

Wednesday, August 8, 2018

Determine the prime factorization of the following numbers:

$40 = 2 \cdot 2 \cdot 2 \cdot 5$ $52 = 2 \cdot 2 \cdot 13$ $64 = 2^6$ $125 = 5^3$
 (Handwritten prime factorizations for 40, 52, 64, and 125)

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Quiz Review ?

4) $\frac{22}{7}$ IRRATIONAL < Non ending nonrepeating
 $3.142857143...$
 6) 16π IRRATIONAL
 50.26548246

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers

Day 5 - Simplifying Radical Expressions

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

or is the coefficient. Technically, it is being multiplied by $\sqrt{\quad}$.

radical symbol

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

index

radical symbol

radicand

Square Root Table

Complete the table below.

Squares each of the following numbers.	1	2	3	4	5	6	7	8	9	10	11
Show and square a number and square.	1	2	3	4	5	6	7	8	9	10	11
Perfect Squares	1	4	9	16	25	36	49	64	81	100	121
Take the square root of each perfect square.	$\sqrt{1}$	$\sqrt{4}$	$\sqrt{9}$	$\sqrt{16}$	$\sqrt{25}$	$\sqrt{36}$	$\sqrt{49}$	$\sqrt{64}$	$\sqrt{81}$	$\sqrt{100}$	$\sqrt{121}$
Square Roots	1	2	3	4	5	6	7	8	9	10	11

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

Think about the process we just performed: **Number \rightarrow Squared \rightarrow Square Root \rightarrow 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.

Estimating Square Roots

Sometimes the radicand is not a perfect square, cube, etc. In some of these cases, we may be asked to estimate the square root. The square root has to be in between two **numbers**. So think about the perfect squares that are **less than** or **greater than** the number.

Example: $\sqrt{55}$
 So 55 is between 49 and 64, so therefore the $\sqrt{55}$ has to be between 7 and 8.

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers

Practice: 1) $\sqrt{45}$ 2) $\sqrt{80}$ 3) $\sqrt{108}$ 4) $\sqrt{105}$

between 4 3 5 $9 \cdot 5 = 45$ $8 \cdot 10 = 80$ $9 \cdot 12 = 108$ $10 \cdot 11 = 110$

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. $\sqrt{25} = \sqrt{5^2} = 5$)
- no perfect squares are in the denominator
- no radicals are in the denominator

Prime Factorization

One of the first steps to simplifying radicals is finding the prime factorization of the radicand. You may remember this as creating a factor tree to find the prime factors. What are prime factors?

A **prime factor** is a number greater than one that only has the factors of **one** and **itself**.

Examples: 2, 3, 5, 7, 11, 13.

Practice: Find the prime factorization of each number.

1) $45 = 2 \cdot 3 \cdot 3 \cdot 5$ 2) $80 = 2^4 \cdot 5$ 3) $108 = 2^3 \cdot 3^3$ 4) $105 = 3 \cdot 5 \cdot 7$

Simplifying Radicals

old example: Simplify $\sqrt{108}$.

Step 1: Find the prime factorization of the number inside the radical.

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's of a kind.

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.

Step 4: Simplify the expressions both inside and outside the radical by multiplying.

$\sqrt{108} = \sqrt{2^3 \cdot 3^3} = 2 \cdot 3 \sqrt{3} = 6\sqrt{3}$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers

Practice: Simplify:

1) $\sqrt{45}$ 2) $\sqrt{98}$ 3) $\sqrt{108}$ 4) $\sqrt{140}$ 5) $\sqrt{20}$ 6) $\sqrt{75}$

7) $\sqrt{99}$ 8) $\sqrt{108}$ 9) $\sqrt{125}$

10) $\sqrt{12}$ 11) $\sqrt{200}$ 12) $\sqrt{12}$

Pick a column

$\sqrt{45} = 3\sqrt{5}$

$\sqrt{98} = 7\sqrt{2}$

$\sqrt{108} = 6\sqrt{3}$

$\sqrt{140} = 2\sqrt{35}$

$\sqrt{20} = 2\sqrt{5}$

$\sqrt{75} = 5\sqrt{3}$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers

Practice

Day 5 - Simplifying Radical Expressions

Simplify:

