Simplifying Radicals

Bill Hanlon

From grade school, you can probably remember how to take square roots of numbers like $\sqrt{25}$, $\sqrt{64}$, and the $\sqrt{100}$. The number on the inside of the radical sign is called the radicand.

Finding those answers are easy when the radicand is a perfect square. But what happens if the radicand is not a perfect square? Knowing you were thinking just that very thought, you must be very pleasantly surprised to know I am going to tell you how to simplify those expressions.

Let me just tell you how, then I'll use an example to make it more clear.

To simplify a square root (second root), you rewrite the radicand as a product of a perfect square and some other number, then you take the square root of the number you know. The number you don't know the square root of stays inside the radical.

Example. Simplify $\sqrt{75}$

We don't know the $\sqrt{75}$ so we'll rewrite the radicand as a product of a perfect square and some other number. Since 25 is a perfect square that is a factor of 75, we'll rewrite.

$$\sqrt{75} = \sqrt{25x3}$$

$$= \sqrt{25} \text{ x } \sqrt{3}$$

$$= 5\sqrt{3}$$

That's pretty straight forward. If you are not familiar with perfect squares, you should write them down. By multiplying the counting numbers by themselves. Examples; 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, ….

Example Simplify $\sqrt{72}$

$$\sqrt{72} = \sqrt{36x2} = \sqrt{36} \text{ x } \sqrt{2}$$

$$= 6\sqrt{2}$$

Now, what would have happened if you rewrote 72 as 9 x 8?
Let's see.

$$\sqrt{72} = \sqrt{9x8} = \sqrt{9} \text{ x } \sqrt{8}$$

$$= 3\sqrt{8}$$

Oh, oh, that's not the same answer we got before. How can that be? Well, one reason is we're not finished, we can simplify $\sqrt{8}$.

$3\sqrt{8} = 3\sqrt{4x2}$

$= 3\sqrt{4} \text{ x } \sqrt{2}$

$= 3 \text{ x } 2 \text{ x } \sqrt{2}$

$= 6\sqrt{2}$

That's the same answer we got before.

Whew! You would not have able to go to bed tonight thinking about that.

When simplifying radicals, it would be a good idea to become comfortable with perfect squares. And just as importantly, when you rewrite the radicand as the product of a perfect square and some other number, use the LARGEST perfect square you can. Otherwise, you'll end up doing a lot more steps.

Remember reducing fractions, you'd use the largest factor that divided into the numerator and denominator because that meant you ended up with less work. The same applies here, the larger the perfect square you use, the shorter the problem.

Try a couple on your own.

$\sqrt{48}$

$\sqrt{175}$

$\sqrt{32}$

Now, with that sub skill out of the way, we are ready to work with the Quadratic Formula. Happy?