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TOPIC: RULES OF EXPONENTS

EXPONENT RULES

Name	Example	Rule	Description
Base 1	1^4 = ______________ = _____	$1^n = 1$	1 to *any* power equals ______
Neg to Even Power	$(-3)^2$ = ___________________ = _____ $(-3)^4$ = ___________________ = _____	$(-a)^{even} = a^{even}$	**[CANCEL | KEEP]** negative sign
Neg to Odd Power	$(-2)^3$ = ___________________ = _____	$(-a)^{odd} = -a^{odd}$	**[CANCEL | KEEP]** negative sign
Product Rule	$4^2 \times 4^1$ = = $4^{\_\_}$ = $4^{\_\_\_\_}$ $y^{30} \times y^{70}$ = $y^{\_\_}$ = $y^{\_\_\_\_}$	$a^m \times a^n = a^{m+n}$	*Multiply* terms w/ ***same base*** ⇒ **[ADD | SUBTRACT]** exponents
Quotient Rule	$\frac{4^3}{4^1}$ = = $4^{\_\_}$ = $4^{\_\_\_\_}$	$\frac{a^m}{a^n} = a^{m-n}$	*Divide* terms w/ ***same base*** ⇒ **[ADD | SUBTRACT]** exponents ALWAYS _____ − _________
Zero Exp. Rule	$\frac{2^4}{2^4}$	$a^0 = 1$	*ANYTHING* (except 0) raised to ____ exponent = ____
Neg. Exp. Rule	$\frac{2^2}{2^5}$	$a^{-n} = \frac{1}{a^n}$ $\frac{1}{a^{-n}} = a^n$	Neg exp in ***top*** ⇒ flip to **[BOTTOM | TOP]** with pos exp Neg exp in ***bottom*** ⇒ flip to **[BOTTOM | TOP]** with pos exp
Power Rule	$(4^3)^2$ ( )( )	$(a^m)^n = a^{m \cdot n}$	*Power* to another power ⇒ __________ exponents
Power of a Product	$(3 \cdot 4)^2$	$(a \cdot b)^m = a^m \cdot b^m$	***Distribute*** exponent to each _______ in parentheses
Power of a Quotient	$\left(\frac{12}{4}\right)^2$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	***Distribute*** exponent to

Note: This table will span multiple videos.

TOPIC: RULES OF EXPONENTS

- When you can't combine "like terms", you'll need new rules to simplify/manipulate exponents in expressions.

$$\boxed{4 - x + 3x^2 + 2x^2} = 4 - x +$$

$$\frac{(-2)^3(x^4y^2)}{-8yx^3}$$

Here are some rules to help!

EXAMPLE: Simplify the expressions using the exponent rules above.

(A) $\dfrac{(-5)^9}{(-5)^6}$

(B) $\dfrac{(2x^4)(7x^2)}{x^5}$

(C) $(6x^3y^2)(4x^2y^5)$

PRACTICE: Simplify the expression using exponent rules.

$$(-5a^2)(3a^8)$$

PRACTICE: Simplify the expression using exponent rules.

$$\frac{-12b^{11}}{4b^7}$$

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TOPIC: RULES OF EXPONENTS
ZERO & NEGATIVE EXPONENTS

● In some problems, using the Quotient Rule results in zero or negative exponents.

EXAMPLE: Simplify the expressions using the rules above.

(A) $(xy)^{-3}$

(B) xy^{-3}

(C) $\frac{9^0}{9^{-4}}$

POWER RULES

● When you see powers (exponents) or products ________________ other powers, use the **Power Rules**.

EXAMPLE: Simplify the exponential expressions using the power rules.