1. $\sqrt{18}$ 2. $\sqrt{48}$ 3. $\sqrt{64}$

4. $\sqrt{125}$ 5. $\sqrt{81}$ 6. $\sqrt{54}$

7. $\sqrt{63}$ 8. $\sqrt{27}$ 9. $\sqrt{121}$

10. $\sqrt{40}$ 11. $-\sqrt{26}$ 12. $\sqrt{150}$

13. $-\sqrt{90}$ 14. $\sqrt{188}$ 15. $\sqrt{36}$

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Thursday, August 9, 2018

Use prime factorization to simplify the following radicals

Simplify:

1. $\sqrt{18} = \sqrt{3 \cdot 3 \cdot 2} = 3\sqrt{2}$

2. $\sqrt{125} = \sqrt{5 \cdot 5 \cdot 5} = 5\sqrt{5}$

3. $\sqrt{72} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3} = 6\sqrt{2}$

4. $\sqrt{180} = \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5} = 3\sqrt{20} = 3\sqrt{4 \cdot 5} = 6\sqrt{5}$

Use factor trees on 1 & 2
Use the calculator on 3 & 4

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Day 6 - Simplifying Radical Expressions 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).
If I see x^2 , that just means $x \cdot x$.
If I see x^4 , that just means $x \cdot x \cdot x \cdot x$.
The **power or exponent** of the variable tells us how many times to multiply the variable by **itself**.

Simplify the following radical expressions:

1. $\sqrt{16x^4} = 4x^2$

2. $\sqrt{27} = 3\sqrt{3}$

3. $\sqrt{y^4} = y^2$

PLEASE DON'T ENTER VARIABLES IN THE CALCULATOR!

Understanding Exponents in the Calculator!

For some, fitting out the variables may be beneficial. Others may see a pattern for when we have variables as our radicand and choose to follow that pattern as their method.

When we have variables as the radicand, we want to pay attention to $\sqrt[n]{x}$ exponents.
When we have an **even exponent**, we are going to take $\frac{1}{2}$ out and there will be nothing left under the radical.
When we have an **odd exponent**, we are going to leave $\frac{1}{2}$ under the radical and take of the rest out.

Observe Example 1 above, $\sqrt{x^4}$. What was the exponent of the variable? 4. How many 'x's did we take out? 2. Was there anything left under the radical? no.

Observe Example 2 above, $\sqrt{x^5}$. What was the exponent of the variable? 5. How many 'x's did we take out? 2. Was there anything left under the radical? yes.

Practice: Simplify the following radical expressions.

1. $\sqrt{25} = 5$

2. $\sqrt{36} = 6$

3. $\sqrt{18} = 3\sqrt{2}$

4. $\sqrt{100} = 10$

5. $\sqrt{144} = 12$

6. $\sqrt{169} = 13$

7. $\sqrt{225} = 15$

8. $\sqrt{400} = 20$

9. $\sqrt{625} = 25$

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Putting It All Together

When simplifying radical expressions, you simply **combine** 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. $\sqrt{36x^3} = 6x\sqrt{x}$

b. $\sqrt{4x^2} = 2x$

c. $\sqrt{16x^2y^2z^2} = 4xyz$

d. $\sqrt{45y^2} = 3y\sqrt{5}$

e. $\sqrt{108x^3y^2} = 6x\sqrt{3xy^2}$

f. $\sqrt{20x^2y^2z^2} = 2xyz$

g. $\sqrt{180x^2y^2z^2} = 6xyz$

h. $\sqrt{36x^2y^2z^2} = 6xyz$

i. $\sqrt{25x^2y^2z^2} = 5xyz$

j. $\sqrt{100x^2y^2z^2} = 10xyz$

k. $\sqrt{144x^2y^2z^2} = 12xyz$

l. $\sqrt{169x^2y^2z^2} = 13xyz$

m. $\sqrt{225x^2y^2z^2} = 15xyz$

n. $\sqrt{400x^2y^2z^2} = 20xyz$

o. $\sqrt{625x^2y^2z^2} = 25xyz$

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Day 6 - Simplifying Radical Expressions with Variables

RADICALS ARE IN SIMPLEST FORM WHEN...

