Big Ideas Math: Algebra 1

Chapter Summary

Chapter 5: Solving Systems of Linear Equations

Learning Goals

Check solutions of systems of linear equations.

Solve systems of linear equations by graphing.

Solve systems of linear equations by substitution.

Solve systems of linear equations by elimination.

Determine the numbers of solutions of linear systems.

Solve linear equations by graphing.

Solve absolute value equations by graphing.

Check solutions of linear inequalities.

Graph linear inequalities in two variables.

Use linear inequalities to solve real-life problems.

Check solutions of systems of linear inequalities.

Graph systems of linear inequalities.

Write systems of linear inequalities.

Use systems of linear equations to solve real-life problems.

Use systems of linear inequalities to solve real-life problems.

Use linear equations to solve real-life problems.

Essential Questions

How can you solve a system of linear equations?

How can you use substitution to solve a system of linear equations?

How can you use elimination to solve a system of linear equations?

Can a system of linear equations have no solution or infinitely many solutions?

How can you use a system of linear equations to solve an equation with variables on both sides?

How can you graph a linear inequality in two variables?

How can you graph a system of linear inequalities?

Games

- Linear System Sleuths
- Equation Tic-Tac-Toe
- Sunken Ship

These are available online in the *Game Closet* at www.bigideasmath.com.

Core Vocabulary

A ***system of linear equations*** is a set of two or more linear equations in the same variables.

A ***solution of a system of linear equations*** in two variables is an ordered pair that is a solution of each equation in the system.

A ***linear inequality in two variables***, x and y, can be written as $ax + by < c$, $ax + by \leq c$, $ax + by > c$, or $ax + by \geq c$ where a, b, and c are real numbers.

A ***solution of a linear inequality in two variables*** is an ordered pair (x, y) that makes the inequality true.

The ***graph of a linear inequality*** in two variables shows all the solutions of the inequality in a coordinate plane.

Two regions of the coordinate plane divided by a boundary line are called ***half-planes***.

A ***system of linear inequalities*** is a set of two or more linear inequalities in the same variables.

A ***solution of a system of linear inequalities*** in two variables is an ordered pair that is a solution of each inequality in the system.

The ***graph of a system of linear inequalities*** is the graph of all the solutions of the system.

Core Concept

Methods for Solving Systems of Linear Equations

Method	When to Use
Graphing	To estimate solutions
Substitution	When one of the variables in one of the equations has a coefficient of 1 or −1
Elimination	When at least one pair of like terms has the same or opposite coefficients
Elimination (Multiply First)	When one of the variables cannot be eliminated by adding or subtracting the equations

Core Concept

Solving a System of Linear Equations by Graphing

Step 1 Graph each equation in the same coordinate plane.

Step 2 Estimate the point of intersection.

Step 3 Check the point from Step 2 by substituting for x and y in each equation of the original system.

Solving a System of Linear Equations by Substitution

Step 1 Solve one of the equations for one of the variables.

Step 2 Substitute the expression from Step 1 into the other equation and solve for the other variable.

Step 3 Substitute the value from Step 2 into one of the original equations and solve.

Solving a System of Linear Equations by Elimination

Step 1 Multiply, if necessary, one or both equations by a constant so at least one pair of like terms has the same or opposite coefficients.

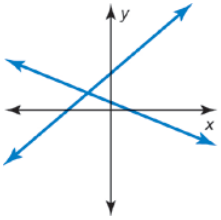
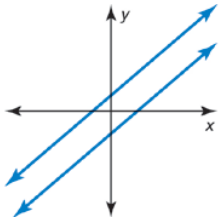
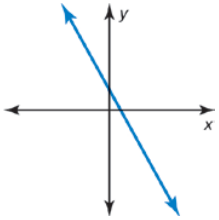
Step 2 Add or subtract the equations to eliminate one of the variables.

Step 3 Solve the resulting equation.

Step 4 Substitute the value from Step 3 into one of the original equations and solve for the other variable.

Solutions of Systems of Linear Equations

A system of linear equations can have *one solution*, *no solution*, or *infinitely many solutions*.

One solution	No solution	Infinitely many solutions
		
The lines intersect.	The lines are parallel.	The lines are the same.

Solving Linear Equations by Graphing

Step 1 To solve the equation $ax + b = cx + d$, write two linear equations.

$y = ax + b$ and $y = cx + d$

Step 2 Graph the system of linear equations. The x-value of the solution of the system of linear equations is the solution of the equation $ax + b = cx + d$.

Graphing a Linear Inequality in Two Variables

Step 1 Graph the boundary line for the inequality. Use a dashed line for $<$ or $>$. Use a solid line for $\leq$ or $\geq$.

Step 2 Test a point that is not on the boundary line to determine whether it is a solution of the inequality.

Step 3 When the test point is a solution, shade the half-plane that contains the point. When the test point is *not* a solution, shade the half-plane that does *not* contain the point.

Graphing a System of Linear Inequalities

Step 1 Graph each inequality in the same coordinate plane.

Step 2 Find the intersection of the half-planes that are solutions of the inequalities. This intersection is the graph of the system.

What's the Point?

The STEM Videos available online show ways to use mathematics in real-life situations.

The Chapter 5: Setting Fisher Limits STEM Video is available online at www.bigideasmath.com.

Additional Review

- Solving Absolute Value Equations by Graphing, *p. 263*
- Writing a System of Linear Inequalities, *p. 276*