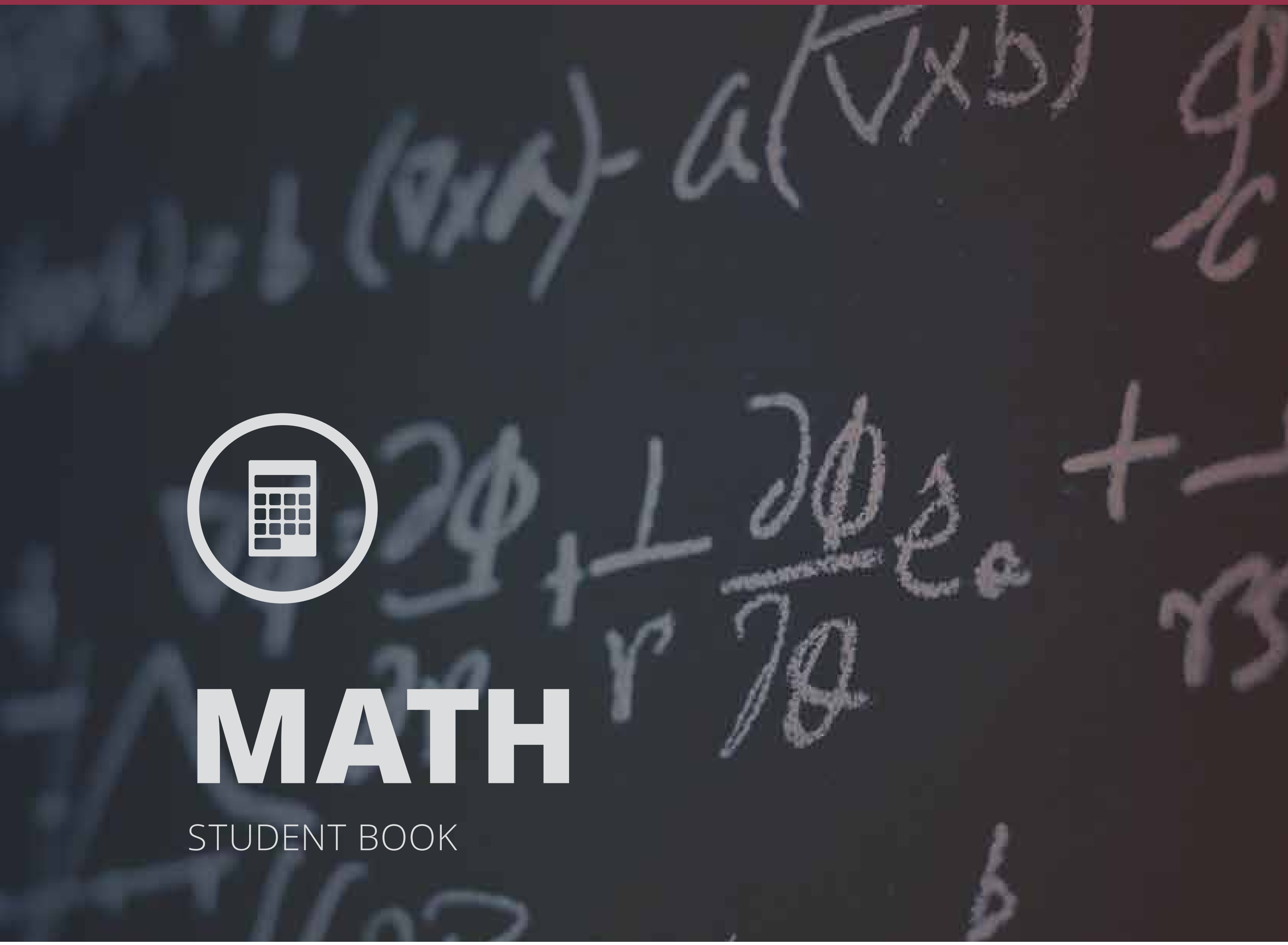
LIFEPAC®



MATH

STUDENT BOOK

11th Grade | Unit 3

Alpha Omega PUBLICATIONS

MATH 1103

LINEAR EQUATIONS AND INEQUALITIES

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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Linear Equations and Inequalities

Introduction

A function has been defined as a set of ordered-pair numbers for which each first element has a unique second element. If a set of ordered-pair numbers is such that its graph is a straight line, the function is a linear function. Equations of one or two variables of degree one are linear functions and their graphs are lines. This LIFEPAC® contains a study of the associated properties of lines. Included are the graphs of lines, their slope, intercepts, and equations.

