Chapter 9, Lesson 1

Square Roots

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a number is the opposite of squaring a number.



\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the square root of \_\_\_\_\_\_\_\_\_\_\_\_.

We call \_\_\_\_\_\_\_\_\_\_\_\_\_ a perfect square because

its root is a whole number.

Every perfect square has two square roots. (One is \_\_\_\_\_\_\_ and the other is \_\_\_\_\_\_\_.)

 Example: $\sqrt{100}$

 Positive: Negative:

We can use this sign to show both positive and negative: $\pm $ 10. We don’t need to write the 10 twice.

Practice: Find the square root of each value.

1. $\sqrt{121}$ 2. $\sqrt{256}$ 3. $\sqrt{64}$

We can’t find an exact value for the square roots of numbers that aren’t perfect squares. If we put them into a calculator, it will give us an infinite, non-repeating decimal. (This means the number is irrational- We will learn about this during Chapter 5.)

We can find the approximate value with and without a calculator.

Approximate the square root without using a calculator.

Example: $\sqrt{158}$

This number is between which two perfect squares? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The square root will be between which two whole numbers? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To figure out which root it is closer to, check to see which perfect square it is closer to.

 $\sqrt{158}$ is approximately \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Practice: Approximate the square root of each value. Round to the nearest integer.

4. $\sqrt{12}$ 5. $\sqrt{95}$ 6. $-\sqrt{37}$

Evaluate the following radical expressions. ($\sqrt{ } $🡨 This is called a radical.)

Example: $-3\sqrt{x+y}$ for $x=25, y=11$

* The radical acts as a grouping symbol. You must simplify everything under the radical before you can find the square root.

Practice:

7. $\sqrt{x^{2}-3(x-4)}$ for $x=11$ 8. $\sqrt{x^{2}-y^{2}}$ for $x=10, y=6$

Solve the following equations. Be sure to include all solutions.

* The inverse operation of squaring a number is to find the square root.

9. $x^{2}=81$ 10. $x^{2}=169$

HW: 9.1 (page 480) #16-52 even, 54-57, 58-64 even

Challenge problems: #66- 69

Chapter 9, Lesson 2:

Simplifying Square Roots

Review: Find the square roots of the following numbers.

 $\sqrt{144}$ $\sqrt{36}$ $-\sqrt{625}$ $\sqrt{64}$

Today, we are going to simplify radical expressions without using a calculator.

A radical is in simplest form when:

* No factor of the expression under the radical sign has any perfect square factor (other than 1)
* There are no fractions under the radical sign, and no racial sign in the denominator of any fraction.

Simplify the following expressions.

* Since the following values are not perfect squares, we must factor them so that one factor is a perfect square.
* We can then take the square root of the individual factor.
* You may need to use factor trees to help you find the perfect square.

Example: $\sqrt{63}$ = $\sqrt{ ∙ } = \sqrt{ }$

1. $\sqrt{28}$ 2. $\sqrt{180}$

3. $\sqrt{675}$ 4. $\sqrt{245}$

5. $\sqrt{80}$ 6. $\sqrt{72}$

To simplify variable expressions, remember:

* A perfect square must have an \_\_\_\_\_\_\_\_\_\_\_\_ exponent.
* The square root of an exponential expression will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the original exponent.

Example: $\sqrt{99x^{2}}= \sqrt{ ∙ ∙ }= \sqrt{ }$

7. $\sqrt{54t^{2}}$ 8. $\sqrt{176y^{4}}$

9. $\sqrt{21x^{3}}$ 10. $\sqrt{m^{4}n^{5}}$

When a fraction is in a radical, you can take the square root of the numerator and denominator individually.

Example: $\sqrt{\frac{13}{36}}= \frac{\sqrt{ }}{\sqrt{ }}= $

11. $\sqrt{\frac{32}{n^{2}}}$ 12. $\sqrt{\frac{49}{121x^{2}}}$

13. $\sqrt{\frac{48m^{5}}{16n^{2}}}$ 14. $\sqrt{\frac{108}{64}}$

HW: 9.2 (page 484) #9-26, 29-32; Challenge problems #27-28, 33

Performing Operations on Square Roots

Part 1: Multiplying and Dividing Radical Expressions

Example 1:

$$\sqrt{15∙} \sqrt{6}$$

To complete a problem like this, you can multiply both numbers. Then use perfect square factors to simplify.

Practice:

1. $\sqrt{10}∙ \sqrt{2}$ 2. $\sqrt{12}∙ \sqrt{8}$

Example 2:

$$\frac{\sqrt{20}}{\sqrt{15}}$$

To complete a problem like this, you can write the fraction under the same radical, then simplify the fraction.

$$\sqrt{\frac{20}{15}}= \sqrt{\frac{}{}}= \sqrt{\frac{}{}} $$

Notice that we have a radical in the denominator. This means that it is not simplified. In order to remove the radical, we must multiply by the denominator over itself (1).

$$\sqrt{\frac{}{}} ∙ \frac{\sqrt{}}{\sqrt{}}=$$

Practice:

3. $\frac{\sqrt{54}}{\sqrt{42}}$ 4. $\frac{\sqrt{27}}{\sqrt{45}}$

Part 2: Adding and Subtracting Radical Expressions

In order to add and subtract radical expressions, the terms must have the same radicals. It works the same way as adding and subtracting like terms.

Example 3:

$$2\sqrt{5}- \sqrt{7}+6\sqrt{5}$$

* The like terms are \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_ because they have the same radical.

Example 4:

In this problem, we can simplify the first term. This may make it possible to combine the terms.

$$\sqrt{12}+8\sqrt{3}$$

Practice:

5. $4\sqrt{11}-3\sqrt{11}+6\sqrt{3}$ 6. $\sqrt{18} +5\sqrt{2}$

HW: pg. 487 #1-15

Cube Roots

A cubic root is very similar to a square root, except the root is raised to the third power (not the second power).

$10^{3}=1,000$; $ \sqrt[3]{1000}=10$

Cube roots are a little more difficult to calculate (without the help of a calculator).

We are going to use prime factorization to find cubic roots.

1000

You can see that we have three 2’s and three of 5’s. \_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_

Practice: (If you know the root, you don’t need to do the factor tree.)

1. $\sqrt[3]{8}= $\_\_\_\_\_\_\_\_ 2. $\sqrt[3]{-27}= $\_\_\_\_\_\_\_\_

3. $\sqrt[3]{512}= $\_\_\_\_\_\_\_\_ 4. $\sqrt[3]{-216}= $\_\_\_\_\_\_\_\_

HW: Practice Worksheet (Next page in notes)

Cube Roots- Practice Problems

1. $\sqrt[3]{-125}= $\_\_\_\_\_\_\_\_ 2. $\sqrt[3]{1}= $\_\_\_\_\_\_\_\_

3. $\sqrt[3]{64}= $\_\_\_\_\_\_\_\_ 4. $\sqrt[3]{343}= $\_\_\_\_\_\_\_\_

5. $\sqrt[3]{3375}= $\_\_\_\_\_\_\_\_ 6. $\sqrt[3]{-1}= $\_\_\_\_\_\_\_\_

7. $\sqrt[3]{8000}= $\_\_\_\_\_\_\_\_ 8. $\sqrt[3]{9,261}= $\_\_\_\_\_\_\_\_

9. $\sqrt[3]{-729}= $\_\_\_\_\_\_\_\_ 10. $\sqrt[3]{1728}= $\_\_\_\_\_\_\_\_