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LESSON 12: Radical Expressions, Functions, and Models

- ☐ $\sqrt{a} = \sqrt[2]{a}$: Square root of *a*
- ☐ Radical sign, index and radicand
- ☐ Calculating roots using calculator
- ☐ Simplifying $\sqrt{(a)^2}$ using the absolute value
- ☐ $\sqrt[3]{a}$: Cube root of *a*
- ☐ $\sqrt[n]{a}$: the nth root of a for odd index n
- ☐ $\sqrt[n]{a}$: the nth root of a for even index n

Anatomy of a pure power

$$b^n = a$$

For each of the following power expressions, do each of the following:

i. Specifically identify the value of base *b* and the value of power *n*

iii. Evaluate the expression

The first one is done for you.

1A. 11^2

1B. 2^6

1C. 3^4

1D. 5^3

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Backward Problem: anatomy of radicals

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

For each of the following power expressions, do each of the following:

i. Specifically identify the value of index n and the value of radicand a

iii. Evaluate the expression by transforming each expression into a power equation

The first one is done for you.

2A. $\sqrt[2]{100}$

2B. $\sqrt[3]{27}$

2C. $\sqrt[5]{32}$

2D. $\sqrt[4]{27}$

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3. Evaluate each entry of the tables below. Then, in the last row of the table, specifically identify the index of each radical expression.

TABLE 3A: Values of $\sqrt[2]{x^2}$	
Input x	Output $y = \sqrt[2]{x^2}$
-3	
-2	
-1	
0	
1	
2	
3	
What is the index of $y = \sqrt[2]{x^2}$:_____	

TABLE 3B: Values of $\sqrt[3]{x^3}$	
Input x	Output $y = \sqrt[3]{x^3}$
-3	
-2	
-1	
0	
1	
2	
3	
What is the index of $y = \sqrt[3]{x^3}$:_____	

4. Look at the output values of $y = \sqrt[2]{x^2}$ in table 3A. What pattern do you notice about these output values versus the input values of x? Why do the negative signs on the input values of x "disappear" in this table? What function behaves like this?

5. Look at the output values of $y = \sqrt[3]{x^3}$ in tables 3B. What pattern do you notice about these output values versus the input values of x? Why DON'T the negative input values of x "disappear" in this table?

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6. Evaluate each entry of the tables below. Then, in the last row of the table, specifically identify the index of each radical expression.

TABLE 3C: Values of $\sqrt[4]{x^4}$	
Input x	Output $y = \sqrt[4]{x^4}$
-2	
-1	
0	
1	
2	
What is the index of $y = \sqrt[4]{x^4}$:_____	

TABLE 3D: Values of $\sqrt[5]{x^5}$	
Input x	Output $y = \sqrt[5]{x^5}$
-2	
-1	
0	
1	
2	
What is the index of $y = \sqrt[5]{x^5}$:_____	

7. Look at the output values of $y = \sqrt[4]{x^4}$ in table 3C. What pattern do you notice about these output values versus the input values of x? Why do the negative signs on the input values of x "disappear" in this table? What function behaves like this?

8. Look at the output values of $y = \sqrt[5]{x^5}$ in tables 3D. What pattern do you notice about these output values versus the input values of x? Why DON'T the negative input values of x "disappear" in this table?

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INVERSE OPERATIONS FOR ODD POWERS

Suppose index $n = 3, 5, 7, 9, \ldots$ is an odd number

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

INVERSE OPERATIONS FOR EVEN POWERS

Suppose index $n = 2, 4, 6, 8, \ldots$ is an even number:

$$\sqrt[n]{x^n} = |x|$$

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Simplify each expression below using the rules for radicals with an even and radicals with an odd index

6A. $\sqrt[2]{w^2}$

6B. $\sqrt[4]{16 \cdot b^4}$

6C. $\sqrt[5]{32 \cdot a^{10}}$

6B. $\sqrt[3]{-125y^3}$