\sqrt[3]{54}$

$\sqrt[3]{27 \cdot 2}$

$\boxed{3x^2y\sqrt[3]{2y^2}}$

Ex. 5 $\sqrt{72x^3y^2}\cdot\sqrt{10xy^3}$

$\sqrt{720x^4y^5}$

x: $4 \div 2 = 2$

y: $5 \div 2 = 2$ R 1

$\sqrt{720}$

$\sqrt{144 \cdot 5}$

$\boxed{12x^2y^2\sqrt{5y}}$

Ex. 6 $2\sqrt[3]{50x^2y}\cdot 7\sqrt[3]{5x^5y^2}$

$14\sqrt[3]{250x^7y^3}$

x: $7 \div 3 = 2$ R 1

y: $3 \div 3 = 1$

$14\sqrt[3]{250}$

$14\sqrt[3]{125 \cdot 2}$

$14 \cdot 5\sqrt[3]{2}$

$\boxed{70x^2y\sqrt[3]{2x}}$