

## Lesson 25: Solve by Square Roots

CC attribute: *College Algebra* by C. Stitz and J. Zeager.



**Objective:** Solve quadratic equations of the form  $ax^2 + c = 0$  by introducing a square root.

**Students will be able to:**

- Solve equations by taking a square root.

**Prerequisite Knowledge:**

- Simplifying radicals.
- Solving by isolating a quadratic term.
- Complex numbers.

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**Lesson:**

Up until now, when attempting to solve an equation such as  $x^2 - 4 = 0$ , we have had no choice but to factor the expression on the left and set each factor equal to zero.

$$\begin{aligned}x^2 - 4 &= 0 \\(x - 2)(x + 2) &= 0 \\x &= \pm 2\end{aligned}$$

In this lesson, we will look at solving the expression  $ax^2 + c = 0$ , and instead will introduce a square root, when solving for  $x$ . In our next lesson, we will refer to this method as *extracting square roots*.

**I - Motivating Example(s):**

**Example:** Solve the equation  $x^2 - 4 = 0$  for all possible values of  $x$ .

$$\begin{array}{ll}x^2 - 4 = 0 & \text{Isolate } x^2; \text{ Add 4 to both sides.} \\x^2 = 4 & \text{Introduce a square root, include a } \pm . \\ \sqrt{x^2} = \pm\sqrt{4} & \text{Simplify.} \\x = \pm 2 & \text{Our solution}\end{array}$$

The values  $x = 2$  and  $x = -2$  are known as the *zeros* or *roots* of the equation  $y = x^2 - 4$ .

## II - Demo/Discussion Problems:

Solve each of the following equations for all possible  $x$ . Classify each solution as either real or imaginary.

1.  $x^2 - 9 = 0$

2.  $3x^2 - 20 = x^2 + 20$

3.  $x^2 + 16 = 0$

4.  $x^3 + 16x = 0$

5.  $x^2 + 12 = 0$

## III - Practice Problems:

Solve each of the following equations for all possible  $x$ . Classify each solution as either real or imaginary.

1.  $x^2 - 100 = 0$

4.  $x^2 + 81 = 0$

7.  $4x^3 - 32x = 0$

10.  $10x^2 - 70 = 0$

2.  $x^2 + 1 = 0$

5.  $x^2 + 20 = 0$

8.  $-5x^2 = 80$

11.  $-5x^2 = 20$

3.  $3x^2 - 48 = 0$

6.  $3x^2 - 27 = 0$

9.  $x^3 = 6x$

12.  $\frac{1}{4}x^3 = 100x$