

Topic B

The Structure of Linear Equations in One Variable

In topic B, students extend beyond the mechanics of solving linear equations in one variable in topic A to focus on using the structure of a linear equation to inform them about the number of its solutions.

The topic begins by students discovering that there are equations for which any value of the variable makes the equation true, so these equations have infinitely many solutions. By comparing a group of equations that have one solution to a group of equations that have infinitely many solutions, students begin to recognize that the equations with infinitely many solutions have equivalent expressions on both sides of the equation.

Students then consider equations that have no solution. In solving these equations, students notice that they eventually write an equation that is false, which indicates that the original equation is also false. Students solve a variety of equations that have only one solution, infinitely many solutions, or no solution. Building on their initial observations about the expressions that comprise the equations, students now analyze the structure of linear equations in more depth. They use the relationships between the linear and constant terms in the expressions on each side of an equation to distinguish between equations with only one solution, infinitely many solutions, and no solution.

Students rely on this new knowledge about the structure of linear equations to write equations that have a specified number of solutions. They advance their understanding of the structure of these equations by classifying equations of a general form and by analyzing student work to identify a common misconception.

Students then encounter real-life situations and represent them with linear equations in one variable. Because the equations have only one solution, infinitely many solutions, or no solution, students need to recontextualize the results to ensure they make sense in the situations. Having access to equations with different numbers of solutions allows students to study different situations than those in topic A.

Use the equation provided to write an equation with the stated number of solutions.

$$-2x + 1 = \square x + \square$$

a. Only one solution

Sample: $-2x + 1 = 2x - 2$

b. Infinitely many solutions

Sample: $-2x + 1 = -2x + 1$

c. No solution

Sample: $-2x + 1 = -2x + 2$

The last lesson of the topic uses a familiar proportional relationship from grade 7, $d = rt$. Students work with a partner to determine if it is faster to drive or fly to a destination based on many variable factors, such as the speed of a vehicle and the time it takes to board and deboard for a flight. Students model their situation with an equation. Then they determine how that equation and its solution will change based on other travel variables, such as a faster boarding time or a vehicle's flat tire.

In topic C, students transition from linear equations in one variable to linear equations in two variables. They develop an understanding that ordered pairs are the solutions to these equations and that the graph of an equation in two variables is a line that represents all the solutions to the equation.

Progression of Lessons

Lesson 7 Linear Equations with More Than One Solution

Lesson 8 Another Possible Number of Solutions

Lesson 9 Writing Linear Equations

Lesson 10 Using Linear Equations to Solve Real-World Problems

Lesson 11 Planning a Trip