Algebra II

Lesson 7.5: Solving Square Root and Other Radical Equations

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In previous chapters we were solving polynomials: $x^2 - 18 = 0$; $x^2 = 18$; $\sqrt{x^2} = \sqrt{18}$; $x = \pm 3\sqrt{2}$. This is what is called solving by square roots, because we need to take the square root of x.

Now, when we have the variable as a radicand or the variable has a fraction for an exponent (indicates that it is a root), we have what is called a **radical equation**. So to solve for our variable we would have to what???

Solve: $\sqrt{3x-2} - 2 = 0$	Follow the same process we have always used: Start by isolating the variable term. First add/subtract numbers To get rid of the radical square both sides of the equation and simplify solve for x
$2 + \sqrt{3x-2} = 6$	$3\sqrt{5x+1} - 6 = 0$

We can also solve equation where instead of a radical there is a fractional exponent. How? **Raise each side of the equation to the reciprocal power of the exponent.** With the following rule resulting:

$$\left(x^{m/n}\right)^{n/m} = |x|$$

- The above rule generates two possible answers: $|x| = \pm$
- When both sides of an equation are raised to a power, a chance for extraneous solutions is introduced so… ***check solutions to verify presence of an extraneous solution.***

A brief review of absolute values:

$\lvert\quad\rvert = 5$ $= \pm 5$ therefore if $\lvert x+3 \rvert = 5$ then: $x + 3 = \pm 5$ and $x + 3 = 5 \; and \; x + 3 = -5$ so! $x = ??$	The "stuff" inside the AV can either be positive or negative, so there will be 2 possible solutions for x. The +/- solutions are the 2 possible solutions. Do both values of *x* work?
Let's see how this works, Solve: $2(x+3)^{\frac{3}{2}} = 54$	1. Get rid of coefficient 2 by multiplying by reciprocal. 2. The exponent is $\frac{3}{2}$, so we raise each side by the reciprocal of $\frac{2}{3}$ **rule of exponents:** exponent raised to an exponent, multiply the exponents. 3. Now simplify the right side of the equation the rational exponent means we take the cube root of 27^2 or!! the cube root of 27 then squared. 4. Set the absolute value equal to the $\pm$ the expression and solve CHECK ANSWERS!! THERE MAY BE A FALSE SOLUTION!!

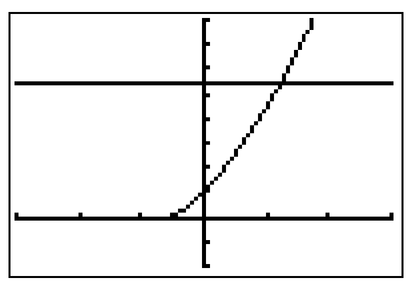
$2(x-2)^{2/3} = 50$	$3(x+3)^{3/4} - 5 = 76$

If a calculator is available, checking your work will be quicker, but you need to do this without the assistance of technology. Enter each side of the original equation as a separate entry in your calculator's **Y=** function. Locate the intersection of the two lines to verify the solutions.

For the above example we find that there is only one solution for Y=27 as shown on the following graph:

Graph the equation $(x+3)^{\frac{3}{2}} = 27$
on calculator enter

Y1=$(x+3)^{\frac{3}{2}}$
Y2= 27
WINDOW Xmin= -15
Xmax= 15
Scl= 5
Ymin= -10
Ymax= 40
Scl=5
set windows to include y=27 on the graph
we know that $x = 6\ or -12$ so set windows accordingly.



Equations can contain more than one radical expression

- ISOLATE one of the radicals.
- **IF** it contains an expression with a variable under a radical and a variable outside the radical, focus on isolating the variable under the radical by squaring each side.
- Well! Well! You may end up with a quadratic equation! You can handle that!
- Squaring and equation may introduce false solutions. ***ALWAYS CHECK FOR EXTRANEOUS SOLUTIONS, PLEASE!***

Now Try:

$\sqrt{3x+2} - \sqrt{2x+7} = 0$	$(2x+1)^{1/3} - (2+3x)^{1/3} = 0$
$\sqrt{x+7} - x = 1$	$(2x+1)^{0.5} - (3x+4)^{0.25} = 0$