

TEACHER'S GUIDE

MATH SERIES

**LINEAR EQUATIONS
and Their Graphs: Let's Get It Straight**

Part 1
16 Minutes

Distributed by BENCHMARK MEDIA

FOR USE IN: Mathematics

LEVEL: Grades 7-9, Advanced Grade 6

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EDUCATIONAL OBJECTIVES:

To help students understand:

- **Linear equations and their graphs**
- **The domain of an equation**

BACKGROUND INFORMATION:

With the exception of constant functions, linear functions are the simplest of all functions. That makes linear equations the most convenient and simple instruments for modeling real-world processes. The ability to derive equations of given straight lines is an essential skill in many situations. For example, this skill comes into play whenever one must find the coordinates of the points on a line, or the intersection points of different straight lines, or to determine whether or not a given line goes through a given point, and so on. All of these questions are vital not only in pure mathematics but in an enormous number of applications as well.

BEFORE SHOWING THE VIDEO:

The video contains several optional pauses where the students are presented with calculations to complete, while the VCR may be placed on pause. After the pause, correct answers are given. If the teacher plans to use these pauses, the students may be requested to have paper and pens available before starting the video. For a more intensive interaction between students and parts of the video, the teacher may wish to pause the tape after the presentation of a particular concept to inquire if the students have understood it; and/or ask the students before starting the video to signal the teacher to stop at any point for clarification. The video may also be shown in its entirety without pause either as an introduction or a review of the subject. It is always helpful if teachers are able to view the video before showing it to the class.

Most students have no difficulty in plotting a set of points to generate a straight line, or even calculating the Y coordinates of the points, using the equation of the line. However, many students do have difficulty when presented with a straight-line graph and asked to find its equation. This program takes students through the process of finding straight-line equations, from the simplest to the more complicated.

Some practical examples of the use of linear equations might be discussed. For example, the following problem can be offered to the students: A company had \$100,000 in its bank account at the beginning of the year. The amount of money increased practically uniformly and six months later there was \$160,000 in the account. How can one evaluate the amount of money in the account after 2 months from the starting date? After 3 months? After x months? The following approach is used: As is usually done in the similar cases in newspapers, handbooks, etc., a diagram is constructed. A straight line is drawn, on the coordinate grid, from point (0, 100000) to point (6, 160000). It then becomes clear that what actually must be found is the y-coordinate of that point on this line whose x-coordinate equals 2, followed by the y-coordinate of that point on this line whose x-coordinate equals 3, and so on. In other words, we must learn how to find the equation for a straight line.

Before we can find the equation for a straight line, we must review some facts about the slope of a straight line (as explained in a prior video in this series, SLOPES: That's a Bit Steep)

CONTENT OF THE VIDEO:

This summarizes what is presented using an eye catching style, combining live action with computer simulation, to find equations for events such as a plane's takeoff, leveling off, and landing:

1. First we reviewed how to calculate the slope of a line (shown in a prior video "Slopes"), by using the coordinates of 2 points on the line.

2. Then we learned how to write the equation of a line that goes through zero, zero, on a grid, that's the "origin". Sometimes the line has a negative slope. When a straight line passes through the origin, its equation is y equals the slope times x .
3. If a line doesn't go through the origin, we have to add the Y intercept into its equation. Then its equation has the form $y=sx+b$, where s is the slope and b is called the y -intercept and is equal to the y -coordinate of the intersection point of this straight line and the y -axis. If the line cuts the Y axis below the X axis, the Y intercept is negative.
4. If we want to be formal, we can write the complete statement about a line, including its domain.
5. Finally, if we can't read the Y intercept from the graph, we can calculate it. In some cases we cannot use the derived formulas of straight lines for any x . In fact, in such cases we work only with some segments of straight lines. Therefore we must take the values of x only for certain intervals (say, $0 \leq x \leq 8.4$ or $2 \leq x \leq 4$, etc.)

AFTER SHOWING THE VIDEO:

Some questions that may be used to stimulate discussion:

1. Draw straight lines through points with coordinates a) (0, 0) and (1, 2); b) (1, 3) and (2, 1); c) (1, 3) and (2, 3). Are there any vertical lines among them? Any horizontal lines? Any lines with a positive slope? With a negative slope? Find the slopes of these lines.
2. Draw a straight line through the origin. Can the equation $y=2x+4$ be the equation of this line? What about the equation $y=-3x-5$? Explain your answer.
3. a) Draw a straight line through points with coordinates (0, 0) and (2, 4)
 b) Find the slope of this line
 c) The slope shows the change in the y -coordinate of a point on this line when its x -coordinate changes by 1. Using this fact fill the table of values for the obtained straight line.

x	1	2	3	4	5
y					

- d) Find the equation of this straight line
- e) Find the y -coordinate of the point on this line whose x -coordinate is equal to 2.3.
4. Draw a straight line through the point (0, 1) that is parallel to the straight line discussed above. Find the slope of this line. Find its y -intercept. (It is important to emphasize that the y -intercept is the y -coordinate of the intersection point of the line and the y -axis). Find the equation of this line.

EXPLORING AND INVESTIGATING:

The following questions may be used to lead students into a more detailed discussion:

1. Solve the problem about the bank account of the company discussed above. A further question may also be posed: what was the amount of money in the company's account after two years? What is the answer that can be obtained using the linear equation derived

before? How reliable, in your view, is this equation in answering this question (if we know nothing about the company's business during this period)? The domain of the derived equation can be discussed.

2. A boy went out of his house and walked at a constant speed. After 90 minutes of walking he covered 3 miles. Draw a straight line through the points (0, 0) and (90, 3). What can be modeled in this way (what is y)? Find the equation of this line and determine how many miles the boy covered after 30 minutes of walking? After 50 minutes? What is the domain of the obtained equation?

The Math Series consists of 10 videos:

ALGEBRA: A Piece of Cake Part 1

ALGEBRA: A Piece of Cake Part 2

SLOPES: That's a Bit Steep!

PERCENTAGES That Make Sense

LINEAR EQUATIONS and Their Graphs: Let's Get It Straight Part 1

LINEAR EQUATIONS and Their Graphs: Let's Get It Straight Part 2

INTEGER OPERATIONS: Into the Negative Zone Part 1 Adding and Subtracting

INTEGER OPERATIONS: Into the Negative Zone Part 2 Multiplying and Dividing

FACTORING IS FANTASTIC Part 1: Common Factors

FACTORING IS FANTASTIC Part 2: Quadratic Trinomials

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