5.1 Radicals

Concept #19: To convert radicals in mixed form to entire form (and vice versa), to identify the restriction on the value for a variable in a radical expression and to add and subtract radicals.

$$r\sqrt[n]{x}$$

"r" is the _______________

"n" is the _______________

"x" is the _______________

Perfect Squares:

- 1, 4,
- x^2, x^4,

Perfect Cubes

- 1, 8,
- x^3, x^6,

Example #1- Changing Mixed Radicals to Entire Radicals

1) $7\sqrt{2}$ 2) $a^4\sqrt{a}$ 3) $-5b\sqrt[3]{3b^2}$

Radicals in Simplest Form are Mixed Radicals such that:

- the radicand contains no factor that is a perfect square, cube, etc. (Depending on the index)
- there is no radical in the denominator of a fraction.

Example #2: Write as a mixed radical in simplest form.

1) $\sqrt{52}$ 2) $\sqrt[3]{48c^4}$ 3) $5\sqrt{72}$ 4) $\sqrt{48y^5}$

5) $\sqrt{27x^4y^{12}}$ 6) $\sqrt[4]{m^7}$

Example #3: Order the following five numbers in order from least to greatest without using a calculator

a) $4(13)^{\frac{1}{2}},\ 8\sqrt{3},\ 14,\ \sqrt{202},\ 10\sqrt{2}$

Adding/Subtracting Radicals – simplify then combine like terms (terms that have the same index and the same radicand)

Example #4: 1) $\sqrt{5}-6\sqrt{5}$

2) $3\sqrt{5}+1.2+2\sqrt{2}-8\sqrt{5}-6\sqrt{2}+5$

3) $-\sqrt{27}+3\sqrt{5}-\sqrt{80}-2\sqrt{12}$

4) $\sqrt{4c}-4\sqrt{9c}$ (c≥0)

Restrictions – if a radical represents a real number and has an ***even index***, the radicand must be positive or 0.

Example #5: Identify the restrictions on the values for the variables.

a) $-5\sqrt{2a}$

b) $2a\sqrt{x-4}$

c) $\sqrt[3]{8r}$

Note: If the index is ***odd***, the radicand can be any real number.

5.1 Assignment: Page 278 #1,2,3,4,6 (No calc), 8, 9, 10,12, 19

5.2 Multiplying and Dividing Radical Expressions (Day1)

Concept #20: To multiply radical expressions with one or more terms and leave answers in simplest form. Also state restrictions.

Multiplying Radical Expressions

- multiply the _______________ and multiply the ________________ (if they have the ***same index***)
- radicals should be simplified before multiplying
- answer in simplest form
- state restrictions for variables (if index is even, the radicand must be _______________)

Examples – Multiply and simplify. State any restrictions on the values of the variables.

1) $(5\sqrt{2x})(3\sqrt{5x}) =$

2) $(3\sqrt{6})(-4\sqrt{2}) =$

3) $7\sqrt{3}(2\sqrt{3} - 5\sqrt{7}) =$

4) $5\sqrt[3]{9}(4\sqrt[3]{2} + 9\sqrt[3]{3}) =$

5) $\left(4\sqrt{2} + 2\sqrt{3}\right)\left(5\sqrt{2} - 6\sqrt{3}\right) =$

6) $9\sqrt[3]{2w}\left(\sqrt[3]{4w} + 7\sqrt[3]{28}\right) =$

7) $\left(2\sqrt{5}-3\sqrt{2}\right)^2$ =

8) $\left(5\sqrt{2}-6\sqrt{3}\right)\left(5\sqrt{2}+6\sqrt{3}\right)$ =

<u>5.2 DAY 1 Assignment</u>: Page 289 #1abcd, 2ac, 3ab, 4abc, 5

<u>5.2 (con't) Dividing Radical Expressions (Day 2)</u>

Concept #21: To divide radicals and rationalize a square root monomial and a square root binomial denominator using the conjugate

- Divide the _______________and divide the ______________ (if they have the ***same index***)
- A rational in simplest form does ***not*** have a radical in the denominator. If necessary, ***rationalize*** the denominator:

  a) monomial denominator – multiply the numerator and denominator by an expression that produces a rational number in the denominator

  b) binomial denominator – multiply the numerator and denominator by the _____________ of the denominator. <u>Conjugate</u>: *(a + b)* and *(a – b)* are conjugates

<u>Example#1</u> – Find the conjugate of the following

1) $5\sqrt{2}-\sqrt{3}$ →

2) - $2\sqrt{6}+5\sqrt{7}$ →

<u>Example#2</u> – Divide and simplify

1) $\dfrac{\sqrt{24x^3}}{\sqrt{3x}}$; x ≥ 0

2) $\dfrac{12\sqrt{6}}{15\sqrt{3}}$

3) $\dfrac{8\sqrt{5}}{4\sqrt{2}}$

4) $\dfrac{7\sqrt{3}}{3\sqrt{x}}$

5) $\dfrac{6}{3+\sqrt{2}}$

6) $\dfrac{5\sqrt{2}}{3\sqrt{2}-\sqrt{3}}$

7) $\dfrac{4+\sqrt{2}}{\sqrt{3}+5\sqrt{2}}$

8) $\dfrac{4\sqrt{11}}{y\sqrt[3]{6}}$

<u>5.2 DAY 2 Assignment</u>: Page 290 #6abcd, 7b,8ab, 9ab, 10abd, 15,17,19,20

5.3 Radical Equations (Day 1 and 2)

Concept#22: To solve Radical equations (equations where the variable you are solving is in the radicand) and check for extraneous roots.

STEPS:

1. State your restriction(s)
2. Isolate one radical (if there are two you should begin by getting the most complicated one by itself)
3. Square both sides (if there is a binomial on one side you must square that binomial and get a trinomial!)
4. If there is still a radical in your equation, isolate it and repeat step 2 again
5. Solve for the variable
6. Verify your answers. very important!! Does it meet the restrictions? Is it extraneous?
7. Note: If none of your answers satisfy the check or restrictions there is "NO SOLUTION"

Example#1: a) State the restrictions on x. b) Solve the radical
c) Verify your solution(s) and state any extraneous roots

$$5+\sqrt{2x-1}=12$$

Example #2 a) State the restrictions on m b) Solve the radical
c) Verify your solution(s) and state any extraneous roots

$$m-\sqrt{2m+3}=6$$

#6b) Pg 300 $-7-4\sqrt{2x-1}=17; x\geq\frac{1}{2}$

<u>Example #3:</u> Solve $\sqrt{x+2}-\sqrt{3x-5}=-1$

<u>Example#4</u>: Solve $7+\sqrt{3x}=\sqrt{5x+4}+5$

5.3 Day 2

<u>Example #5</u> What is the speed, in metres per second , of a 0.4kg football that has 28.8 J of Kinetic energy? Use the kinetic energy formula, $E_k=\frac{1}{2}mv^2$, where E_k represents the kinetic energy, in joules; m represents mass, in kilograms; and v represents speed in metres per second.

Example #6/State restrictions and solve $\sqrt{3x^2-12}=x+5$ *(Video approx. 5 mins)*
https://www.youtube.com/watch?v=rbJjp9KrA6s&t=1s&list=WL&index=2 or https://bit.ly/2MMvZU5

<u>5.3 Assignment</u>: Page 300 #3ab, 4ab, 5, 6a,7bc, 8d,9bc,10, 13, 14, 18