4.1: Square Roots and Cube Roots and More!!!

April 3, 2017 10:42 AM

Complete the following operations (Bonus Cool points for doing them in your head)

memorize

$1^2 = 1 \times 1 = 1$
$2^2 = 2 \times 2 = 4$
$3^2 = 3 \times 3 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$
$11^2 = 121$
$12^2 = 144$
$13^2 = 169$
$14^2 = 196$
$15^2 = 225$

memorize

$1^3 = 1 \times 1 \times 1 = 1$
$2^3 = 2 \times 2 \times 2 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

These are squares and cubes. We could go even further and do powers of 4, 5, etc.

Roots are the reverse operation of these powers : just like $\times$, $\div$ / $+$, $-$

Root:

$\sqrt[Y]{X}$

Y: integer (No y means y=2)
X: Real number

This root tells us to find a real number that equals "X" when it is multiplied by itself "Y" number of times

Example:

$\sqrt{64} = \sqrt[2]{\underbrace{8 \cdot 8}_{2}} = 8$

$\sqrt[2]{4 \cdot 36} = \sqrt[2]{144}$
$= \sqrt[2]{\underbrace{12 \cdot 12}_{2}} = 12$

$\sqrt[3]{125} = \sqrt[3]{\underbrace{5 \cdot 5 \cdot 5}_{3}} = 5$

$$\sqrt[3]{125} = \sqrt[3]{\underbrace{5 \cdot 5 \cdot 5}_{3}} = 5$$

$$\sqrt[2]{(4)(36)} = 12$$

one way

other way

Roots can be distributed just like powers. The root of two numbers multiplied or divided together can be broken apart.

Example:

$$\sqrt[2]{(4)(36)} = \sqrt[2]{4} \cdot \sqrt[2]{36}$$
$$= 2 \cdot 6$$
$$= 12$$

$$\boxed{\sqrt[y]{(x)(t)} = \sqrt[y]{x} \cdot \sqrt[y]{t} \quad \text{or} \quad \sqrt[y]{\frac{x}{t}} = \frac{\sqrt[y]{x}}{\sqrt[y]{t}}}$$

You try

$$\sqrt{(16)(144)} = \sqrt{16} \cdot \sqrt{144}$$
$$= 4 \cdot 12 \quad = \underline{48}$$

$$\sqrt{(9)(81)} = \sqrt{9} \cdot \sqrt{81}$$
$$= 3 \cdot 9 \quad = \underline{27}$$

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

$27 = 3 \cdot 3 \cdot 3$

$x^3 = x \cdot x \cdot x$

You can apply a root to a variable the same way as you would to a number.

$$\sqrt[3]{y^3} = \sqrt[3]{\underbrace{y \cdot y \cdot y}_{3\ y\text{'s}}}$$
$$= y$$

$$\sqrt{9y^4x^6} = \sqrt{\underbrace{3\cdot3}_{2}\cdot\underbrace{y\cdot y}_{2}\cdot\underbrace{y\cdot y}_{2}\cdot\underbrace{x\cdot x}_{2}\cdot\underbrace{x\cdot x}_{2}\cdot\underbrace{x\cdot x}_{2}}$$

$$= 3\cdot y\cdot y\cdot x\cdot x\cdot x$$

$$= 3y^2x^3$$

You try

$$\sqrt{4x^2} = \sqrt{\underbrace{2\cdot2}_{2}\cdot\underbrace{x\cdot x}_{2}} = 2x$$

$$\sqrt[3]{64a^6} = \sqrt{\underbrace{4\cdot4\cdot4}_{3}\cdot\underbrace{a\cdot a\cdot a}_{3}\cdot\underbrace{a\cdot a\cdot a}_{3}} = 4\cdot a\cdot a$$

$$= 4a^2$$

$$\sqrt{18x^3} = \sqrt{2\cdot\underbrace{\cancel{3\cdot3}}_{2}\cdot\underbrace{\cancel{x\cdot x}}_{2}\cdot x} = \underline{\underline{3x\sqrt{2x}}}$$

What happens if they number does not go into the root evenly?

$$\sqrt{18x^3} = \sqrt{\underbrace{3\cdot3}_{2}\cdot2\cdot\underbrace{x\cdot x}_{2}\cdot x}$$

$$= 3x\sqrt{2x}$$

Take out what you can from the root and leave what remains behind.

You try

$$\sqrt{12} = \sqrt{3\cdot\underbrace{\cancel{2\cdot2}}_{2}} = \underline{\underline{2\sqrt{3}}}$$

$$\sqrt[3]{16a^5} = \sqrt[3]{\underbrace{\cancel{2\cdot2\cdot2}}_{3}\cdot2\cdot\underbrace{\cancel{a\cdot a\cdot a}}_{3}\cdot a\cdot a} = \underline{\underline{2a\sqrt[3]{2a^2}}}$$

Homework: pg. 158 Q: 1-8 (ace)
9, 11, 13, 15

Bathroom

Steph

Negative numbers in exponents

-10^2 vs. $(-10)^2$

$= -(10)^2$

$= -100$

$= (-10)\cdot(-10)$

$= 100$