- NO perfect square factors other than 1 are under the radical.
- NO fractions are under the radical.
- NO radicals are in the denominator.

Simplify:

1. $\sqrt{x^2}$	2. $\sqrt{49x^2}$	3. $\sqrt{81y^2}$
4. $\sqrt{16x^2}$	5. $\sqrt{25y^2}$	6. $\sqrt{144z^2}$
7. $\sqrt{90xy}$	8. $\sqrt{24xy^2}$	9. $\sqrt{15x^2y^2}$

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Practice

10. $\sqrt{196x^2y^2}$	11. $\sqrt{4900z^2}$	12. $\sqrt{48xy^2z^2}$
13. $\sqrt{48a^2b^2c^2}$	14. $\sqrt{27x^2}$	15. $\sqrt{12y^2}$
16. $\sqrt{81z^2}$	17. $\sqrt{54x^2}$	18. $\sqrt{128xy^2z^2}$
19. $\sqrt{54x^2}$	20. $\sqrt{98a^2b^2c^2}$	21. $\sqrt{48x^2y^2z^2}$

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Friday, August 10, 2018

Simplify the following radicals

1. $\sqrt{a^2b^4} = ab^2$

2. $\sqrt{49x^8y^{12}} = 7x^4y^6$

3. $\sqrt{32m^7n^{11}} = 4m^3n^5\sqrt{2mn}$

4. $\sqrt{20x^{10}y^5} = 2x^5y^2\sqrt{5y}$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers Notes

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Day 7 - Radical Operations

Yesterday, we learned how to simplify radicals. Today, we are going to learn some operations we can perform with radicals: the first operation we will explore is multiplication.

The _____ of _____ states the square root of a product equals the product of the square roots of the factors.

$$\sqrt{ab} = \sqrt{a}\sqrt{b} \text{ where } a \geq 0 \text{ and } b \geq 0$$

When multiplying radicals, follow the following rules:

Multiplying Radicals - RULES

1. Multiply the **coefficients** together.
2. Multiply the **radicand** together.
3. **Simplify** the radical.

coefficients
5T2 · 3Tx
radicands
15T2x

Directions: Multiply the following radicals. Make sure they are in simplest form.

a. $\sqrt{2} \cdot \sqrt{18}$ b. $\sqrt{5} \cdot \sqrt{16}$ c. $\sqrt{8} \cdot \sqrt{32}$

Handwritten work:

a. $\sqrt{2} \cdot \sqrt{18} = \sqrt{2 \cdot 18} = \sqrt{36} = 6$

b. $\sqrt{5} \cdot \sqrt{16} = \sqrt{5 \cdot 16} = \sqrt{80} = 4\sqrt{5}$

c. $\sqrt{8} \cdot \sqrt{32} = \sqrt{8 \cdot 32} = \sqrt{256} = 16$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers Notes

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Multiplying Radicals with Variables

Recall: Do you remember what the rule is when you multiply two variables with exponents together? Work through the following examples to come up with the rule for multiplying exponents.

1. $x^2 \cdot x^3 =$
2. $a^4 \cdot a^2 =$
3. $y^2 \cdot y^3 \cdot z^4 =$

Law of Exponents: When multiplying expressions with the same bases, _____ the exponents.

$$x^m \cdot x^n =$$

Directions: Multiply the following radicals. Make sure they are in simplest form.

a. $\sqrt{27} \cdot \sqrt{48}$ b. $\sqrt{3} \cdot \sqrt{15}$ c. $5\sqrt{3} \cdot \sqrt{12}$

d. Challenge: $-3\sqrt{8} \cdot 5\sqrt{12}$

Adding and Subtracting Radicals

To add and subtract radicals, you have to use the same concept of combining "like terms", in other words, your radicands must be the same before you can add or subtract.