(A) $(m^{-2})^{-5}$

(B) $(xy^3)^4$

(C) $\left(\frac{5}{x}\right)^{-3}$

PRACTICE: Rewrite the expression using exponent rules.

$$(4x^2)^3$$

PRACTICE: Rewrite the expression using exponent rules.

$$\left(\frac{3x^4}{y^{-2}}\right)^3$$

TOPIC: RULES OF EXPONENTS
SIMPLIFYING EXPRESSIONS WITH EXPONENTS

- You'll often have to use multiple exponent rules to fully simplify expressions. Use this checklist!
  - There's no "correct" order in using rules but *usually* it's easiest to simplify from inner-most expression outward.

EXAMPLE: Simplify the expressions.

(A) $(3x^{-5})^2 \cdot (-2x^4)^3$

(B) $\left(\frac{x^2y^7}{x^5y^4}\right)^{-1}$

Expressions are ***fully simplified*** when:	Name	Rule
✓ No powers raised to other powers	Power Rules	$(a^m)^n = a^{m\cdot n}$
		$(a \cdot b)^m = a^m \cdot b^m$
✓ No parentheses		$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
✓ No same bases multiplied or divided (e.g. $x^2 \cdot x^4$, $\frac{y^7}{y^4}$)	Product & Quotient Rules	$a^m \times a^n = a^{m+n}$
		$\frac{a^m}{a^n} = a^{m-n}$
✓ No zero exponents	Zero Exp. Rule	$a^0 = 1$
✓ No negative exponents	Negative Exp. Rule	$a^{-n} = \frac{1}{a^n}$
✓ All numbers with exponents evaluated	Base 1	$1^n = 1$
	Neg to Even Power	$(-a)^{even} = a^{even}$
	Neg to Odd Power	$(-a)^{odd} = -a^{odd}$
✓ All operations $(\times, \div, +, -)$ performed		

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TOPIC: INTRO TO POLYNOMIALS

- **Polynomial:** Algebraic expression where variables have only ________ number exponents (*no negatives, no fractions*)
  - **Monomial:** ______ term(s)
  - **Binomial:** ______ term(s)
  - **Trinomial:** ______ term(s)

$$6x^3 + 3x^2 + 5x$$

EXAMPLE: Determine if the expression is a polynomial. If so, identify if it's a monomial, binomial, trinomial, or none.

(A) $\frac{3}{4}x + x^3$

Whole number exp? ☐
Number of terms? ___

MONOMIAL
BINOMIAL
TRINOMIAL
NONE

(B) $\frac{5}{y}$

Whole number exp? ☐
Number of terms? ___

MONOMIAL
BINOMIAL
TRINOMIAL
NONE

(C) $2x^3y^2$

Whole number exp? ☐
Number of terms? ___

MONOMIAL
BINOMIAL
TRINOMIAL
NONE

Writing Polynomials in Standard Form

- **Standard Form:** Terms written in ______________ order of exponents & all ________ terms combined
  - **Degree:** __________ exponent of variable in polynomial

$$3x^2 + 5x + 4$$

___________ Coefficient   Coefficients   Constant

EXAMPLE: Write each polynomial in standard form. Identify the degree & leading coefficient.

(A) $\frac{1}{2}x + x^3$

Descending order? ☐
Like terms combined? ☐
Degree: ________
Leading Coefficient: ________

(B) $5x - 3x^2 + 2x - 7 + x^2$

Descending order? ☐
Like terms combined? ☐
Degree: ________
Leading Coefficient: ________

TOPIC: INTRO TO POLYNOMIALS

Adding & Subtracting Polynomials

- Like algebraic expressions, add/subtract polynomials by ____________ like terms.

Algebraic Expressions

$(2x + 3) + (4x + 8)$

$6x + 11$

EXAMPLE: Perform the given operation and simplify.

Adding Polynomials	Subtracting Polynomials
$(5x^2 + 2x + 3) + (x^2 + 7x + 8)$	$(3x^2 + 2x + 4) - (5x + 10 - x^2)$

Caution! Remember to distribute signs into parentheses!

