

DISCOVERING ALGEBRA WITH GRAPHING CALCULATORS

Graphing a Line Teacher's Guide



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

Program Description

Demonstrates how to graph a line on the graphing calculator. Students learn step-by-step keystrokes, geometric and algebraic definitions of a linear function, and new, visual ways to solve linear equations. A mountain climber explains how math factors into planning a climb.

Learning Objectives

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

- Identify the slope-intercept form of a linear equation as $y = mx + b$;
 - Illustrate positive and negative slope graphically;
 - Detect patterns in charts and graphs;
 - Express algebraic equations with words, symbols, graphs, and charts;
 - Apply algebra to real-world situations and develop logical reasoning skills.
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Classroom Connections

What is a linear equation? Have students write down their own definition and then share it with a partner. What does the graph of a linear equation look like?

In the equation $y = mx + b$, what is the y-intercept? What is the slope of the line? Convert the following equations to slope-intercept form:

$$2x + 3y = 12$$

$$28x - 7y = 56$$

$$4y - 6x = 24$$

Why do mountain climbers and deep-sea divers need algebra to help them prepare for expeditions? What other activities require algebra or problem solving?

In addition to the examples used in the program, what other relationships are linear functions? Brainstorm examples as a class then have students work in small groups to think of other functional relationships (positive and negative) in science, math, and their daily lives.

Classroom Activities

Ask students to share their part-time jobs with the class. What are the three most common jobs? How much does each job pay per hour? Make a chart with the three most popular answers and their hourly pay rates. Now have students imagine that they are saving up for a new computer that costs \$1,500. How many hours would someone have to work at each job in order to earn \$1,500? (Assume taxes have already been taken out of the hourly salaries.) How could this relationship be expressed as a function and as a linear equation? Have students write down an equation that describes each job and graph the equations on their calculators. Using the “Trace” function, determine the number of worked hours needed to earn \$1,500.

Statisticians often use graphs to interpret data and phenomena that have massive economic, political, and social implications. In 2005, Japan experienced a negative population growth of -0.2 percent, meaning that the number of deaths in the country was greater by 0.2 percent than the number of births. If the country’s population was approximately 128,085,000 in 2005, what would be the 2006 population? How could this relationship be expressed as a linear function? Ask students to graph this function on their calculators, adjusting the scale as necessary. If the population continued to decline at this rate, in how many years would it take for the population to reach 125,000,000?

Now, break the class into groups and have each group research Japan’s demographics, or population statistics, to answer the following questions:

- Why do experts believe Japan is experiencing negative population growth?
- What is the mean, or average age of a Japanese citizen?
- How would a negative population growth affect the country’s economy?

After answering these questions in groups, bring everyone back together and discuss them as a class.

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

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

quadrant - any of the four parts into which a plane is divided by rectangular coordinate axes lying in that plane

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

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