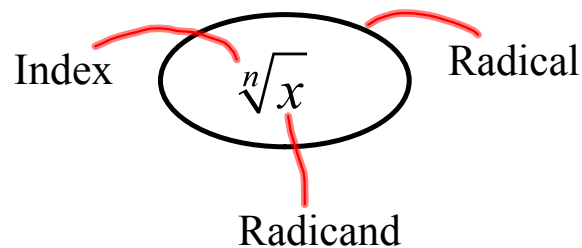


Section 4.1 Estimating Roots

Explaining the meaning of the index of a radical

In the $\sqrt[n]{x}$ the n is called the **index** of the radical and x is the **radicand**.



Radical	Example	Index	What does it mean?
$\sqrt{x} = \sqrt{x}$	$\sqrt{121}$	2	$\sqrt{121} = 11, 11^2 = 121$
$\sqrt[3]{x}$	$\sqrt[3]{64}$	3	$\sqrt[3]{64} = 4, [4]^3 = 64$
$\sqrt[3]{x}$	$\sqrt[3]{\frac{27}{125}}$	3	$\sqrt[3]{\frac{27}{125}} = \left(\frac{3}{5}\right), \left(\frac{3}{5}\right)^3 = \frac{27}{125}$
$\sqrt[4]{x}$	$\sqrt[4]{625}$	4	$\sqrt[4]{625} = 5, (5)^4 = 625$
$\sqrt[4]{x}$	$\sqrt[4]{3164.0625}$	4	$\sqrt[4]{3164.0625} = 7.5, (7.5)^4 = 3164.0625$
$\sqrt[4]{x}$	$\sqrt[4]{10,000}$	4	$\sqrt[4]{10000} = 10, (10)^4 = 10000$
$\sqrt[4]{x}$	$\sqrt[4]{0.0625}$	4	$\sqrt[4]{0.0625} = 0.5, (0.5)^4 = 0.0625$
$\sqrt[4]{x}$	$\sqrt[4]{\frac{16}{81}}$	4	$\sqrt[4]{\frac{16}{81}} = \frac{2}{3}, \left(\frac{2}{3}\right)^4 = \frac{16}{81}$
$\sqrt[4]{x}$	$\sqrt[4]{\frac{1}{256}}$	4	$\sqrt[4]{\frac{1}{256}} = \frac{1}{4}, \left(\frac{1}{4}\right)^4 = \frac{1}{256}$
$\sqrt[4]{x}$	$\sqrt[4]{\frac{6561}{28561}}$	4	$\sqrt[4]{\frac{6561}{28561}} = \frac{9}{13}, \left(\frac{9}{13}\right)^4 = \frac{6561}{28561}$
$\sqrt[5]{x}$	$\sqrt[5]{243}$	5	$\sqrt[5]{243} = [3], [3]^5 = 243$
$\sqrt[6]{x}$	$\sqrt[6]{4096}$	6	$\sqrt[6]{4096} = [6], [6]^6 = 4096$

Ex) Evaluate to two decimal places (if necessary). Explain verbally what your answer means.

A) $\sqrt{250}$ ≈ 15.81 <i>It means</i> $(15.81)^2 \approx 250$	B) $\sqrt{121}$ $= 11$ <i>It means</i> $(11)^2 = 121$	C) $\sqrt[3]{83}$ ≈ 4.36 <i>It means</i> $(4.36)^3 \approx 83$	D) $\sqrt[3]{1728}$ $= 12$ <i>It means</i> $(12)^3 = 1728$
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E) $\sqrt[3]{915.0625}$ ≈ 9.71 <i>It means</i> $(9.71)^3 \approx 915.0625$	F) $\sqrt[4]{92.3521}$ $= 3.1$ <i>It means</i> $(3.1)^4 = 92.3521$	G) $\sqrt[5]{243}$ $= 3$ <i>It means</i> $(3)^5 = 243$	H) $\sqrt[5]{-243}$ $= -3$ <i>It means</i> $(-3)^5 = -243$
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I) $\sqrt[4]{-243}$ What does this mean?

error on calculator or non real answer

This means that there is no number that can be multiplied by itself 4 times that will equal -243.

Negative Radicands in Radicals

Negative radicands CAN ONLY BE EVALUATED IN THE REAL NUMBER SYSTEM if the INDEX is **ODD**

You cannot evaluate a negative radicand if the index is even. There is no number that can be multiplied by itself an even amount times to give you a negative answer.

Example: Determine if the following are possible or not possible.

$\sqrt[3]{-300}$	Possible
$\sqrt[4]{-300}$	Impossible
$\sqrt{2600}$	Possible
$\sqrt{-2600}$	Impossible

Example: Evaluate.

A) $\sqrt[3]{200}$ ≈ 5.85	B) $\sqrt[3]{-200}$ ≈ -5.85	C) $\sqrt[3]{-27,000}$ $= -30$
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D) $\sqrt[3]{-15,625}$ $= -25$	E) $\sqrt[3]{\frac{8}{27}}$ $= \frac{2}{3}$	F) $\sqrt[4]{16}$ $= 2$
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G) $\sqrt[3]{-16}$ ≈ -2.52	H) $-\sqrt[4]{16}$ $= -2$	I) $\sqrt[4]{-16}$ non-real answer
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J) $\sqrt[5]{\frac{32}{3125}}$ $= \frac{2}{5}$	K) $\sqrt[5]{-3125}$ $= -5$	L) $\sqrt[6]{-3125}$ <i>no solution in the real number system</i>
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Example: For each number, write an equivalent form as a square root, cube root and fourth root.

A) 5

Answers

$\sqrt{25} = 5$

$\sqrt[3]{125} = 5$

$\sqrt[4]{625} = 5$

B) 0.8

Answers

$\sqrt{0.64} = 0.8$

$\sqrt[3]{0.512} = 0.8$

$\sqrt[4]{0.4096} = 0.8$

Example: Choose values of n and x so that $\sqrt[n]{x}$ is :

A) a whole number $\{0, 1, 2, 3, \dots\}$ *possible answers* $\sqrt{36} = 6$ $\sqrt[3]{8} = 2$

B) a negative integer

possible answers $\sqrt[3]{-27} = -3$ $\sqrt[5]{-243} = -3$

C) a rational number

possible answers $\sqrt{\frac{25}{49}} = \frac{5}{7}$ $\sqrt[3]{0.064} = 0.4$

D) an approximate decimal

possible answers $\sqrt{18} \approx 4.24$ $\sqrt[5]{46} \approx 2.15$

Homework: Page 206, Questions 1 - 6
Must be completed for Monday.