PRACTICE: Perform the indicated operation.

$$(x^3 + 3x^2 - 7x) + 2(x^3 - 5x^2 + 9x + 4)$$

PRACTICE: Perform the indicated operation.

$$(-2x^4 + 10x^3 + 6x - 3) - (x^4 - 7x^2 + 8x + 5)$$

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TOPIC: MULTIPLY POLYNOMIALS
FOIL Method

- Many problems involve multiplying two ____________. Instead of distributing, use the **FOIL** method and simplify.
  - **FOIL** is an acronym that tells you which two terms to multiply and in what order!

F.O.I.L.

Multiply **F**_______ terms ⇒ **O**_________ terms ⇒ **I**_________ terms ⇒ **L**______ terms

Distributive Property	F.O.I.L.
$x^2(x-2)$ x^3-2x^2	$(x+2)(x+3)$

PRACTICE: Multiply the polynomials by using FOIL.

$$(x-5)(x-12)$$

PRACTICE: Multiply the polynomials by using FOIL.

$$(4x+7)(-x+6)$$

TOPIC: MULTIPLY POLYNOMIALS

PRACTICE: Multiply the polynomials by using FOIL.

$$(x^2 - 3x)(2x + 8)$$

Distributive Property

- For multiplying polynomials with > 2 terms, _______ terms of shortest expression, then ________________.

Summary of Multiplying Polynomials

1 Term × Many Terms	2 Terms × 2 Terms (FOIL)	Many Terms × Many Terms
$x(x^2 + x - 2)$	$(x + 3)(x - 2)$	$(x + 3)(x^2 + x - 2)$
$x^3 + x^2 - 2x$	$x^2 - 2x + 3x - 6$	
	$x^2 + x - 6$	

PRACTICE: Multiply the polynomials.

$$(x + 4)(3x^2 - 2x + 1)$$

TOPIC: MULTIPLY POLYNOMIALS

PRACTICE: Multiply the polynomials.

$$(x+3)(x-5)(-2x+1)$$

Special Products – Square Formulas

- For some polynomials, using formulas to multiply is easier and faster than FOIL-ing or distributing.

EXAMPLE: Multiply the polynomial.

$(x+5)(x-5)$

a = ___ b = ___

$(x+6)^2$

a = ___ b = ___

$(x+3)(x-3)$

$(a+b)(a-b)$ = __________

(Difference of Squares)

$(a+b)^2$ = a^2 ___ $2ab$ ___ b^2

$(a-b)^2$ = a^2 ___ $2ab$ ___ b^2

(Square of Binomial / Perfect Square Trinomial)

PRACTICE: Multiply the polynomials using special product formulas.

$$(5x-9)(5x+9)$$

PRACTICE: Multiply the polynomials using special product formulas.

$$(3x+5)(3x+5)$$

TOPIC: MULTIPLY POLYNOMIALS
Special Products – Cube Formulas

EXAMPLE: Multiply the polynomial using formulas.

$(x-3)^3$

a = ___ b = ___

$(a+b)^3 = a^3$ ___ $3a^2b$ ___ $3ab^2$ ___ b^3

$(a-b)^3 = a^3$ ___ $3a^2b$ ___ $3ab^2$ ___ b^3

Coefficients: (*Cube of Binomial*)

Powers of a: [↑ | ↓]

Powers of b: [↑ | ↓]

PRACTICE: Multiply the polynomials using special product formulas.

$(2x+4)^3$

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TOPIC: FACTORING POLYNOMIALS

● Previously, we multiplied polynomials. Now you'll need to "break them down" into ________ factors.

Factors = terms that multiply to a product

Multiply

$2 \cdot 3$ = ___ ______ = 6

$x(x+3)$ = ________ ________ = $x^2 + 3x$

Factor

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

Factor Out GCF

● There's 4 methods to factor polynomials. *FIRST,* always look for Greatest __________ Factors in expressions.

