

Linear Equations in Two Variables

Often, we need to relate two quantities, which can be written as ordered pairs. For example,

- Hours worked and dollars earned, (8.5, 110.50)
- Age of a child in months and child's height in inches, (24, 29)
- Years since money was invested and value of the investment, (4.25, 870.79)
- Graduation rate in a certain place and poverty rate, (83%, 31%)
- Daily temperature and kilowatt-hours of electricity used, (84, 21)

The list could go on and on. To display paired information like these examples, we use a [Rectangular Coordinate System](#).

An equation in two variables shows a relationship between two quantities. Here are some examples.

$$y = 3x + 8$$

$$7x - 4y = 42$$

$$x + 15 = 2y + 4$$

The solutions to this type of equation are ordered pairs that make the equation a true statement. In the examples here, all of the order pair solutions to each equation form a line, so we call them *linear equations*. Practice [graphing linear equations](#).

The Slope of a Line

The [slope](#), or how rapidly it is rising or falling, is a key characteristic of a line. If we know any two points on a line, we find the slope using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$; that is, slope is the change in y , divided by the change in x . Sometimes this is referred to as “rise over run”.

Slope-Intercept Form

When x and y are variables, and m and b are fixed (unchanging) real numbers, then the equation $y = mx + b$ is a linear equation in slope-intercept form. The value m is the slope, and the number b is the y -intercept—the point at which the line passes through the y -axis. Practice [using the slope-intercept form](#).

Finding Equations for Lines

Because any line (that is not vertical) can be described by an equation of the form $y = mx + b$, we can use any of the following information to determine the equation of a line:

- The slope, m , and y-intercept, b
- The slope, m , and any other point on the line
- Any two points on the line

Parallel lines (which never intersect) have equal slopes. Perpendicular lines (which intersect at right angles) have slopes whose product is -1 . With this information, we can then write equations for lines that are parallel or perpendicular to each other, if we also know a point on the line.

Learn more, and practice [finding equations for lines](#).

Linear Inequalities

A mathematical statement that uses a less than or greater than symbol tells the reader that two expressions are not equal (in the case of $<$ or $>$) or may not be equal (\leq or \geq). Work with linear inequalities and their graphs [here](#).

Practice Problems

1. What is the slope of the line through the points (1,5) and (4,7)?
2. Write an equation for the line through the point (0,8) with slope $m = -2$.
3. Is the ordered pair (-1,-3) a solution to the equation $2x + y = -1$?

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