Type 2 Radicals

This section discusses how to handle type two radicals.

Type Two Radicals and how to 'simplify' them.

You can watch a video on this topic here:

YouTube link: https://www.youtube.com/watch?v=OUF6PRWy5M0

In some senses, type two radicals are the most straight forward type which is why we start with the type two instead of the type one. In short, a type two radical is 'easy' purely because there isn't anything we can do when it is in this form in terms of 'simplifying' the radical (without manipulating the radicand). The key thing here is that you ***absolutely cannot simplify a type two radical!*** This may seem straight forward, but it is often easy to overlook this and simplify things because it seems like it should work. For example;

Example 1 (Find values of x so that $\sqrt{x^2+9}=10$)**.** *Notice that the radical in the problem is type 2 because it has more than one term in the radicand. Nonetheless many reading this example will want to immediately 'simplify' the radical to get the equation:* $x+3=10$ *(by square rooting each of the terms). Unfortunately this is invalid... to see that it doesn't work, let's try it this way and see what we get.*

Doing this 'simplification' gets us that $x+3=10$ *which we can solve to find* $x=7$*. An astute student might want to include the* $\pm$ *option because of the* x^2*, so let's consider that possibility as well; ie* $x+3=-10$ *which gives* $x=-13$*. Now let's plug these "solutions" of* x *back into the original equation to see what happens;*

$$\begin{array}{rccccccc} x=7\text{:} & \sqrt{x^2+9} & = & \sqrt{7^2+9} & = & \sqrt{49+9} & = & \sqrt{58}\neq 10. \\ x=13\text{:} & \sqrt{x^2+9} & = & \sqrt{(-13)^2+9} & = & \sqrt{169+9} & = & \sqrt{178}\neq 10. \end{array}$$

As we can see; in both these cases our 'solutions' didn't work, this is because (***you cannot simplify type two radicals*** *✓/ math loves wasting our time. / because there is a better way to simplify these radicals.). Thus we will need a different way of solving these kinds of equations, which we will discuss later in this topic.*

So, when you are confronted with the need to simplify a type two radical, your only practical approach (at least at this point) is to try and manipulate the radicand to make the type two radical into a type one radical. In short, you need to **factor** the radicand. If possible this is almost always the best way to go, as other techniques to 'solve' equations with type two radicals come with a variety of possible drawbacks.

In the next section we will be discussing how to simplify type one radicals. So once you have factored the type two radical into a type one radical, you can use the techniques in the next section to then simplify the radical.

Learning outcomes: