

7.2 Solving a System of Linear Equations Graphically

The solution of a linear system can be determined by graphing both equations on the same grid. **If the two lines intersect, the coordinates of the point of intersection $P(x, y)$ are the solution of the system.** (Remember that the points that satisfy each equation lie on its graph.) The solution (ordered pair) that satisfies both equations lies where the two graphs intersect!

Example 1: Solve the linear system:

$$2x + 3y = 3$$

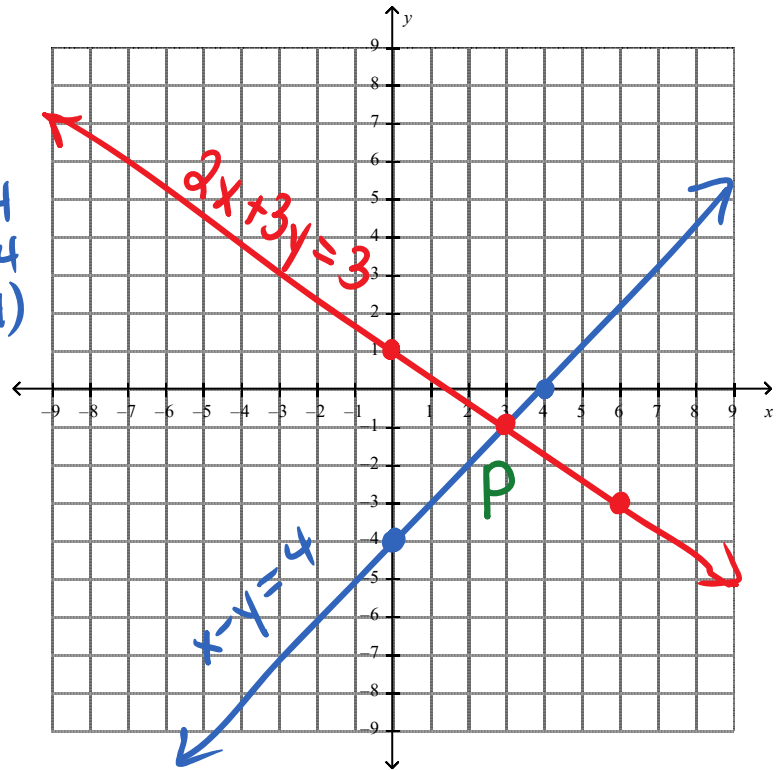
$$x - y = 4$$

$$\begin{array}{l} \text{x-int} \quad \text{y-int} \\ x - 0 = 4 \quad 0 - y = 4 \\ x = 4 \quad (4, 0) \quad y = -4 \\ \quad \quad \quad \quad \quad \quad (0, -4) \end{array}$$

- Graph each line. You can use slope-intercept method or x & y intercepts, whichever is easiest!
- Determine the point of intersection. Write as an ordered pair.

$$\begin{array}{l} -2x + 3y = 3 \\ -2x \quad -2x \\ \hline 3y = -2x + 3 \\ \frac{3y}{3} = \frac{-2x + 3}{3} \\ y = -\frac{2}{3}x + 1 \end{array} \left. \vphantom{\begin{array}{l} -2x + 3y = 3 \\ -2x \\ \hline 3y = -2x + 3 \\ \frac{3y}{3} = \frac{-2x + 3}{3} \\ y = -\frac{2}{3}x + 1 \end{array}} \right\} \text{slope-int}$$

Solution: $P(3, -1)$



Example 2: Solve the linear system:

$$4x - 3y = -21$$

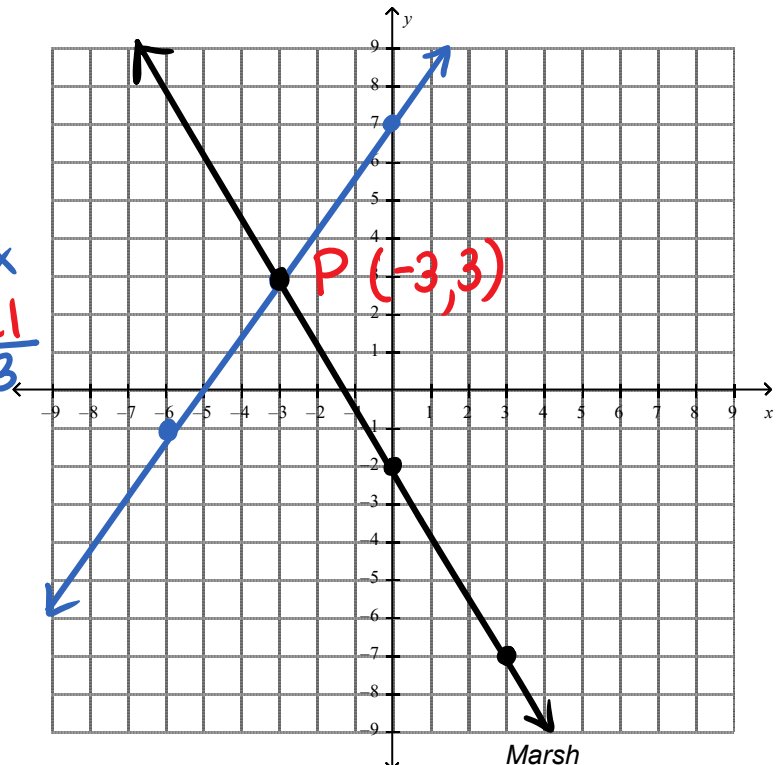
$$5x + 3y = -6$$

$$\begin{array}{l} 4x - 3y = -21 \\ -4x \quad -4x \\ \hline -3y = -4x - 21 \\ \frac{-3y}{-3} = \frac{-4x - 21}{-3} \\ y = \frac{4}{3}x + 7 \end{array}$$

$$\begin{array}{l} 5x + 3y = -6 \\ -5x \quad -5x \\ \hline 3y = -5x - 6 \\ \frac{3y}{3} = \frac{-5x - 6}{3} \\ y = -\frac{5}{3}x - 2 \end{array}$$

