

*Unit 6: nth roots day 1
simplifying radicals/adding and subtracting radicals*



ex: Fill in the Chart...FAST!

x	x^2	x^3	x^4	x^5	x^6
1	1	1	1	1	1
2	4	8	16	32	64
3	9	27	81	243	-----
4	16	64	256	-----	-----
5	25	125	625	-----	-----
6	36	216	-----	-----	-----

nth Roots

$$\sqrt[n]{a}$$

Where:

- a is called the radicand
- n is called the index

*Square Roots: \sqrt{a} , $n = \underline{\hspace{2cm}}^2$

Domain of nth Roots

$$\sqrt[n]{a}$$

$\frac{-\sqrt[3]{8}}{\sqrt[3]{-8}}$

If:

- n is even: $a \geq 0$

- n is odd: $a \in \mathbb{R}$

$\sqrt{-11}$
nonreal

-2

$\sqrt{-8}$

fall reals

ex: Evaluate. If no real value exists, write "nonreal."

a) $\sqrt{25} = 5$

b) $\sqrt[3]{8} = 2$

c) $\sqrt[3]{-125} = -\sqrt[3]{125} = -5$

ex: Evaluate. If no real value exists, write "nonreal."

d) $\sqrt[5]{243} = 3$

e) $\sqrt[4]{-16}$
even
nonreal

f) $\sqrt{\frac{1}{9}} = \frac{1}{3}$

ex: Evaluate. If no real value exists, write "nonreal."

g) $\sqrt[5]{32} = 2$

h) $\sqrt[3]{\frac{125}{8}} = \frac{5}{2}$

i) $-5\sqrt[4]{16} = -10$

ex: Evaluate. If no real value exists, write "nonreal."

$$\text{j) } \sqrt[4]{1} = 1$$

$$\begin{aligned}2^4 &= 16 \\3^4 &= 81 \checkmark \\4^4 &= 256 \\5^4 &= 625\end{aligned}$$

$$\begin{aligned}\text{k) } \sqrt{27} &= \sqrt{9} \cdot \sqrt{3} \\&= 3\sqrt{3}\end{aligned}$$

$$\begin{aligned}\text{l) } \sqrt[4]{162} &= \sqrt[4]{81} \cdot \sqrt[4]{2} \\&= 3\sqrt[4]{2}\end{aligned}$$

ex: Evaluate. If no real value exists, write "nonreal."

m) $\sqrt[5]{-96}$

$$-\sqrt[5]{96} = -\cancel{\sqrt[5]{32}} \cdot \sqrt[5]{3} = -2\sqrt[5]{3}$$

n) $\sqrt[3]{32} = \sqrt[3]{8} \cdot \sqrt[3]{4}$

$$= 2\sqrt[3]{4}$$

o) $\sqrt[6]{-64}$ nonreal

even

p) $7\sqrt[4]{48} = 7\sqrt[4]{16 \cdot \sqrt[4]{3}}$

$= 7 \cdot 2\sqrt[4]{3} = \cancel{14\sqrt[4]{3}}$

$2^4 = 16 \checkmark$
 $3^4 = 81$
 $4^4 = 256$

q) $2\sqrt[3]{81}$

$2\sqrt[3]{27} \sqrt[3]{3} = 2 \cdot 3\sqrt[3]{3} = 6\sqrt[3]{3}$

r) $\sqrt[5]{128} = \sqrt[5]{32} \cdot \sqrt[5]{4} = 2\sqrt[5]{4}$

Operations with nth Roots

- Addition/Subtraction - the radicals must be "like radicals"

ex: Perform the indicated operation.

a) $7\sqrt[5]{8} + \sqrt[5]{8}$

$\sqrt[5]{8}$

b) $4\sqrt[3]{2} - 6\sqrt[3]{2}$ Already simplified

ex: Perform the indicated operation.

c) ~~$\sqrt[3]{2} - \sqrt[3]{2}$~~ $\sqrt[3]{24} + 7\sqrt[3]{3}$
 $\sqrt[3]{8} \cdot \sqrt[3]{3} + 7\sqrt[3]{3}$
 $2\sqrt[3]{3} + 7\sqrt[3]{3} = 9\sqrt[3]{3}$

d) $\sqrt[3]{54} - \sqrt[3]{2}$

\downarrow
 $\underline{\sqrt[3]{27} \cdot \sqrt[3]{2} - \sqrt[3]{2}}$
 $3\sqrt[3]{2} + \sqrt[3]{2} = \cancel{2\sqrt[3]{2}}$

Perform the indicated operation.

e) $2\sqrt[3]{32} + \sqrt[3]{32} + \sqrt[3]{16}$

$$\begin{aligned} & \underbrace{2\sqrt[3]{32} + \sqrt[3]{16}} \\ & \cancel{3\sqrt[3]{8\sqrt[3]{4}} + \sqrt[3]{8} \cdot \sqrt[3]{2}} \\ & \cancel{(6\sqrt[3]{4} + 2\sqrt[3]{2})} \end{aligned}$$

f) $4\sqrt{54} - 3\sqrt{6} + 2\sqrt{3}$

$$4\sqrt{9}\sqrt{6} - 3\sqrt{6} + 2\sqrt{3}$$

$$\underline{12\sqrt{6} - 3\sqrt{6} + 2\sqrt{3}}$$

$$\underline{\underline{9\sqrt{6} + 2\sqrt{3}}}$$

Between which two consecutive integers does the expression lie?

a) $\sqrt{10}$

$$\sqrt{9} < \sqrt{10} < \sqrt{16}$$
$$3 < \sqrt{10} < 4$$

3 and 4

b) $\sqrt[5]{40}$

$$\sqrt[5]{32} < \sqrt[5]{40} < \sqrt[5]{243}$$
$$2 < \sqrt[5]{40} < 3$$

2 and 3