Prerequisite Skills

This lesson requires the use of the following skills:

- solving linear equations (8.EE.7b)
- simplifying square roots (N–RN.2)

Introduction

You can determine how far a ladder will extend from the base of a wall by creating a quadratic equation and then taking the square root of both sides. To find the unknown length, you only need to find the positive square root because a negative length would not make sense in this situation. Most problems involving solving equations of the form $x^2 = c$ usually have both a positive square root and a negative square root.

Key Concepts

- The set of **real numbers** is the set of all rational and irrational numbers.
- Real numbers are **rational numbers** when they can be written as $\frac{m}{n}$, where both m and n are integers and $n \neq 0$. Rational numbers can also be written as a terminating or repeating decimal. The real number 0.4 is a rational number because it can be written as the fraction $\frac{2}{5}$.
- Real numbers are irrational when they cannot be written as $\frac{m}{n}$, where m and n are integers and $n \neq 0$. **Irrational numbers** cannot be written as a terminating or repeating decimal. The real number $\sqrt{3}$ is an irrational number because it cannot be written as the ratio of two integers. Other examples of irrational numbers include $\sqrt{2}$ and π.
- A **quadratic equation** is an equation that can be written in the form $ax^2 + bx + c = 0$, where $a \neq 0$.
- Quadratic equations can have no real solutions, one real solution, or two real solutions.
- Quadratic equations that contain only a squared term and a constant can be solved by taking the square root of both sides. These equations can be written in the form $x^2 = c$, where c is a real number.

- When we take the square root of both sides of a quadratic equation of the form $x^2 = c$, we need to remember that a number and its opposite have the same square. Therefore, rather than simply taking the principal, or positive, square root, we need to take the positive and negative square root. The solution of the equation $x^2 = c$ is $x = \pm\sqrt{c}$.
- We can use a similar method to solve quadratic equations in the form $(ax + b)^2 = c$.
- The nature of c tells us the number and type of solutions for equations of the form $x^2 = c$.

c	**Number and type of solutions**
Negative	No real solutions
0	One real, rational solution
Positive and a perfect square	Two real, rational solutions
Positive and not a perfect square	Two real, irrational solutions

Common Errors/Misconceptions

- forgetting to use ± when taking the square root of both sides of an equation, and therefore forgetting that there may be two solutions
- taking the square root before isolating the squared term