- **G**reatest **C**ommon **F**actor **(GCF):** largest expression (# and/or variable) that evenly divides out of ______ term

EXAMPLE: For each expression, factor out the GCF.

(A) $2x^2 + 6$

GCF: ____

(B) $7x^2 - 5x$

GCF: ____

(C) $-8x^3 + 16x$

GCF: ____

FACTORING GCF	
1) Write "factor tree" for each term	
2) Pull GCF out of parentheses, leave remaining terms from Step 1 inside	
Factor Tree	
12	$6x^2$

PRACTICE: Factor out the Greatest Common Factor in the polynomial.

$$4x^2y - 100y$$

PRACTICE: Factor out the Greatest Common Factor in the polynomial.

$$-3x^4 + 12x^3 - 18x^2$$

TOPIC: FACTORING POLYNOMIALS
Factor by Grouping

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

● For some polynomials, you may not find ***one*** common factor for ***all*** the terms.

- Try separating terms into two ____________, *THEN* factor out a GCF from each one!

FACTORING POLYNOMIALS		
	GCF	**GROUPING**
USE IF	● Common factor in ALL terms ● Use *BEFORE* other methods	● NO common factor in ALL terms (usually __)
STEPS	**1)** Write "factor tree" for each term **2)** Pull GCF out of parentheses, leave remaining terms inside	**1)** Re-write in standard form **2)** ________ first 2 & last 2 terms into pairs **3)** Factor out ____ term GCF from ***each*** group **4)** Factor out ____ term GCF of ***both*** groups
EXAMPLE	$x^3 - 2x^2$ $= (x^2 \cdot x + -2 \cdot x^2)$ $= x^2(x-2)$	$x^3 - 2x^2 + 4x - 8$

PRACTICE: Factor the polynomial by grouping.

$$-x^2 - 5x + 7x + 35$$

PRACTICE: Factor the polynomial by grouping.

$$6x^3 - 2x^2 + 3x - 1$$

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TOPIC: FACTORING POLYNOMIALS
Factoring Using Formulas

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

- Just as we used special product formulas to multiply polynomials, we can also use them to factor.

$$(x+3)(x-3) \underset{\xleftarrow{\text{Factor}}}{\xrightarrow{\text{Multiply}}} x^2 - 9$$

SPECIAL PRODUCT FORMULAS

Difference of Squares

$(a+b)(a-b) \xleftarrow{Factor} a^2 - b^2$

[SAME | OPPOSITE] signs

Sum/Difference of Cubes

(Sum of Cubes)

$(a\_\_b)(a^2\_\_ab\_\_b^2) \xleftarrow{Factor} a^3 + b^3$

$(a\_\_b)(a^2\_\_ab\_\_b^2) \xleftarrow{Factor} a^3 - b^3$

(Difference of Cubes)

Perfect Square Trinomials

$(a+b)^2 \xleftarrow{Factor} a^2 + 2ab + b^2$

[SAME | OPPOSITE] signs

$(a-b)^2 \xleftarrow{Factor} a^2 - 2ab + b^2$

EXAMPLE: Factor the polynomials using formulas.

(A)

$x^2 - 36$

$a =$ ___ $b =$ ___

(B)

$x^3 - 27$

$a =$ ___ $b =$ ___

(C)

$x^2 + 12x + 36$

$a =$ ___ $b =$ ___

PRACTICE: Factor the polynomial by using special product formulas.

$$25x^2 - 110x + 121$$

<u>TOPIC: FACTORING POLYNOMIALS</u>

<u>PRACTICE</u>: Factor the polynomial by using special product formulas.

