Algebra 1 Unit 4: Radicals and Polynomials Notes
Name: _____ Block: _____

# Unit 4: Radicals and Polynomials

In this unit, you will learn how to do the following:

**Learning Target #1: Operations with Radicals**

- Simplify radicals and radical expressions
- Add radicals
- Subtract radicals
- Multiply radicals
- Determine if the outcome of adding or multiplying rational and irrational numbers

**Learning Target #2: Operations with Polynomials**

- Classify polynomials by degree and terms
- Add polynomials
- Subtract polynomials
- Multiply polynomials
- Apply operations of polynomials to real world problems

| Mon, 2/10 | Tues, 2/11 | Wed, 2/12<br>*Day 1/2:*<br>Simplifying/Multiplying Radicals | Thurs, 2/13<br>*Day 3:*<br>Adding and Subtracting Radicals | Thurs, 2/14<br>*Day 4:*<br>Irrational and ~~Rational Numbers~~<br>**Quiz over Days 1-3** |
|---|---|---|---|---|
| **Winter Break** | **Winter Break** | **Winter Break** | **Winter Break** | **Winter Break** |
| Mon, 2/24<br>*Day 5:*<br>Classifying Polynomials<br>Adding & Subtracting Polynomials | Tues, 2/25<br>*Day 6:*<br>Multiplying Polynomials | Wed, 2/26<br>Review Day | Thurs, 2/27<br>**Unit 4 Test** | Fri, 2/28 |

## Tutoring Times

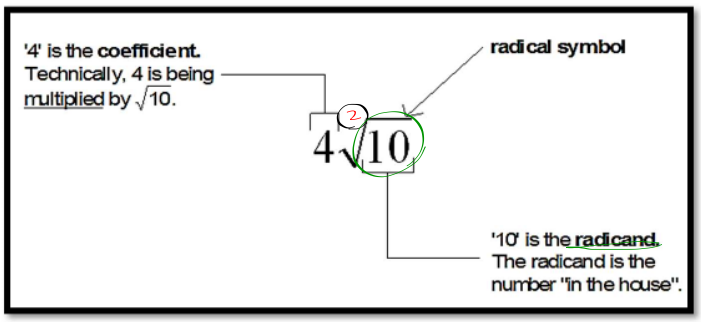
| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| AM | Mrs. Jackson<br>7:45 – 8:15<br>Room 1210 | Mr. Phillips<br>7:45 – 8:15<br>Room 1206 | Mrs. Jackson<br>&<br>Mr. Webb<br>7:45 – 8:15<br>Room 1210<br>Room 1205 | Mr. Watson<br>&<br>Mr. Phillips<br>7:45 – 8:15<br>Room 1208<br>Room 1206 | Mr. Watson<br>7:45 – 8:15<br>Room 1208 |
| PM | NONE | Mrs. Petersen<br>3:30 – 4:30<br>Room 1210 | NONE | NONE | NONE |

1

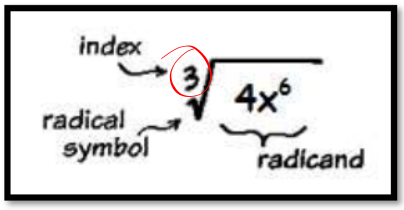
Algebra 1 Unit 4: Radicals and Polynomials Notes

# Day 1 - Simplifying Radical Expressions

A **radical** is any number with a radical symbol ( $\sqrt{\ }$ ).




A **radical expression** is an expression (coefficients and/or variables) with radical.




## Square Root Table

$\sqrt{64} = 8$

Complete the table below. $8^2 = 64$ $64^{1/2} = 8$

| Square each of the following numbers. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | x |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Show what squaring a number really means | $1^2$ | $2^2$ | $3^2$ | $4^2$ | $5^2$ | $6^2$ | $7^2$ | $8^2$ | $9^2$ | $10^2$ | $x^2$ |
| **Perfect Squares** | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 | 100 | $x^2$ |
| Take the square root of each of your perfect squares. | $\sqrt{1}$ | $\sqrt{4}$ | $\sqrt{9}$ | $\sqrt{16}$ | $\sqrt{25}$ | $\sqrt{36}$ | $\sqrt{49}$ | $\sqrt{64}$ | $\sqrt{81}$ | $\sqrt{100}$ | $\sqrt{x^2}$ |
| **Square Roots** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | x |

**Perfect Squares** are the product of a number multiplied by itself ($4 \cdot 4 = 16$; 16 is the perfect square).

Think about the process we just performed: **Number → Squared It → Took Square Root → Same Number**

A root and an exponent are **inverses** of each other (they undo each other). Therefore, square roots and squaring a number are **inverses** or they undo each other, just like adding and subtracting undo each other.