Solution: $P(-3, 3)$

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Example 3: Solve:

$$3x - 4y = 12$$

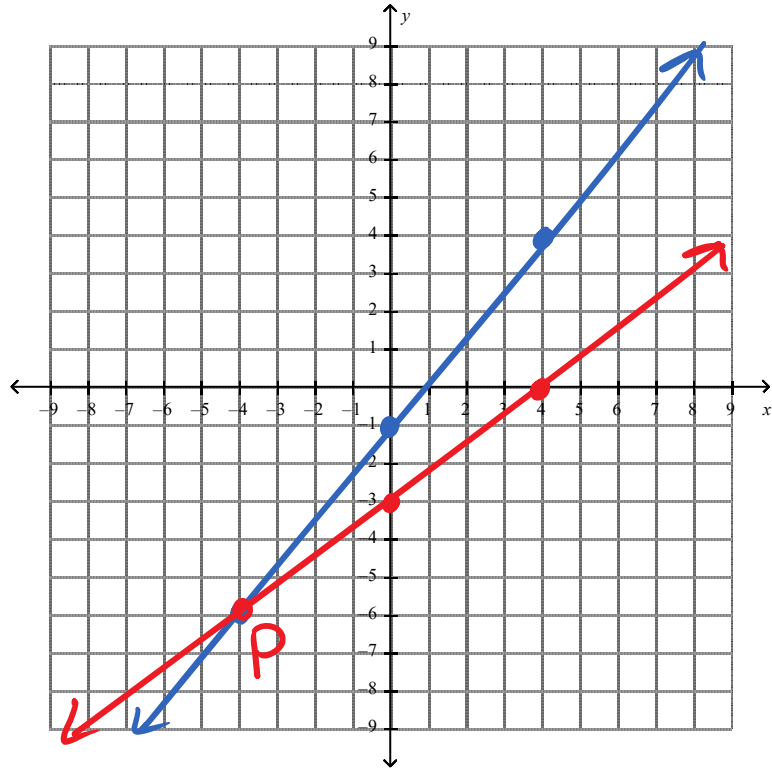
$$5x - 4y = 4$$

$$\begin{aligned} -4y &= -3x + 12 \\ y &= \frac{3}{4}x - 3 \end{aligned}$$

$$-4y = -5x + 4$$

$$y = \frac{5}{4}x - 1$$

Solution: P (-4, -6)



Example 4: Develop a linear system to represent the following problem. Then graph to determine the solution for the system.

Two numbers have a sum of 10. The first number plus three times the second number is 24. Find the numbers.

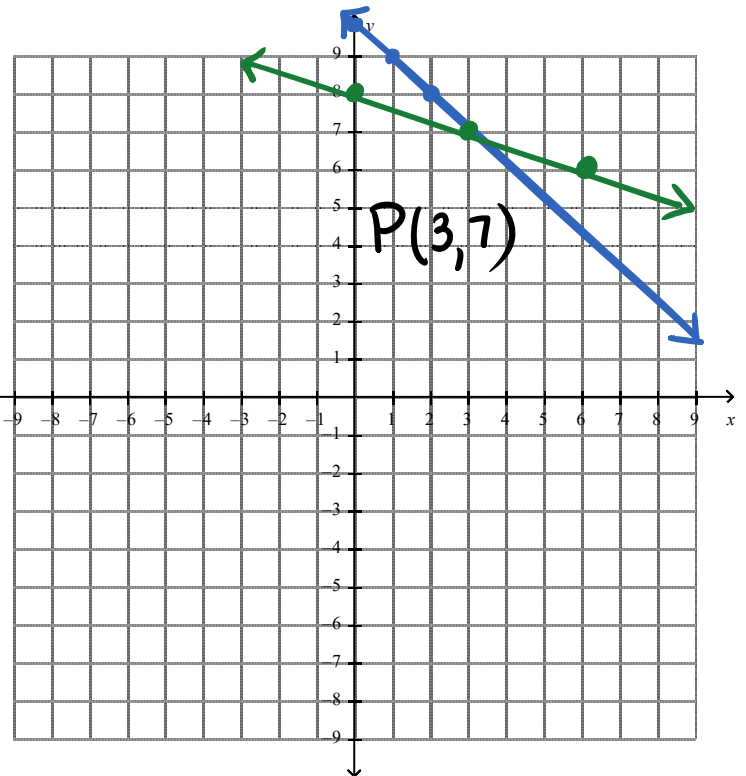
① Let $x = 1^{\text{st}} \#$
 $y = 2^{\text{nd}} \#$

② $x + y = 10 \rightarrow y = -x + 10$

$x + 3y = 24 \rightarrow 3y = -x + 24$

③ Graph.
 $y = \frac{-x + 8}{3}$
 $m = -\frac{1}{3}$

Solution: P (3, 7)



The numbers
 are 3 and 7.