

Topic B

Systems of Linear Equations and Inequalities in Two Variables

In grade 8, students write and solve systems of linear equations. In topic B, students build on that work by representing given scenarios by using systems of two linear equations or inequalities. They estimate solutions to systems graphically and solve them algebraically.

To open the topic, students watch a video about conserving water by using low-flow showerheads, making observations and using relevant information to solve a well-defined problem with a method of their choice. Through class discussion, students are encouraged to consider when representing a situation with a system of linear equations would be an efficient method for solving a problem, providing a bridge from linear equations to systems of linear equations. Students then solve systems of equations by graphing or by using the substitution method. They also determine the number of solutions of a system by inspection. Students extend beyond grade 8 work by representing the solution sets of systems with infinitely many solutions precisely by using set-builder notation and by using the elimination method to solve systems algebraically. Care is taken to demonstrate why the elimination method works and to avoid proceduralizing the method. When using the elimination method, the emphasis is on using properties of equality to add equivalent expressions to both sides of an equation, rather than aligning equations vertically and asking students to add them. Equipped with the tools to solve systems of two linear equations, students solve real-world and mathematical problems by writing and solving systems.

$$\begin{cases} 4a - 6b = -44 \\ 5a + 6b = 26 \end{cases}$$

~~$$\begin{array}{r} 4a - 6b = -44 \\ + 5a + 6b = 26 \\ \hline 9a = -18 \end{array}$$~~

$$\begin{aligned} (4a - 6b) + (5a + 6b) &= -44 + 26 \\ 9a &= -18 \\ a &= -2 \end{aligned}$$

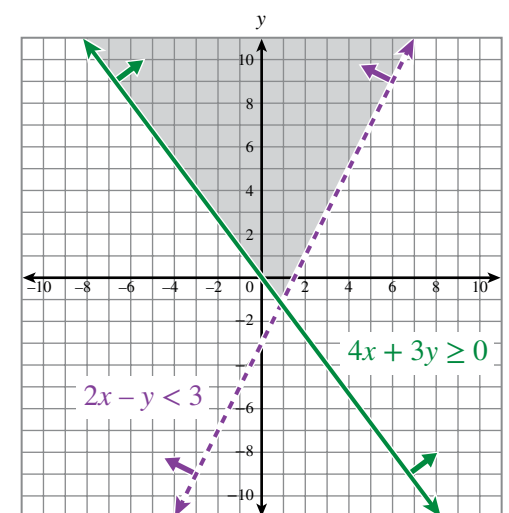
$$\begin{aligned} 2a - 3b &= -22 \\ 2(-2) - 3b &= -22 \\ -4 - 3b &= -22 \\ -3b &= -18 \\ b &= 6 \end{aligned}$$

$$(-2, 6)$$

Topic B concludes with students representing the solution sets of systems of two or more linear inequalities. Students solidify their understanding of the graph of the solution set of a system of two linear inequalities as the intersection of two half-planes, which may include the boundary lines. Students represent the solution sets of systems of inequalities of increasing complexity, including those with more than two inequalities. The emphasis on conceptual understanding in these lessons builds students' ability to make sense of the region that represents the graph of the solution set. Students also solve problems in real-world contexts by writing and solving systems of two or more linear inequalities.

Representing situations with systems of linear equations and inequalities in two variables prepares students to represent situations with systems of equations and inequalities, including nonlinear systems, in Algebra II.

$$\begin{cases} 2x - y < 3 \\ 4x + 3y \geq 0 \end{cases}$$



Progression of Lessons

Lesson 7 Low-Flow Showerhead

Lesson 8 Systems of Linear Equations in Two Variables

Lesson 9 A New Way to Solve Systems

Lesson 10 The Elimination Method

Lesson 11 Applications of Systems of Equations

Lesson 12 Solution Sets of Systems of Linear Inequalities

Lesson 13 Graphing Solution Sets of Systems of Linear Inequalities

Lesson 14 Applications of Systems of Linear Inequalities