

DISCOVERING ALGEBRA WITH GRAPHING CALCULATORS

Solving Systems of Equations

Teacher's Guide



Grade Level: 9–12 **Curriculum Focus:** Math **Running Time:** 25 minutes

Program Description

Illustrates functions for solving systems of linear and quadratic equations. Using matrices, students solve equations in a time-efficient manner. A chef shows how mathematics keeps things cooking at his restaurant.

Learning Objectives

After viewing the program and participating in discussion, students will be able to:

- Solve linear systems in two variables graphically;
 - Utilize matrices to solve linear systems with three variables;
 - Recognize the graph of a quadratic equation;
 - Write equations in slope-intercept and standard form;
 - Classify systems as independent, dependent, or inconsistent;
 - Apply algebra to real-world situations and develop logical reasoning skills.
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Classroom Connections

What is a system of linear equations? Have students write down their own definition and then share it with a partner. What are some methods of solving linear systems?

What is the inverse of the matrix equation $ax = c$? Why is multiplication not commutative when working with matrices?

What would the graph of two inconsistent lines look like? Can all linear systems be consistent? Why or why not?

What qualities of quadratic functions did the final exploration demonstrate? What is a quadratic equation?

In addition to the examples given in the program, how else can matrices be used to solve everyday problems?

Classroom Activities

Tell students they are a group of nutritionists designing a seven-day meal plan for their customers. As a treat, the group decides to include a fast-food hamburger as a dinner in one of the suggested daily menus. The plan's participants can choose from a double cheeseburger or a cheddar-bacon cheeseburger. Three double cheeseburgers and two cheddar-bacon cheeseburgers contain 3,112 calories. One double cheese burger and one cheddar-bacon cheeseburger contain 1,214 calories. How many calories are in each sandwich? Ask the class to write a system of equations describing the problem. Graph the equations with Xmin set at 0, Xmax at 1,300, Xscl at 100, Ymin at 0, Ymax at 1,300, and Yscl at 100. Which burger is "better" for someone following a healthy diet?

Now give students the following nutritional breakdown about each sandwich:

Nutritional Information for Harry's Hamburger Shack

	Carbohydrates (g)	Protein (g)	Fat (g)
Double cheeseburger	45	25	29
Cheddar-bacon cheeseburger	40	29	26

How many burgers would be required to yield 300 grams of carbohydrates, 300 grams of protein, and 1,500 grams of fat?

Break the class into groups, and have each group research certificates of deposits (CDs) and IRAs. Groups should define both terms and note any similarities and differences between the accounts. Ask the groups to summarize their findings in a one-page report.

Next, give the class the following problem: an investor split \$12,000 between a CD and an IRA. The CD has an annual percentage yield (APY) of 8 percent; unfortunately, the money in the IRA suffered a 4 percent loss. If the total annual income from both investments was \$680, how much was invested at each rate? When graphing the problem, students should set Xmin and Ymin to 0, Xmax and Ymax to 12,500, and Xscl and Yscl to 1,000.

Target Vocabulary*

Cartesian coordinate - either of two coordinates that locate a point on a plane and measure its distance from either of two intersecting straight-line axes along a line parallel to the other axis

coefficient - a constant factor of a term as distinguished from a variable

function - a: a mathematical correspondence that assigns exactly one element of one set to each element of the same or another set; b: a variable (as a quality, trait, or measurement) that depends on and varies with another

inverse function - a: an operation (as subtraction) that undoes the effect of another operation; b: a set element that is related to another element in such a way that the result of applying a given binary operation to them is an identity element of the set

linear equation - an equation of the first degree in any number of variables

quadratic - involving terms of the second degree at most (*quadratic* function)

slope-intercept form - the equation of a straight line in the form $y = mx + b$ where m is the slope of the line and b is its y-intercept

standard form - the equation of a straight line in the form $ax + by = c$ where a and b are numerical coefficients and c is the constant

y-intercept - the y-coordinate of a point where a line, curve, or surface intersects the y-axis

*All definitions from Merriam-Webster Online: <http://www.m-w.com>

Academic Standards

The National Council of Teachers of Mathematics (NCTM) has developed national standards to provide guidelines for teaching mathematics. To view the standards online, go to <http://standards.nctm.org/>.

This lesson plan addresses the following math standards:

- Represent and analyze mathematical situations using algebraic symbols
- Understanding patterns, relations, and functions