Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples

WARM-UP

List the perfect squares, cubes, and fourths.

Perfect Squares:

Perfect Cubes:

Perfect Fourths:

N^TH ROOTS

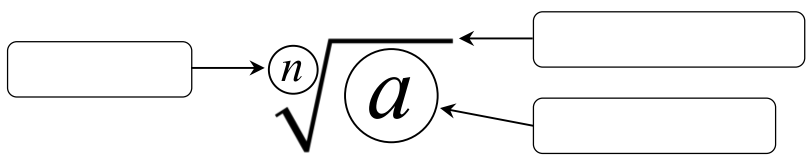
Definition: x is the ***n*^th^ root** of a real number a if ___________________

Examples:

- _____ and _____ are **square roots** of 81 because _____________ and ____________
- _____ is the **cube root** of -8 because ______________
- _____ and _____ are **fourth roots** of 256 because _____________ and ____________

RADICAL *Expression*

The n^{th} root of a real number, a, can be written as the radical expression $\sqrt[n]{a}$



- If there is **no index**, it is assumed that ______________.
- **Number of Roots:**

Index	Radicand	Type of Roots	# of Roots
Even	Positive		
Odd	Positive		
Odd	Negative		
★ Even	Negative		

- If a radicand has more than one n^{th} root, the radical sign indicates only the **principal, or positive, root.**

EVALUATING *Radicals*

Find each value.

$\sqrt{16} =$	$-\sqrt{121} =$	$\sqrt{289} =$	$-\sqrt{\dfrac{4}{25}} =$
$\sqrt[3]{8} =$	$\sqrt[3]{343} =$	$\sqrt[3]{-125} =$	$\sqrt[3]{-\dfrac{1}{27}} =$
$-\sqrt[4]{1} =$	$\sqrt[4]{2{,}401} =$	$-\sqrt[4]{4{,}096} =$	$\sqrt[4]{\dfrac{81}{16}} =$

© Gina Wilson (All Things Algebra®, LLC), 2015-2021

SIMPLIFYING Radicals

1. $\sqrt{117}$	**2.** $4\sqrt{320}$
3. $2\sqrt[3]{48}$	**4.** $3\sqrt[3]{108}$
5. $\sqrt[3]{-250}$	**6.** $6\sqrt[3]{-2}$
7. $3\sqrt[4]{162}$	**8.** $5\sqrt[4]{2{,}592}$

Radicals with VARIABLES

Square Roots	**Cube Roots**	**4th Roots**
Exponents must be multiples of _____!	Exponents must be multiples of _____!	Exponents must be multiples of _____!

9. $\sqrt{32x^4y^9}$	**10.** $\sqrt{324a^3b^7}$
11. $\sqrt[3]{216m^3n^6}$	**12.** $\sqrt[3]{56r^8s^4}$
13. $\sqrt[3]{-64x^{10}y^{21}}$	**14.** $\sqrt[3]{-81p^2q^{12}}$
15. $\sqrt[4]{w^4v^{17}}$	**16.** $\sqrt[4]{48m^8n^3}$

© Gina Wilson (All Things Algebra®, LLC), 2015-2021

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
RATIONAL EXPONENTS	Expressions with rational exponents can be rewritten as radicals using the following rules:

Exponential Form	Meaning	Radical Form
$a^{\frac{1}{n}}$	The n^{th} root of a	$a^{\frac{1}{n}} =$
$a^{\frac{m}{n}}$	The n^{th} root of a, raised to the m^{th} power	$a^{\frac{m}{n}} =$

Converting **EXPONENTIAL TO RADICAL FORM**

Directions: Write each expression in **radical form**. Simplify if needed.

1. $x^{\frac{1}{4}}$	**2.** $24^{\frac{1}{3}}$	**3.** $(15x)^{\frac{1}{2}}$
4. $7^{\frac{2}{3}}$	**5.** $k^{\frac{7}{2}}$	**6.** $3^{\frac{5}{4}}$
7. $(ab)^{\frac{3}{4}}$	**8.** $(-6x)^{\frac{2}{3}}$	**9.** $7(12w)^{\frac{1}{2}}$

Converting **RADICAL TO EXPONENTIAL FORM**

Directions: Write each expression in **exponential form**.

10. $\sqrt[3]{16}$	**11.** $\sqrt{xy}$	**12.** $\sqrt[4]{8w^2}$
13. $\sqrt[3]{11^2}$	**14.** $\sqrt[4]{k^{10}}$	**15.** $\left(\sqrt{3m}\right)^7$
16. $\left(\sqrt[4]{-2a}\right)^5$	**17.** $\sqrt{10^5 a^3 b^8}$	**18.** $\sqrt[8]{9x^2 y^{12}}$

© Gina Wilson (All Things Algebra®, LLC), 2015-2021

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples		
ADDING & SUBTRACTING Radicals	①	**SIMPLIFY** all radicals.	
	②	Identify radicals with the **SAME INDEX** and **SAME RADICAND.** Only these can be combined!	
	③	For common radicals, **add/subtract the coefficients** and **KEEP THE COMMON RADICAL**.	
	1. $3\sqrt{27}-2\sqrt{12}$		**2.** $3\sqrt[3]{54}-2\sqrt[3]{2}+7\sqrt[3]{-16}$
	3. $7\sqrt[4]{48}-2\sqrt[4]{3}+3\sqrt[3]{72}$		**4.** $10\sqrt{28}+\sqrt[3]{-56}-4\sqrt{175}$
	5. $\sqrt{98x^4y^2}-3x^2y\sqrt{2}$		**6.** $\sqrt[3]{-40a^7}+2a^2\cdot\sqrt[3]{135a^4}$
MULTIPLYING Radicals	①	Multiply coefficients, then use the **PRODUCT RULE**: $\sqrt[n]{a}\cdot\sqrt[n]{b}=$	
	②	**SIMPLIFY** the resulting radical.	
	7. $\sqrt{27}\cdot\sqrt{5}$		**8.** $3\sqrt{10}\cdot-2\sqrt{18}$
	9. $2\sqrt[3]{9}\cdot5\sqrt[3]{-24}$		**10.** $-3\sqrt[4]{64}\cdot-\sqrt[4]{8}$

© Gina Wilson (All Things Algebra®, LLC), 2015-2021