$$\frac{x^2}{49} - 9$$

SPECIAL PRODUCT FORMULAS
$(\boldsymbol{a}+\boldsymbol{b})(\boldsymbol{a}-\boldsymbol{b}) = \boldsymbol{a}^2 - \boldsymbol{b}^2$
$(\boldsymbol{a}+\boldsymbol{b})(\boldsymbol{a}^2 - \boldsymbol{ab} + \boldsymbol{b}^2 = \boldsymbol{a}^3 + \boldsymbol{b}^3$
$(\boldsymbol{a}-\boldsymbol{b})(\boldsymbol{a}^2 + \boldsymbol{ab} + \boldsymbol{b}^2 = \boldsymbol{a}^3 - \boldsymbol{b}^3$
$(\boldsymbol{a} \pm \boldsymbol{b})^2 = \boldsymbol{a}^2 \pm 2\boldsymbol{ab} + \boldsymbol{b}^2$

FACTORING POLYNOMIALS			
<u>GCF</u>	<u>GROUPING</u>	<u>FORMULAS</u>	<u>AC METHOD</u>

<u>Factor Using the AC Method When a = 1</u>

● Recall: We multiplied binomials by ____________. We can reverse this process to factor too!

FACTORING POLYNOMIALS	
	<u>AC – METHOD</u>
USE IF	● Polynomial fits ____ + _____+ ___
STEPS	**1)** List positive & negative factors of ______ **2)** Find factors of $\boldsymbol{ac}$ which add to $\boldsymbol{b}$: $\boxed{p \cdot q = \boldsymbol{ac} \quad p + q = \boldsymbol{b}}$
	3a) If $\boldsymbol{a}$ = 1: $(x + \_\_\_)(x + \_\_\_)$
EXAMPLE	Factor the polynomial. $x^2 + 5x + 6$ $(x + \_\_)(x + \_\_)$ Multiply to $\boldsymbol{a \cdot c}$ | Add to $\boldsymbol{b}$

Multiply →

$(x+2)(x+5) = x^2 + 7x + 10$

← *Factor*

Multiply to _____

Add to _____

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TOPIC: FACTORING POLYNOMIALS

PRACTICE: Factor the polynomial.

$$x^2 - 13x + 40$$

PRACTICE: Factor the polynomial.

$$x^2 - 2x - 15$$

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

Factor Using the AC Method When $a \neq 1$

● When a ____ 1, factoring is trickier, but we can use grouping to solve!

	FACTORING POLYNOMIALS	
	AC – METHOD	
USE IF	● Polynomial fits $ax^2 + bx + c$	
STEPS	**1)** List factors of $a \cdot c$ **2)** Find factors of ac which add to b: $\boxed{p \cdot q = ac \quad p + q = b}$	
	3a) If $a = 1$: $(x + p)(x + q)$	**3b)** If $a \neq 1$: Write polynomial as $(ax^2 + \_\_\_) + (\_\_\_ + c)$ **4)** Factor by grouping
EXAMPLE	Factor the polynomial. $x^2 + 5x + 6$ $(x + \mathbf{2})(x + \mathbf{3})$ Multiply to 6 Add to 5	Factor the polynomial. $2x^2 + 7x + 6$ Multiply to: $a \cdot c$	Add to: b

TOPIC: FACTORING POLYNOMIALS

PRACTICE: Factor the polynomial.

$$4x^2 - 19x + 12$$

PRACTICE: Factor the polynomial.

$$3x^2 - 2x - 5$$

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TOPIC: RATIONAL EXPONENTS

● You can re-write radical expressions as terms with exponents that are ______________.

Radicals	Rational Exponents
$(\sqrt{5})^2$	$\left(5^{\frac{1}{2}}\right)^2 = 5^{\left(\frac{1}{2}\cdot 2\right)} =$

$\sqrt{5}$ __ $5^{\frac{1}{2}}$

____

$\boxed{\sqrt[n]{a^m} = a^{\frac{m}{n}}}$

over

____

EXPONENT RULES

$(a^m)^n = a^{m\cdot n}$

EXAMPLE: Rewrite radicals as exponents or exponents as radicals.