When two linear functions are used to represent a particular application, we have a two-order system of linear equations. Two-order systems and their applications will be studied. Also included in this LIFEPAC is a study of the linear inequality and its graphs, and two-order systems of linear inequalities.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

1. Find solutions to the linear function.
2. Graph the linear function.
3. Identify the slope of a line.
4. Write the equations of lines.
5. Solve two-order systems of equations.
6. Solve and graph linear inequalities.
7. Solve two-order systems of inequalities.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. LINES

Lines are determined by sets of points. Lines can be represented by plotting these points, thus constructing the graph of the line. From the set of points, the equations of the line can also be written. Three equation forms are presented in this section.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Find solutions to the linear functions.
2. Graph the linear function.
3. Identify the slope of a line.
4. Write the equations of lines.

GRAPHS

The graph of a line is the configuration of the set of points that are plotted on the coordinate axes. The points are solutions to a particular equation, the linear function. A linear equation has one or two variables and no variable is raised to a power other than 1 or is used as the denominator of a fraction. The slope of the line is then calculated from the solution set.

FINDING SOLUTIONS

Consider the equation $y = 2x + 3$. To find solutions of this equation, we arbitrarily give the number x a value and find the corresponding y value.

Thus for $y = 2x + 3$,
If $x = 2$, then $y = 2(2) + 3$;
or $y = 7$

One solution is therefore, the ordered pair (2, 7). Another solution would be (3, 9), and so on.

Model 1: Find three solutions to $y = 3x - 8$.

Solution: Let x be any three numbers.

For $x = 1$ $y = 3(1) - 8$
$y = 3 - 8$
$y = -5$ Solution (1, -5)

For $x = 0$ $y = 3(0) - 8$
$y = -8$ Solution (0, -8)

For $x = 3$ $y = 3(3) - 8$
$y = 1$ Solution (3, 1)

Model 2: Find three solutions to $y = \frac{x}{2} + 4$.

Solution: Select three numbers for x that are divisible by 2.

For $x = 0$ $\quad y = \frac{0}{2} + 4$

$y = 4$ $\quad$ Solution (0, 4)

For $x = 2$ $\quad y = \frac{2}{2} + 4$

$y = 5$ $\quad$ Solution (2, 5)

For $x = -2$ $\quad y = \frac{-2}{2} + 4$

$y = 3$ $\quad$ Solution (-2, 3)

Two special cases of lines are $y = c$ and $x = c$. Specific examples of these lines are $y = 6$ or $x = -3$ and so on. The c can be any number but it is constant and does not change values.

In the case of $y = c$, we can rewrite the equation as $0x + y = c$. Then we see that y is always equal to c for any value of x.

Model: Find three solutions to $y = 6$.

Solution: Write $y = 6$ as $0x + y = 6$.

For $x = 1$ $\quad 0(1) + y = 6$

$y = 6$ $\quad$ Solution (1, 6)

For $x = 2$ $\quad 0(2) + y = 6$

$y = 6$ $\quad$ Solution (2, 6)

For $x = -5$ $\quad 0(-5) + y = 6$

$y = 6$ $\quad$ Solution (-5, 6)

We call this type of function a **constant function**.

DEFINITION

A *constant function* is a function that has the same second coordinate in all its ordered pairs.

Likewise, for $x = c$ we have $x + 0y = c$. For all values of y, x will always be equal to c.

Model: Find three solutions to $x = 5$.

Solution: (5, 2), (5, 3), (5, 4)

Find three solutions to each equation using the given value of *x*.

