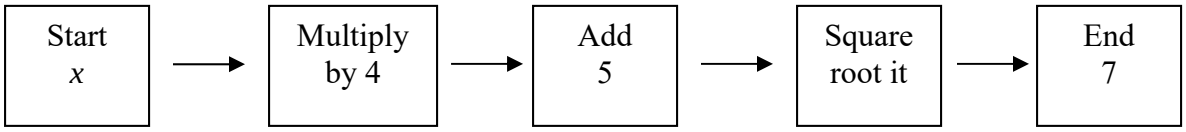
Solving radical equations with verbal models NAME:

Verbal models can often help us figure out the steps needed to efficiently solve an equation. Below is the verbal model for the equation $\sqrt{4x+5}=7$; it helps us visualize the equation. Notice it starts at x and describes what was done to x to make the equation in the first place. (It helps to think about a specific value for x and imagine checking it as a possible solution.)



Again, the idea of a verbal model is to determine the steps you need to solve the equation. To solve $\sqrt{4x+5}=7$, we need to undo the verbal model, *starting at the far-right end*. We want to reverse these operations to unbury x. Below, I have written the algebra out for you.

$$\sqrt{4x+5}=7$$
$$4x+5=49$$
$$4x=44$$
$$x=11$$

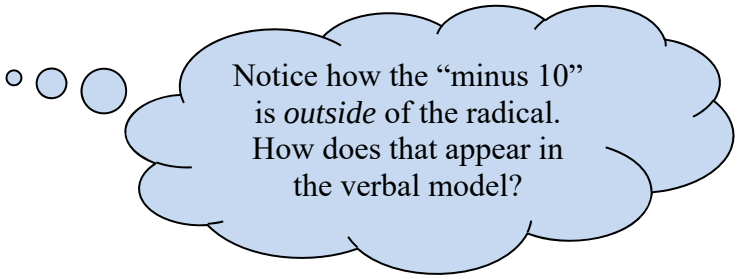
We first square both sides to undo the square root. We then subtract 5 to undo the addition of 5. Lastly, we divide by 4 to undo the multiplication of 4. This leaves us with x on the left side and our solution on the right.

Check the solution. Does it work?

For the equations below, draw out the verbal model that describes what was done to x to make the equation in the first place. Then undo it to solve for x. You might also want to check your solutions.

1. $\sqrt{2x-7}=5$

2. $\sqrt{3x-2}-10=7$



We will practice algebraically solving radical equations and see another important concept as well. You can use verbal models or not, your choice.

3a. In words, explain why the equation $\sqrt{5x-6}=-8$ *must have no solution*. (In other words, what about the equation makes it so that there could be *no* x value that makes it true?)

3b. Often, people will attempt to solve $\sqrt{5x-6}=-8$ algebraically, not realizing that the equation itself does *not* work. Below, you will see the (wrong) solution that is most common. Visibly check the solution in the original equation to show that it does ***not*** work.

$$\sqrt{5x-6}=-8$$
$$\left(\sqrt{5x-6}\right)^2=(-8)^2$$
$$5x-6=64$$
$$5x=70$$
$$\boxed{x=14}$$

3c. In contrast, the equation $\sqrt{5x-6}=8$ does have a solution. Solve the equation $\sqrt{5x-6}=8$ algebraically. You can use a verbal model or not, your choice. Show your work. Check your answer by substituting it into the original equation.

4. Solve the equation $\sqrt[3]{3x+4}+5=0$ algebraically. You can use a verbal model or not, your choice. Show your work. Visibly check your answer by substituting it into the original equation.