(A) $13^{\frac{1}{3}}$

(B) $\sqrt{x}$

(C) $\sqrt[5]{y^2}$

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TOPIC: RADICAL EXPRESSIONS

Square Roots

- The __________ of squaring a number is taking the square root.
  - Positive real numbers always have TWO roots: A __________ ("principal") and a __________ root.

Square Roots	
$(\ \ )^2$ 9 $(\ \ )^2$ $\sqrt{9}$ = ___ $\sqrt{9}$ = ___	-9 $\sqrt{-9}$ = __________ Negative #s ______ be square rooted!

Radical Symbol
- $\sqrt{\ }$ means positive root;
- $-\sqrt{\ }$ means negative root;
- $\pm\sqrt{\ }$ means both

Radicand: Term inside the radical

Warning!
$\sqrt{9} \neq \pm 3$

MEMORY TOOL
Negatives ____*side* $\sqrt{\ }$ → __*kay*
Negatives ____*side* $\sqrt{\ }$ → __*maginary*

EXAMPLE: Evaluate the radicals.

(A) $\sqrt{36}$

(B) $-\sqrt{36}$

(C) $\sqrt{-36}$

PRACTICE: Evaluate the radical.

$$-\sqrt{\frac{1}{4}}$$

PRACTICE: Evaluate the radical.

$$\sqrt{(-5)^2}$$

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TOPIC: RADICAL EXPRESSIONS
Even vs. Odd Roots

n^{th} Roots
$(a)^n = b \leftrightarrow \sqrt[n]{b} = a$

- The reverse of raising a number to the n^{th} power is taking the ____________.
  - n is the **index**, written at top-left of $\sqrt{\ }$ (Square Roots → n = 2, not written)

Even Index (n = 2,4,6…)	(Square Root)	Odd Index (n = 3,5,7…)	(Cube Root)
$(2)^2 =$ ___	$\pm\sqrt{4} =$ _______	$(2)^3 =$ ___	$\sqrt[3]{\quad} =$ _______
$(-2)^2 =$ ___	$\sqrt{-4} =$ _______	$(-2)^3 =$ ___	$\sqrt[3]{\quad} =$ _______
• **[2 | 1]** root(s): 1 positive, 1 negative		• **[2 | 1]** root(s) → Roots always _______ sign as radicand	
• Neg inside $\sqrt{\ }$ → Answer is **[IMAGINARY | NEGATIVE]**		• Neg inside $\sqrt{\ }$ → Answer is **[IMAGINARY | NEGATIVE]**	

EXAMPLE: Evaluate the following n^th roots if possible or indicate the answer is imaginary.

(A) $\sqrt[4]{81}$

(B) $\sqrt[5]{-32}$

(C) $\sqrt[4]{-16}$

(D) $\sqrt[7]{(-5)^7}$

- If a term in $\sqrt{\ }$ has an exponent = the index, they cancel out, leaving just the radicand.

PERFECT POWERS

Squares	Cubes
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	**Other**
$7^2 = 49$	$2^4 = 16$
$8^2 = 64$	$2^5 = 32$
$9^2 = 81$	$3^4 = 81$
$10^2 = 100$	

TOPIC: SIMPLIFYING RADICAL EXPRESSIONS

Simplifying Radicals by Expanding

- When $\sqrt{\ }$'s aren't perfect powers, you can simplify by re-writing it as a ________ where 1 term **IS** a perfect power!
  - An expression is fully simplified when you can't break up $\sqrt{\ }$'s any further.

If a number in a radical has factors $\boldsymbol{a}$ & $\boldsymbol{b}$, $\sqrt[n]{\#}$ = ______ = ___________

EXAMPLE: Simplify the expression.

(A) $\sqrt{20}$

(B) $\sqrt{18x^2}$

(C) $\sqrt[3]{54x^4}$

PERFECT POWERS	
Squares	**Cubes**
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	
$7^2 = 49$	
$8^2 = 64$	
$9^2 = 81$	
$10^2 = 100$	

PRACTICE: Simplify the radical.

