

A **radical equation** is an equation that has a variable in a radicand or a variable with a rational exponent. If the radical has index 2, the equation is a **square root equation**. In this lesson, assume that all radicals and expressions with rational exponents represent real numbers.

Essential Understanding Solving a square root equation may require that you square each side of the equation. This can introduce extraneous solutions.

To solve a radical equation, isolate the radical on one side of the equation. Then raise each side to the power suggested by the index.

Problem 1 Solving a Square Root Equation





2. $\sqrt{2x+3}-7=0$

To solve equations of the form $\left(x^{\frac{m}{n}}\right) = k$, raise each side of the equation to the power $\frac{n}{m}$, the reciprocal of $\frac{m}{n}$. If either *m* or *n* is even, then $\left(x^{\frac{m}{n}}\right)^{\frac{n}{m}} = |x|$.



Got If? What are the solution(s) of $2(x+3)^{\frac{2}{3}} = 8$?



4. $(x+1)^{\frac{3}{2}} - 2 = 25$



Got If? A crater similar to the one in Problem 3 has diameter 1 km. What is the volume of the crater? Use the formula $d = 2\sqrt[3]{\frac{V}{0.3}}$, which relates the diameter *d* of the rim (in meters) to the volume *V* (in cubic meters).

Practice 5. Volume A spherical water tank holds 9000 ft³ of water. What is the diameter of the tank? (*Hint*: $\frac{1}{6}d^{3}\pi = V$)

5EM 6. Hydraulics The formula $\frac{\pi d^2 v}{4} = Q$ models the diameter of a pipe where *Q* is the maximum flow of water in a pipe, and *v* is the velocity of the water. What is the diameter of a pipe that allows a maximum flow of 30 ft³/min of water flowing at a velocity of 400 ft/min? Round your answer to the nearest inch.

When you raise each side of an equation to a power, it is possible to introduce extraneous solutions. Therefore, it becomes very important that you check all solutions in the original equation. A correct solution will give a true statement. An extraneous solution will give a false statement.



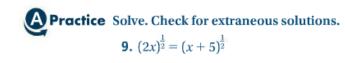
Got lt? a. What is the solution of $\sqrt{5x-1} + 3 = x$? Check your results.



8.
$$(x+3)^{\frac{1}{2}} - 1 = x$$



Got If? What is the solution of $\sqrt{5x+4} - \sqrt{x} = 4$?



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