9.1 Notes: Simplifying Radicals

Lesson Objectives

- Simplify square root expressions with numbers and variables

WARM UP
Complete the table with a calculator for as many values as you can. Use a calculator to find the ones you don't already know.

Put a star next to the ones you need to memorize.

n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)
1		6		11	
2		7		12	
3		8		13	
4		9		14	
5		10		15	

Exploration: Work with your group or a partner.

a) Simplify: $\sqrt{49}$ b) Simplify: $\sqrt{64}$

c) A square television set has an area of 144 square inches. Find the length of one side.

Square Roots and Radicals	

Examples #1 – 8: Simplify each expression.

1) $\sqrt{49}$ 2) $\sqrt{64}$ 3) $\sqrt{81}$ 4) $\sqrt{1}$

5) $6\sqrt{4}$ 6) $3\sqrt{16}$ 7) $-7\sqrt{25}$ 8) $5\sqrt{36}$

Simplifying Square Roots	

Example 9) Simplify $\sqrt{20}$. Also, use a calculator to find the decimal approximation.

Examples #10 – 15: Simplify each of the following radical expressions.

10. $\sqrt{12}$ 11. $\sqrt{360}$ 12. $-5\sqrt{24}$

You Try #13 – 15!

13. $\sqrt{90}$ 14. $\sqrt{600}$ 15. $4\sqrt{8}$

Simplifying Square Roots with Variables:

Examples 16 – 21: Simplify each radical expression. Assume all variables are positive.

16) $\sqrt{x^5}$ 17) $\sqrt{40x^{11}y^4}$ 18) $-3\sqrt{50b^7}$

You Try #19 – 21!

19) $\sqrt{a^9b^{14}}$ 20) $2\sqrt{18x^3y^5}$ 21) $\sqrt{36x^4y^{10}}$

9.2 Notes: Multiplying and Dividing Radicals

Lesson Objectives

- Multiply square root expressions
- Square radical expressions
- Divide simply square root expressions

Multiplying Square Roots	

For Examples #1 – 6, simplify each expression.

1) $\sqrt{3} \cdot \sqrt{6}$

2) $\sqrt{8 \cdot 2}$

3) $\sqrt{15} \cdot \sqrt{10}$

You Try #4 – 6!

4) $\sqrt{21} \cdot \sqrt{3}$

5) $\sqrt{2 \cdot 6}$

6) $\sqrt{3} \cdot \sqrt{12}$

For Examples #7 – 12: Simplify each expression.

7) $\sqrt{3}(2\sqrt{3})$

8) $5\sqrt{8 \cdot 20}$

9) $-2\sqrt{10} \cdot 5\sqrt{14}$

You try!

10) $-4\sqrt{35 \cdot 21}$

11) $\sqrt{7}\left(3\sqrt{21}\right)$

12) $3\sqrt{6} \cdot 4\sqrt{2}$

Squaring Radical Expressions	

For Examples #13 – 18, simplify each expression:

13) $\left(\sqrt{5}\right)^2$ 14) $\left(3\sqrt{2}\right)^2$ 15) $\left(-8\sqrt{5}\right)^2$

You Try #16 – 18!

16) $\left(\sqrt{11}\right)^2$ 17) $\left(-6\sqrt{3}\right)^2$ 18) $\left(4\sqrt{7}\right)^2$

Dividing with Square Roots	

For #19 – 26, simplify each expression.

19) $\sqrt{\frac{49}{25}}$ 20) $\frac{\sqrt{25}}{\sqrt{9}}$ 21) $\frac{\sqrt{48}}{\sqrt{12}}$ 22) $\frac{9\sqrt{40}}{3\sqrt{2}}$

You Try #23 – 26!

23) $\sqrt{\frac{4}{121}}$ 24) $\frac{\sqrt{49}}{\sqrt{36}}$ 25) $\frac{\sqrt{27}}{\sqrt{3}}$ 26) $\frac{10\sqrt{56}}{2\sqrt{7}}$

9.3 Notes: Cube Roots and Rational Exponents

Lesson Objectives

- Simplify cube root expressions
- Simplify expressions with rational exponents

WARM UP
Complete table without a calculator.

n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)
1		6		11	
2		7		12	
3		8		13	
4		9		14	
5		10		15	

n	n^3 (Perfect Cubes)	n	n^3 (Perfect Cubes)
1		4	
2		5	
3		6	

Simplifying Cube Roots

Examples #1 – 6: Simplify each expression. Assume all variables are positive.

