6.1 Solving Systems by GRAPHING

GOAL **Graph and solve systems of linear equations.**

Vocabulary

A **system of linear equations,** or simply a *linear system*, consists of two or more linear equations in the same variables.

A **solution of a system of linear equations** in two variables is an ordered pair that satisfies each equation in the system.

Common Student Errors

- Not checking solutions

  Tip Stress the importance of checking a solution of a system because the graphing method is not completely accurate.

- Graphing linear equations incorrectly

  Tip You may want to review how to graph linear equations in standard form and in slope-intercept form.

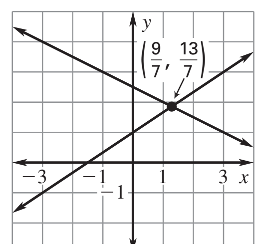
Having students leave space for a check may help:

Check in Equation 1:

Check in Equation 2:

System: $x + 2y = 5$
$2x - 3y = 3$

Graph:

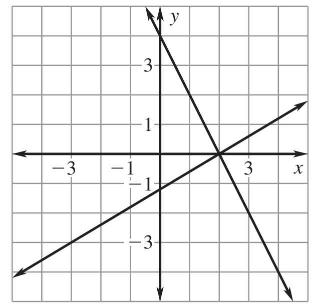


EXAMPLE 1 Check the intersection point

Use the graph to solve the system. Then check your solution algebraically.

$2x + y = 4$ Equation 1

$3x - 5y = 6$ Equation 2



Solution

The lines appear to intersect at the point (2, 0).

CHECK Substitute 2 for *x* and 0 for *y* in each equation.

Equation 1	**Equation 2**
$2x + y = 4$	$3x - 5y = 6$
$2(2) + 0 \stackrel{?}{=} 4$	$3(2) - 5(0) \stackrel{?}{=} 6$
$4 + 0 \stackrel{?}{=} 4$	$6 - 0 \stackrel{?}{=} 6$
$4 = 4$ ✓	$6 = 6$ ✓

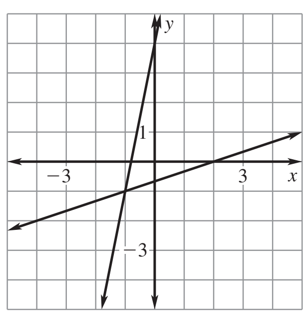
Because the ordered pair (2, 0) is a solution of each equation, it is a solution of the system.

EXAMPLE 2 Use the graph-and-check method

Solve the linear system: $x - 3y = 2$ Equation 1

$-5x + y = 4$ Equation 2

STEP 1 **Graph** both equations.



STEP 2 **Estimate** the point of the intersection. The two lines appear to intersect at (−1, −1).

STEP 3 **Check** whether $(-1, -1)$ is a solution by substituting -1 for x and -1 for y in each of the original equations.

Equation 1	Equation 2
$x - 3y = 2$	$-5x + y = 4$
$-1 - 3(-1) \stackrel{?}{=} 2$	$-5(-1) + (-1) \stackrel{?}{=} 4$
$-1 + 3 \stackrel{?}{=} 2$	$5 - 1 \stackrel{?}{=} 4$
$2 = 2$ ✓	$4 = 4$ ✓

Because the ordered pair $(-1, -1)$ is a solution of each equation, it is a solution of the system.

EXAMPLE 3

Solve a multi-step problem

Delivery Service The Rosebud Flower Shop has a basic delivery charge of $5 plus a rate of $.25 per mile. The Beautiful Bouquets Shop has a basic delivery charge of $7 plus a rate of $.20 per mile. Determine the number of miles a delivery must be for the charges to be equal.

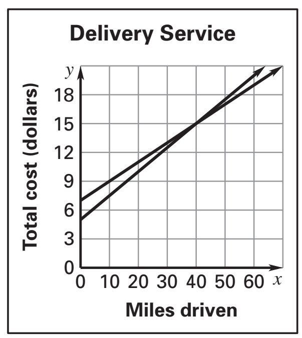
Solution

STEP 1 **Write** a linear system. Let x be the number of miles driven and y be the total cost of the delivery.

$y = 5 + 0.25x$ Equation for Rosebud Flower Shop

$y = 7 + 0.20x$ Equation for Beautiful Bouquets Shop

STEP 2 **Graph** both equations.



STEP 3 **Estimate** the point of intersection. The two lines appear to intersect at (40, 15).

STEP 4 **Check** whether (40, 15) is a solution.

Equation 1	Equation 2
$y = 5 + 0.25x$	$y = 7 + 0.20x$
$15 \stackrel{?}{=} 5 + 0.25(40)$	$15 \stackrel{?}{=} 7 + 0.20(40)$
$15 = 15$ ✓	$15 = 15$ ✓

Exercises for Examples 1, 2, and 3

Solve the linear system by graphing.

1. $-3x + y = 4$
   $5x - 2y = -7$

2. $x + \frac{1}{2}y = 4$
   $5x + 2y = 18$

3. $2x - 6y = 4$
   $7x - 4y = -20$

4. In Example 3, suppose Rosebud Flower Shop increases its basic charge to $10, and Beautiful Bouquets raises its basic charge to $13. Determine when the costs will be equal.