Name:_____ Date:_____ Per._____

U7 CWK #3: *Simplifying Square Roots*

In this section we will learn two strategies for simplifying square roots of numbers that are not perfect squares. Both strategies are really doing the same thing, but the methods for each are a little different.

Think back to the previous lesson. What does it mean to simplify a square root of a non-perfect square? What was the difference between the simplified version of these square roots as opposed to how they looked before they were simplified?

Let's look at some example from the previous lesson:

$$\sqrt{8} = 2\sqrt{2}$$
$$\sqrt{18} = 3\sqrt{2}$$
$$\sqrt{32} = 4\sqrt{2}$$
$$\sqrt{40} = 2\sqrt{10}$$

What observations can you make about the simplified versions of these square roots non-perfect squares? List them here:

Two Strategies for Simplifying Square Roots

Strategy 1:

1. Find the greatest perfect square that is a factor of the number inside the square root symbol.
2. Rewrite the number inside the square root symbol as the product of the greatest perfect square and the other factor.
3. Take the square root of the perfect square. Remember: When you take the square root of the perfect square, it is no longer inside the square root symbol.
4. Continue this process until you can no longer find a perfect square other than 1 that is a factor of the number inside the square root symbol.

Strategy 2:

1. Using the factor tree method, factor the number inside the square root symbol.
2. Look for and circle any pairs of numbers among the factors.
3. Put a square around any numbers that are not part of a pair. Re-write the numbers as factors to see that the pairs can be removed, while anything left over must stay under the square root symbol.
4. Remove the pairs and leave any leftover numbers inside the square root symbol. Remember that because we are factoring, all of these numbers are being multiplied, so if you end up with multiple numbers outside or inside the square root symbol, multiply them together.

Examples:

$\sqrt{8} = \sqrt{4 \cdot 2} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$

$\sqrt{60} = \sqrt{4 \cdot 15} = \sqrt{4} \cdot \sqrt{15} = 2\sqrt{15}$

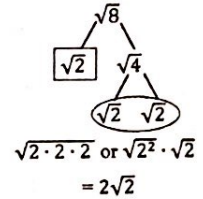
$\sqrt{40} = \sqrt{4 \cdot 10} = \sqrt{4} \cdot \sqrt{10} = 2\sqrt{10}$

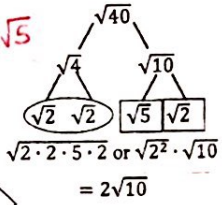
$\sqrt{80} = \sqrt{4 \cdot 20} = \sqrt{4 \cdot 4 \cdot 5} = \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{5} = 2 \cdot 2\sqrt{5} = 4\sqrt{5}$

$\sqrt{32} = \sqrt{16 \cdot 2} = \sqrt{16} \cdot \sqrt{2} = 4\sqrt{2}$

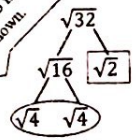
$\sqrt{12} = \sqrt{4 \cdot 3} = \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$

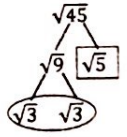
$\sqrt{45} = \sqrt{9 \cdot 5} = \sqrt{9} \cdot \sqrt{5} = 3\sqrt{5}$

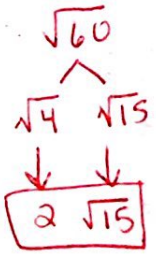


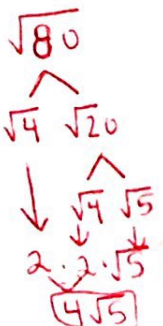


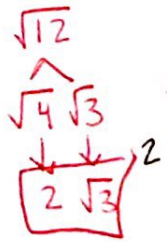
Hint: You can stop when you find a pair rather than continue to factor it down.











Strategy 1

Now you try…

$\sqrt{50}$ $\sqrt{25 \cdot 2} = \sqrt{25} \cdot \sqrt{2} = \boxed{5\sqrt{2}}$

$\sqrt{200}$ $\sqrt{4 \cdot 50} = \sqrt{4} \cdot \sqrt{50} = 2\sqrt{50}$

$2\sqrt{50} = 2 \cdot \sqrt{25 \cdot 2} = 2 \cdot \sqrt{25} \cdot \sqrt{2} = 2 \cdot 5\sqrt{2} = \boxed{10\sqrt{2}}$

$\sqrt{72}$ $\sqrt{9 \cdot 8} = \sqrt{9} \cdot \sqrt{8} = 3\sqrt{8} = 3\sqrt{4 \cdot 2} = 3\sqrt{4} \cdot \sqrt{2}$

$3 \cdot 2 \cdot \sqrt{2} = \boxed{6\sqrt{2}}$

$\sqrt{147}$ $\sqrt{49 \cdot 3} = \sqrt{49} \cdot \sqrt{3} = \boxed{7\sqrt{3}}$

$\sqrt{128}$ $\sqrt{16 \cdot 8} = \sqrt{16 \cdot 4 \cdot 2} = \sqrt{16} \cdot \sqrt{4} \cdot \sqrt{2} = 4 \cdot 2 \cdot \sqrt{2}$

$\boxed{8\sqrt{2}}$

$\sqrt{\frac{1}{4}}$ $\frac{\sqrt{1}}{\sqrt{4}} = \frac{1}{2}$

Strategy 2 : (Trees)

$-\sqrt{8}$

$\sqrt{8}$ → $\sqrt{4}$ $\sqrt{2}$

$\boxed{-2\sqrt{2}}$

*Ignore negative & come back to it
* Sneak it back in @ end.

$-5\sqrt{45}$

$\sqrt{45}$ → $\sqrt{9}$ $\sqrt{5}$ → $-5 \cdot 3\sqrt{5} = \boxed{-15\sqrt{5}}$

$10\sqrt{96}$

$\sqrt{96}$ → $\sqrt{4}$ $\sqrt{24}$ → $\sqrt{6}$ $\sqrt{4}$

$10 \cdot 2 \cdot 2\sqrt{6} = \boxed{40\sqrt{6}}$

$\sqrt{\frac{49}{36}}$ $\frac{\sqrt{49}}{\sqrt{36}} = \boxed{\frac{7}{6}}$

$-\sqrt{36}$ $\sqrt{36}$ → $\boxed{-6}$

$\sqrt{\frac{4}{25}}$ $\frac{\sqrt{4}}{\sqrt{25}} = \boxed{\frac{2}{5}}$

What happens when we apply this same method with a perfect square?

$\sqrt{100} = \sqrt{25 \cdot 4} = \sqrt{25} \cdot \sqrt{4} = 5 \cdot 2 = 10$

$\sqrt{144} = \sqrt{36 \cdot 4} = \sqrt{4 \cdot 9 \cdot 4} = \sqrt{4} \cdot \sqrt{9} \cdot \sqrt{4} = 2 \cdot 3 \cdot 2 = \boxed{12}$