Explore: Simplify the following expressions:

a. $4x + 6x$ b. $5x^2 - 2x^2$ c. $8x^3 + 3x - 4x^2$

Adding/Subtracting Radicals - RULES

1. _____ all radicals.
2. Then add/subtract the _____ radicals.

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers Notes

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Practice:

a. $2\sqrt{3} + 6\sqrt{3}$ b. $3\sqrt{7} + 2\sqrt{7}$ c. $4\sqrt{3} - 6\sqrt{3}$

d. $6\sqrt{7} + 8\sqrt{10} - 3\sqrt{7}$ e. $11\sqrt{5} - 2\sqrt{50}$ f. $3\sqrt{3} + 6\sqrt{27}$

g. $3\sqrt{5} + 2\sqrt{500}$ h. $3\sqrt{3} - 2\sqrt{12}$ i. $12\sqrt{50} + 6\sqrt{2}$

Putting it all Together

a. $\sqrt{12}(\sqrt{9} - \sqrt{4})$ b. $\sqrt{3}(\sqrt{3} + 2\sqrt{3})$ c. $\sqrt{5}(\sqrt{10} + \sqrt{15})$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers Practice

Name: _____ Date: _____

Day 7 - Operations with Radicals

Multiply each expression.

1. $8\sqrt{3} \cdot 5\sqrt{2}$	2. $-4\sqrt{5} \cdot 9\sqrt{6}$	3. $3\sqrt{8} \cdot 2\sqrt{5}$
4. $-6\sqrt{2}(-6\sqrt{3})$ WITH <i>Handwritten:</i> $36T64$ NO VARIABLES = USE CALCULATOR	5. $\sqrt{2x} \cdot \sqrt{6x}$	6. $\sqrt{30x} \cdot \sqrt{3x^2}$ <i>Handwritten:</i> $130 \cdot 3 \cdot x \cdot x^2 = 3x \cdot 10 \cdot x^2 = 3x^3 \cdot 10$
7. $\sqrt{15x^2} \cdot \sqrt{10x^2}$	8. $\sqrt{8x^2} \cdot \sqrt{4x}$	9. $5\sqrt{xy} \cdot 3\sqrt{xy^2}$
10. $\sqrt{2x} \cdot \sqrt{6x}$ <i>Handwritten:</i> $12 \cdot 6 \cdot x \cdot x = 72x^2$	11. $\sqrt{10xy} \cdot \sqrt{2xy^2}$	12. $\sqrt{5}(\sqrt{15} + \sqrt{5})$ CALCULATOR! <i>Handwritten:</i> $110 + 5T3$
13. $\sqrt{2}(\sqrt{8} - 5)$	14. $\sqrt{3}(1 + \sqrt{27})$	15. $8\sqrt{3}(2\sqrt{3} + \sqrt{8})$

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Foundations of Algebra Unit 1 - Rational and Irrational Numbers Practice

Name: _____ Date: _____

Simplify each expression.

1. $\sqrt{150} - 2\sqrt{24}$	2. $-2\sqrt{90} - 5\sqrt{40}$	3. $3\sqrt{98} - 6\sqrt{18}$
4. $\sqrt{20} - 15\sqrt{7} - 5\sqrt{20} + 3\sqrt{7}$	5. $-9\sqrt{5} + 4\sqrt{7} - 4\sqrt{5} + 2\sqrt{7}$	
6. $x\sqrt{27} + \sqrt{75x^2} + 2x\sqrt{12}$	7. $x\sqrt{63} - x\sqrt{28} + x\sqrt{700}$	
8. $5\sqrt{8xy} + 9\sqrt{200xy} + \sqrt{32xy}$	9. $-2\sqrt{64} + 7\sqrt{150} + 3\sqrt{144}$	
10. $-10\sqrt{9x} + 3\sqrt{36x} - \sqrt{50x}$	11. $5\sqrt{120x} + 12\sqrt{75x} - 4\sqrt{250x}$	

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