1) $\sqrt[3]{54}$ 2) $-10\sqrt[3]{40}$ 3) $\sqrt[3]{27x^6y^8}$

You try #4 – 6!

4) $\sqrt[3]{80}$ 5) $15\sqrt[3]{270}$ 6) $\sqrt[3]{128a^5b^{15}}$

Rational Powers	$x^{1/2} = \sqrt{x}$	$x^{1/3} = \sqrt[3]{x}$

For Examples #7 – 12, simplify each expression.

7) $98^{1/2}$ 8) $45^{1/2}$ 9) $250^{1/3}$

You Try #10 – 12!

10) $216^{1/2}$ 11) $216^{1/3}$ 12) $48^{1/3}$

We can also multiply (and divide) square roots with variables. Below are some examples with multiplication with variables and radicals.

For Examples #13 – 18: Simplify each expression. Assume all variables are positive.

13) $\left(\sqrt{x^5}\right)\left(\sqrt{x^6}\right)$ 14) $5a\sqrt{6a \cdot 3a^4}$ 15) $6\sqrt{x^3y^2} \cdot 4\sqrt{xy^5}$

You try #16 – 18!

16) $-4\sqrt{3a^3 \cdot 12a}$ 17) $4b\sqrt{b^3} \cdot \sqrt{b^7}$ 18) $\left(3\sqrt{xy^2}\right)\left(4\sqrt{x^5y^6}\right)$

Challenge! Assume all variables are positive. Simplify: $-10a^2b \cdot \sqrt[3]{24a^3b^6}$

9.4 Notes: Rationalizing Expressions

Lesson Objectives

- Rationalize numerical expressions with square roots
- Rationalize variable expressions with square roots

Rationalizing with Square Roots	

Examples #1 – 8: Simplify each expression. Rationalize as needed. Hint: look for a pattern!

1) $\frac{1}{\sqrt{3}}$ 2) $\frac{1}{\sqrt{2}}$ 3) $\frac{1}{\sqrt{15}}$ 4) $\frac{1}{\sqrt{11}}$

You Try #5 – 8!

5) $\frac{1}{\sqrt{23}}$ 6) $\frac{1}{\sqrt{5}}$ 7) $\frac{1}{\sqrt{17}}$ 8) $\frac{1}{\sqrt{7}}$

Examples #9 – 16: Simplify each expression. Rationalize as needed. Hint: look for a pattern!

9) $\frac{5}{\sqrt{3}}$ 10) $\frac{-7}{\sqrt{2}}$ 11) $\frac{15}{\sqrt{3}}$ 12) $\frac{14}{\sqrt{7}}$

You Try #13 – 16!

13) $\frac{-4}{\sqrt{23}}$ 14) $\frac{2}{\sqrt{5}}$ 15) $\frac{4}{\sqrt{2}}$ 16) $\frac{10}{\sqrt{5}}$

Simplifying Radical Expressions with Ratios (Fractions)	1) Look for Fraction Reducing 2) Simplify Radicals 3) Rationalize, if needed 4) Check for steps 1 and 2 one more time!

Examples #17 – 24: Simplify each expression. Rationalize as needed.

17) $\frac{\sqrt{15}}{\sqrt{30}}$ 18) $\frac{\sqrt{20}}{\sqrt{50}}$ 19) $\frac{2}{\sqrt{28}}$ 20) $\frac{6\sqrt{2}}{3\sqrt{10}}$

You Try #21 – 24!

21) $\frac{\sqrt{20}}{\sqrt{60}}$ 22) $\frac{\sqrt{12}}{\sqrt{15}}$ 23) $\frac{4}{\sqrt{20}}$ 24) $\frac{10\sqrt{7}}{2\sqrt{42}}$

Rationalizing with Variables	

Examples #25 – 28: Simplify each expression. Rationalize as needed. Assume all variables are positive.

25) $\frac{3}{\sqrt{x}}$ 26) $\frac{5}{2\sqrt{a}}$ 27) $\frac{2}{\sqrt{b}}$ 28) $\frac{7}{3\sqrt{y}}$