Finding the square root of a number and squaring a number are

______________________ operations. To find the square root of a number a, you must find a number with a square of a. Similarly, the inverse of raising a number to the nth power is finding the _____________________ of a number.

Powers	Factors	Words	Roots
$x^3 = 64$	$4 \cdot 4 \cdot 4 = 64$	4 is a cube root of 64.	$\sqrt[3]{64} = 4$
$x^4 = 625$	$5 \cdot 5 \cdot 5 \cdot 5 = 625$	5 is a fourth root of 625.	$\sqrt[4]{625} = 5$
$x^5 = 32$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$	2 is a fifth root of 32.	$\sqrt[5]{32} = 2$
$a^n = b$	$\underbrace{a \cdot a \cdot a \cdot \ldots \cdot a}_{n \text{ factors of } a} = b$	a is an nth root of b.	$\sqrt[n]{b} = a$

KeyConcept Definition of nth Root

Words For any real numbers a and b, and any positive integer n, if $a^n = b$, then a is an nth root of b.

Example Because $(-3)^4 = 81$, -3 is a fourth root of 81 and 3 is a principal root.

Symbol that indicates *nth* root:

Some numbers have more than one real nth root.

ex) 64 has two square roots

When there is more than one real root and n is even, the nonnegative root is called the principal root.

Examples of nth roots:

$\sqrt{25} = 5$ — $\sqrt{25}$ indicates the principal square root of 25.

$-\sqrt{25} = -5$ — $-\sqrt{25}$ indicates the opposite of the principal square root of 25.

$\pm\sqrt{25} = \pm 5$ — $\pm\sqrt{25}$ indicates both square roots of 25.

1. Simplify:
   a. $\pm\sqrt{16y^4}$
   b. $-\sqrt{(x^2-6)^8}$
   c. $\sqrt[5]{243a^{20}b^{25}}$
   d. $\sqrt{-16x^4y^8}$
   e. $\pm\sqrt{36x^{10}}$
   f. $-\sqrt{(y+7)^{16}}$
   g. $\sqrt[4]{y^4}$
   h. $\sqrt[6]{64(x^2-3)^{18}}$
   i. $\sqrt{36y^6}$
   j. $\sqrt[4]{16(x-3)^{12}}$

k. $\pm\sqrt{100y^8}$

n. $\sqrt[4]{16g^{16}h^{24}}$

l. $-\sqrt{49u^8b^{12}}$

o. $\sqrt{-16y^4}$

m. $\sqrt{(y-6)^8}$

p. $\sqrt[6]{64(2y+1)^{18}}$