Understanding Solutions to Linear Equations

Short Description: Explore linear equations in one variable with one solution, infinitely many solutions, or no solutions in this Math Shorts video.

Long description: In this video, explore linear equations in one variable with one solution, infinitely many solutions, or no solutions. In the accompanying classroom activity, students watch the video and then write and solve three equations: one with one solution, one with infinitely many solutions, and one with no solutions. They trade with a partner and solve each other's equations. To get the most from this lesson, students should be comfortable solving linear equations in one variable with one solution.

Activity Text

Learning Outcomes
Students will be able to:
- solve linear equations with one solution, infinitely many solutions, and no solutions
- define the mathematical term below

Common Core State Standards: 8.EE.C.7.a

Vocabulary: Linear equation

Materials: Per student: pencil, paper

Procedure
1. Introduction (5 minutes, whole group and pairs)
Distribute pencils and paper, divide the class into pairs, and tell students that they will be learning about *linear equations* in one variable with one solution, infinitely many solutions, and no solutions. Ask pairs to take a moment to come up with an example of a linear equation with one solution. If students need an example to get started, suggest a simple equation such as $x + 1 = 3$.

Invite a few volunteers to share their equations and solution strategies.

2. Watch the Video (10 minutes, whole group and pairs)
Have student pairs discuss the following question: Do you think all linear equations have one solution? Why or why not? After a moment, gather a few ideas and let students know that they will be exploring this question in the video.

Show students the video, pausing as follows for discussion:
- 0:14—Give students a moment to solve the problem before continuing on to reveal the solution.
- 0:34—Ask, Could there be more than one solution? How do you know?

- 0:40 and 1:22—Give pairs a moment to try to solve the problem and to talk over whether there might be more than one solution.
- 1:40—Present the problem that will appear next on the screen: $x + 3 = x + 3$. Ask pairs to look for a solution, and then gather a few ideas.

When the video is over, write an equation on the board that has no solutions and one that has infinitely many (e.g., $x + 1 = x - 1$ and $2(x + 1) = 2x + 2$). Ask students to solve the problems with a partner.

As volunteers share their solution strategies with the class, probe their thinking with questions such as:
- How do you know that this equation has no solutions? Can anyone find a solution?
- How do you know that this equation has infinitely many solutions? Can anyone find a number that is *not* a solution?

3. Writing and Solving Equations (10 minutes, individuals and pairs)
Ask students to make up three equations:
- One with one solution
- One with infinitely many solutions
- One with no solutions

Students should solve the problem with just one solution and show how they know that the other problems have no solutions or infinitely many. Then, have them trade equations with a partner and solve each other's equations.

As students work, circulate to encourage them to explain their solution strategies to you.

4. Conclusion (5 minutes, whole group)
Wrap up by engaging the class in reflecting on the following questions:
- Does a linear equation always have one solution? Why or why not?
- How can you tell if an equation has infinitely many solutions?
- How can you tell if an equation has no solutions?

Activity Extension: Have students make up word problems to match each of the equations that they wrote. They should then trade and solve each other's word problems.