$\sqrt{75}$

PRACTICE: Simplify the radical.

$\sqrt{180}$

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TOPIC: SIMPLIFYING RADICAL EXPRESSIONS
Simplifying Radicals with Variables

● We can apply everything we've seen for Square & n^{th} Roots with Variables in $\sqrt{\ }$'s!

Radicals WITHOUT Variables		Radicals WITH Variables	
$(3)^2 =$	$(2)^3 =$	$(\quad)^2 =$	$(\quad)^3 =$
$\sqrt{9} =$	$\sqrt[3]{8} =$	$\sqrt{x^2} =$	$\sqrt[3]{x^6} =$

Power Rule
$(a^m)^n = a^{m \cdot n}$

● Remember: When $\sqrt{\ }$'s aren't perfect powers, split them where 1 factor (# or variable) ***IS*** a perfect power.

- For $\sqrt{\ }$'s with numbers AND variables, simplify them ______________.

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

EXAMPLE: Simplify the expression.

(A) $\sqrt{x^3}$

(B) $\sqrt{x^7}$

(C) $\sqrt{8x^5}$

PERFECT POWERS	
Squares	Cubes
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	
$7^2 = 49$	
$8^2 = 64$	
$9^2 = 81$	
$10^2 = 100$	

PRACTICE: Simplify the radical.

$\sqrt{63x^2}$

TOPIC: SIMPLIFYING RADICAL EXPRESSIONS

Simplifying Radicals with Fractions

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

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

- Split up OR combine radical expressions with fractions using these rules:
  - Sometimes it's better to split & simplify, sometimes it's better to divide & simplify.

$\sqrt{\frac{49}{64}} =$ $\qquad\qquad$ $\frac{\sqrt{32}}{\sqrt{2}} =$

EXAMPLE: Simplify the expression.

(A) $\sqrt{\frac{64x^4}{9x^2}}$

(B) $\frac{\sqrt{72x^3}}{\sqrt{9x}}$

PERFECT POWERS	
Squares	**Cubes**
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	
$7^2 = 49$	
$8^2 = 64$	
$9^2 = 81$	
$10^2 = 100$	

Adding & Subtracting LIKE Radicals

- Just how we combined ***like terms***, combine ________________ (same ***radicand***, same ***index***).

Algebraic Expressions	Radical Expressions
$2x + 3 + 4x + 8$	$(2\sqrt{x} + 3) + (4\sqrt{x} + 8)$
$(2x + 4x) + (3 + 8)$	
$6x + 11$	

EXAMPLE: Perform the indicated operation and simplify. Assume all variables are positive.

(A) $3\sqrt{7} + 2\sqrt{7} - \sqrt[3]{7}$

(B) $9\sqrt[3]{x} - \sqrt{x} - 5\sqrt[3]{x} + 3$

Warning!
$\sqrt[m]{a} + \sqrt[m]{b} \neq \sqrt[m]{a+b}$

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TOPIC: SIMPLIFYING RADICAL EXPRESSIONS

PRACTICE: True or False: $\sqrt{9+16}$ and $\sqrt{9}+\sqrt{16}$ are equal.

Adding & Subtracting UNLIKE Radicals

- When adding/subtracting radicands that are NOT alike, you'll have to ____________ them *first* before combining!

Combining LIKE Radicals	Combining UNLIKE Radicals
$3\sqrt{5}+4\sqrt{5}$	$\sqrt{5}+\sqrt{20}$

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

EXAMPLE: Add or subtract the expressions and simplify.

(A) $5\sqrt{2}-\sqrt{18}$

(B) $\sqrt{18}+\sqrt{50}$

PERFECT POWERS

Squares	Cubes
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	
$7^2 = 49$	
$8^2 = 64$	
$9^2 = 81$	
$10^2 = 100$	