1.1	$y = 2x - 3$	a. (1, ______)	b. (2, ______)	c. (3, ______)
1.2	$y = 3x + 1$	a. (-1, ______)	b. (-2, ______)	c. (0, ______)
1.3	$y = 5x - 5$	a. (0, ______)	b. (1, ______)	c. (2, ______)
1.4	$y = -2x + 1$	a. (1, ______)	b. (5, ______)	c. (-5, ______)
1.5	$y = 7 - 2x$	a. (3, ______)	b. (4, ______)	c. (-2, ______)

Circle the pair of numbers that is *not* a solution to the given equation.

1.6	$y = x - 4$	(1, -3)	(2, 2)	(3, -1)
1.7	$y = 5 - 2x$	(1, 3)	(2, 1)	(0, 3)
1.8	$y = \frac{x}{5} + 1$	(5, 2)	(10, 3)	(0, 2)
1.9	$y = \frac{2x + 1}{3}$	(1, 2)	(4, 3)	$(0, \frac{1}{3})$
1.10	$y = \frac{3 - x}{4}$	(-1, -1)	(-1, 1)	$(0, \frac{3}{4})$

Find any three solutions to the given equation. Be sure to check each solution.

1.11	$y = 5 - x$	(______ , ______)	(______ , ______)	(______ , ______)
1.12	$y = 6x - 5$	(______ , ______)	(______ , ______)	(______ , ______)
1.13	$y = 2x - 2$	(______ , ______)	(______ , ______)	(______ , ______)
1.14	$y = 5$	(______ , ______)	(______ , ______)	(______ , ______)
1.15	$y = x - \frac{1}{2}$	(______ , ______)	(______ , ______)	(______ , ______)
1.16	$y = \frac{x + 3}{2}$	(______ , ______)	(______ , ______)	(______ , ______)
1.17	$x = -2$	(______ , ______)	(______ , ______)	(______ , ______)
1.18	$y = \frac{7x - 7}{7}$	(______ , ______)	(______ , ______)	(______ , ______)
1.19	$y = \frac{4 - 2x}{5}$	(______ , ______)	(______ , ______)	(______ , ______)
1.20	$y = \frac{2x}{5} - \frac{1}{5}$	(______ , ______)	(______ , ______)	(______ , ______)

Circle the equations that are *not* linear equations.

1.21	a. $-x - y = 2$	b. $x^2 + y = 4$	c. $\frac{x}{2} - y^3 = 1$	d. $x = 5$
1.22	a. $x^2 + y^2 = 5$	b. $y = 2x - 1$	c. $y = x^2 + 3$	d. $7 = 2x - 3y$

Find three solutions to each of these equations.

1.23 $x + y = 6$ (______ , ______) (______ , ______) (______ , ______)

1.24 $x - y = 5$ (______ , ______) (______ , ______) (______ , ______)

1.25 $2x + y = 7$ (______ , ______) (______ , ______) (______ , ______)

1.26 $x + 2y = 0$ (______ , ______) (______ , ______) (______ , ______)

1.27 $2x + 2y = 4$ (______ , ______) (______ , ______) (______ , ______)

1.28 $3x - 2y = 6$ (______ , ______) (______ , ______) (______ , ______)

1.29 $2x + 3y = 6$ (______ , ______) (______ , ______) (______ , ______)

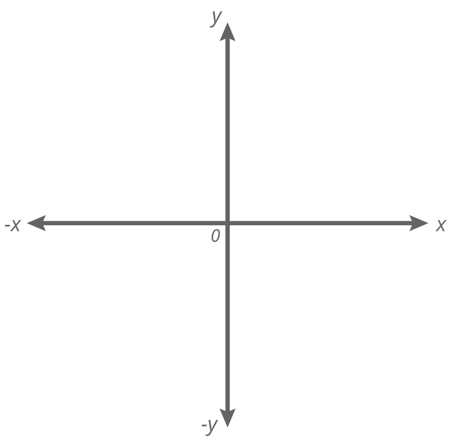
1.30 $3x - 5y = -3$ (______ , ______) (______ , ______) (______ , ______)

GRAPH BY TWO POINTS

We graph the line on the rectangular coordinate axes. The rectangular axes have a horizontal number line as the perpendicular bisector of a vertical number line at the respective zero points of the two number lines.

