

# Key Concepts

Lesson  
6

## Graphing Linear Equations

**Objective** Guide students to recognize linear equations and to graph them by plotting points by hand.

**Note to the Teacher** *The most important objective in this lesson is for students to practice graphing lines by hand. This process is important because it increases students' understanding of what the graphs mean and how the graphs depend on the coefficients in the linear equations.*

Begin by plotting a simple linear equation given as a word problem.

**Example** A man walks at a rate of 3 miles per hour. Graph his distance walked versus the time he has been walking, with time (in hours) along the  $x$ -axis and distance walked (in miles) along the  $y$ -axis.

**Solution** First, introduce the variables  $t$  for time and  $d$  for distance. Ask students, "What is the relationship between  $t$  and  $d$ ?" They should find the algebraic relationship

$$d = 3t.$$

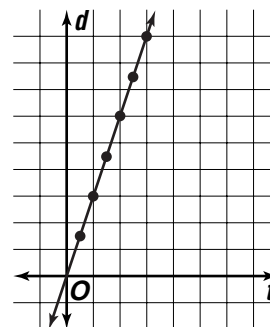
Using this relationship, create a table like the one below, or better, have the students generate their own table.

Time (hours)	Distance Walked (miles)
0.5	1.5
1	3
1.5	4.5
2	6
2.5	7.5
3	9

Point out that each value of time gives an ordered pair (time, distance). So, from the table above, we have the collection of ordered pairs  $\{(0.5, 1.5), (1, 3), (1.5, 4.5), (2, 6), (2.5, 7.5), (3, 9)\}$ .

Have students plot the points and ask them, “What pattern do you see?”

They should see that the points lie along a line like the one at the right. Emphasize that it is a straight line.



Point out that the class of equations that have straight lines as graphs is called the class of **linear equations**, and that this class can be described algebraically.

**Key Idea**

A linear equation can always be written in the form  
 $Ax + By = C$ .

The equations  $2x - 5y = 7$ ,  $3x + 5y = -1$ , and  $-4x + 7y = 11$  are all linear equations.

**Note to the Teacher** *Emphasize that the form in the key idea is only one form in which linear equations may be expressed. Show students that equations not in the  $Ax + By = C$  form are still linear because they can be rewritten in this form by using the Addition and Multiplication Properties of Equality. Also point out that not all equations are given using the variables  $x$  and  $y$ . When other variables are used, it is important to specify which variable corresponds to the horizontal axis and which corresponds to the vertical axis.*

The equation  $d = 3t$  from the example is linear. It can be rewritten as  $-3t + d = 0$  by subtracting  $3t$  from each side of the equation. This equation is in the  $Ax + By = C$  form, with  $t$  playing the role of  $x$  and  $d$  playing the role of  $y$ .

The equation  $y = -4x + 1$  is linear. By adding  $4x$  to each side, it can be rewritten as  $4x + y = 1$ .

**Note to the Teacher** *Point out that for an equation in the  $Ax + By = C$  form, it is usually best to solve for  $y$  in terms of  $x$  in order to plot points.*

Now, have students plot various equations on their own. Make sure to include equations where the variables are not  $x$  and  $y$ , equations where the slope is negative, and equations that are not in the  $Ax + By = C$  form.

End of  
Lesson