## When are Radical Expressions in Simplest Form?

A radical expression is in **simplest form** if:

- No perfect square factors other than 1 are in the radicand (ex. $\sqrt{20} = \sqrt{4 \cdot 5}$)

$\sqrt{20}$

$\sqrt{2 \cdot 2 \cdot 5}$

$2\sqrt{5}$

OR

20 = 5 · 4 = 5 · 2 · 2

$\sqrt{4 \cdot 5}$

$\sqrt{4} \cdot \sqrt{5}$

$2\sqrt{5}$

2

Algebra 1 Unit 4: Radicals and Polynomials Notes

## Simplifying Radicals

2, 3, 5, 7, 11, 13, 17, 19

Prime #: numbers that cannot reduce further

**Guided Example:** Simplify $\sqrt{108}$.

| | |
|---|---|
| **Step 1:** Find the prime factorization of the number inside the radical. | $\sqrt{108} = \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3}$ |
| **Step 2:** Determine the index of the radical. Since we are only talking about square roots, the index will be 2, which means we will circle all of our two of a kind. | $\sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3}$ |
| **Step 3:** Move each circled pair of numbers or variables from inside the radical to outside the radical. List your circled pair as just one factor outside the radical. | $2 \cdot 3\sqrt{3}$ |
| **Step 4:** Simplify the expressions both inside and outside the radical by multiplying. | $6\sqrt{3}$ |

108 → 9, 12 → 3, 3, 3, 4 → 2, 2

**Practice:**

a. $\sqrt{16}$ → 4

b. $\sqrt{48}$ → 48 → 6, 8 → $\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3}$ → $2 \cdot 2\sqrt{3}$ → $4\sqrt{3}$

c. $\sqrt{28}$ → 28 → 7, 4 → $\sqrt{7 \cdot 4}$ → $\sqrt{7} \cdot \sqrt{4}$ → $\sqrt{7} \cdot 2 = 2\sqrt{7}$

d. $\sqrt{14}$ → 14 → 2, 7 → $\sqrt{2 \cdot 7}$ → $\sqrt{14}$

e. $3\sqrt{96}$ → 96 → 32, 3 → 16, 2 → $3\sqrt{2 \cdot \sqrt{3} \cdot \sqrt{16}}$ → $3 \cdot \sqrt{2} \cdot \sqrt{3} \cdot 4$ → $12\sqrt{6}$

f. $4\sqrt{20}$ → 20 → 4, 5 → $4\sqrt{2 \cdot 2 \cdot 5}$ → $4 \cdot 2\sqrt{5}$ → $8\sqrt{5}$

g. $6\sqrt{120}$ → 120 → 12, 10 → 6, 2, 2, 5 → $6\sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 5}$ → $2 \cdot 6\sqrt{2 \cdot 3 \cdot 5}$ → $12\sqrt{30}$

h. $2\sqrt{36}$ → $2 \cdot 6$ → 12

Algebra 1 Unit 4: Radicals and Polynomials Notes

$\sqrt{x} = x^{1/2}$

## Simplifying Radicals with Variables

When simplifying radical expressions, you simplify the variables using the same method as you did previously. (Remember $\sqrt{x^2} = x$; square and square roots undo each other).

a. $\sqrt{x^8}$

b. $\sqrt{x^5}$

c. $\sqrt{y^4z^3}$

## Simplifying Radical Expressions with Square Roots

When simplifying radical expressions, you simplify both the coefficients and variables using the same method as you did previously (Remember $\sqrt{x^2} = x$; square and square roots undo each other). Remember, anything that is left over stays under the radical!

a. $\sqrt{9x^6}$

b. $\sqrt{4x^4}$

c. $\sqrt{32z^7}$

d. $\sqrt{45y^2}$

e. $\sqrt{108x^5y^9}$

f. $3\sqrt{12x^2}$

g. $3\sqrt{18a^4}$

h. $-2\sqrt{36f^3g^4}$

i. $5\sqrt{20x^{16}y^{10}}$