The horizontal number line is called the *x*-axis and the vertical line is the *y*-axis.

We learned in geometry that two points determine a line. Therefore, to graph a line, find two solutions to the equation, locate these solutions as points on the coordinate axis, and draw a line through the two points.

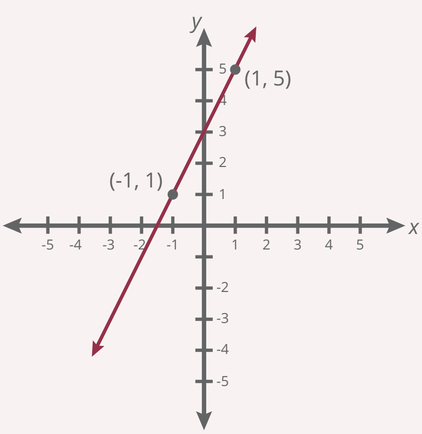


Model: Graph $y = 2x + 3$.

Solution: Find two solutions.

For $x = 1$ $y = 2(1) + 3$
$y = 5$ Solution (1, 5)

For $x = -1$ $y = 2(-1) + 3$
$y = 1$ Solution (-1, 1)



Locate (1, 5) and (-1, 1) on the coordinate axes.
Draw the line through the two points.

To avoid making a mistake in your graph, you should graph a third solution as a check. The line should go through the third solution also. If it does not, you have made a mistake somewhere in the solution process.

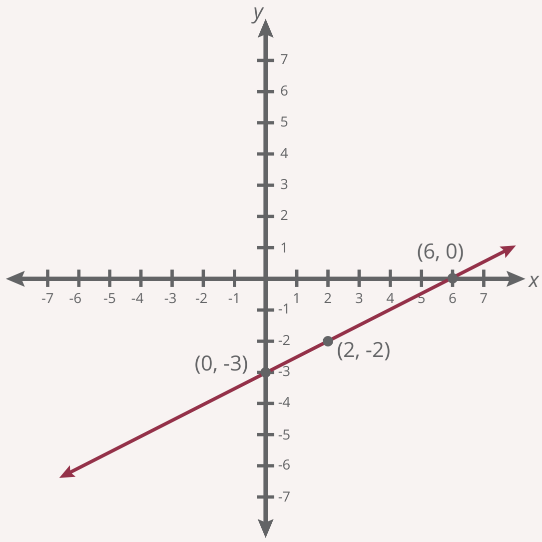
You should realize that *every point of the line is a solution to the equation, and every solution to the equation is a point of the line*.

Model 1: Graph $y = \frac{x}{2} - 3$.

Find three solutions, two for the graph, and one for a check.

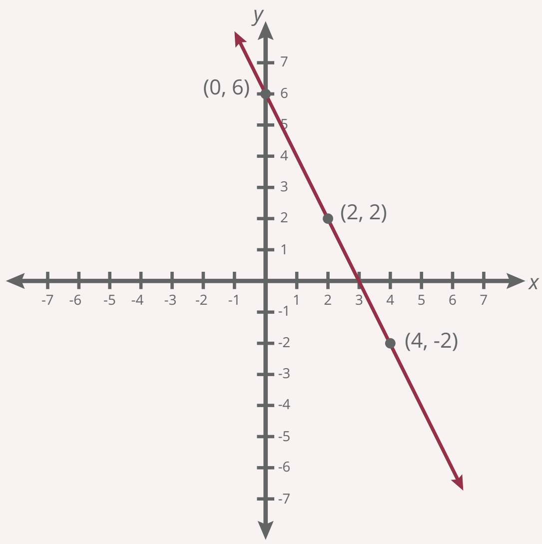
Three solutions are (2, -2), (0, -3), and (6, 0).

Locate the three solutions as points on the coordinate axes. The line should go through all three points.



Model 2: Graph $y = 6 - 2x$.

Three solutions are (0, 6), (2, 2), and (4, -2).



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