6-1 Roots and Radical Expressions

$3^2 = 9$ 3 is a square (second) root of 9

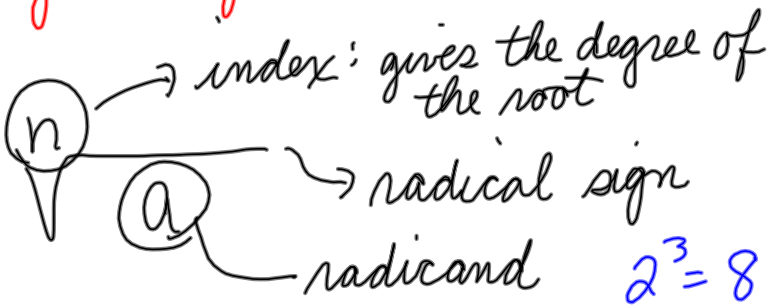
$3^3 = 27$ 3 is a cube (third) root of 27

$3^4 = 81$ 3 is a fourth root of 81

$a^n = b$ a is an n^{th} root of b

If n is odd	If n is even and b is positive
$\sqrt[n]{b}$ there is only one real root of b	$\sqrt{b}$ → principal root $-\sqrt{b}$ → negative root
Ex: $\sqrt[3]{125} = 5$ $\sqrt[5]{-32} = -2$	Ex: $x^2 = 9$ $x = 3, -3$ $\sqrt[4]{16} = 2$ $-\sqrt[4]{81} = -3$
$x^3 = 125$ $x = 5$	If b is negative, there are no real nth roots of b Ex: $\sqrt{-25}$: not a real number

* Note: The only root of 0 is 0.



What are the real cube roots of:

a. $0.008 = \sqrt[3]{0.008} = 0.2$

b. $-1{,}000 = \sqrt[3]{-1{,}000} = -10$

c. $\frac{1}{27} = \sqrt[3]{\frac{1}{27}} = \frac{\sqrt[3]{1}}{\sqrt[3]{27}} = \frac{1}{3}$

$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$

0.2
0.2
0.04
x 0.2
0.008

What is each real number root?

a. $\sqrt[2]{0.36} = 0.6$

b. $\sqrt[3]{-1} = -1$

c. $\sqrt[4]{-1}$: not a real number $\longrightarrow$ even root of $(-)$ — not a real number

d. $\pm\sqrt{(-3)^2} = \sqrt{9} = 3$

$(-)(-)(-)(-)$

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$+$

For any R.N. a, $\sqrt[n]{a^n} = \begin{cases} a & \text{if } n \text{ is odd} \\ |a| & \text{if } n \text{ is even} \end{cases}$

(and exponent on "a" is odd)

$\sqrt[3]{x^3} = x$

$\sqrt{x^2} = |x|$

$\sqrt{(-3)^2} = |3|$

Simplify.

a. $\sqrt{25a^4} = 5a^2$

b. $\sqrt[3]{a^6b^9} = a^2b^3$

c. $\sqrt[4]{x^8y^{12}} = x^2|y^3|$