

4.1 SYSTEMS OF LINEAR EQUATIONS IN TWO VARIABLES

(PART 1)

OBJECTIVES:

- Decide whether an ordered pair is a solution of a linear system.
- Solve linear systems by graphing.
- Solve linear systems (with two variables) by substitution.

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System of Linear Equations

- A **system of linear equations**, often called a **linear system**, consists of two or more linear equations with the same variables.
- A **solution of a system** of linear equations is an ordered pair that makes both equations true at the same time. A solution is said to *satisfy* the equation.

Deciding Whether an Ordered Pair is a Solution

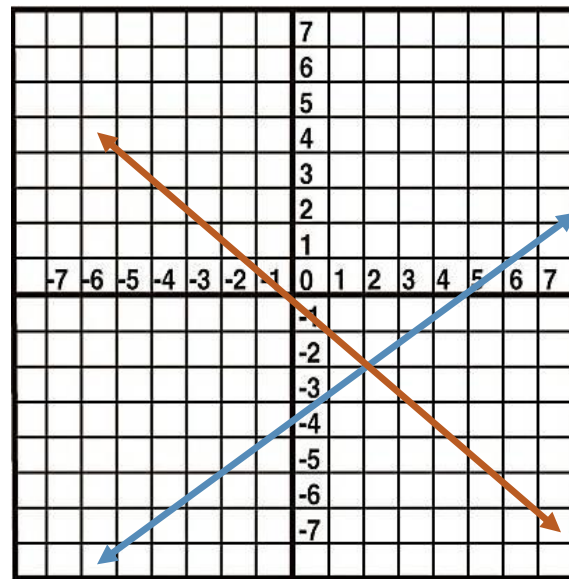
- Decide whether the ordered pair $(4, -1)$ is a solution of each system

a)
$$\begin{aligned} 5x + 6y &= 14 \\ 2x + 5y &= 3 \end{aligned}$$

b)
$$\begin{aligned} -x - y &= -3 \\ x + y &= -3 \end{aligned}$$

Solving a System by Graphing

- The set of all ordered pairs that are solutions of a system is its **solution set**.
- ⦿ One way to find the solution set of a system of two linear equations is to graph both equations on the same axes.

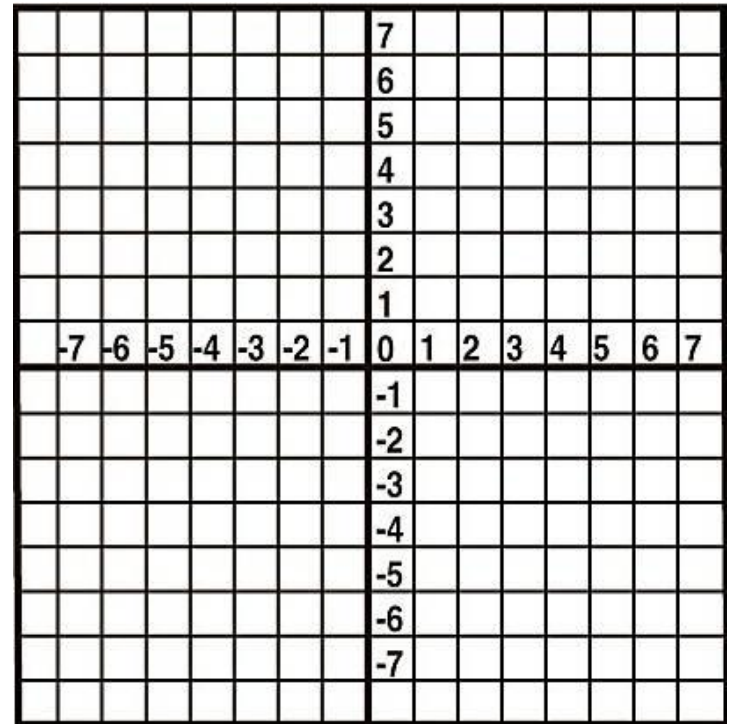


Solving a System by Graphing

- *Step 1* **Graph each equation** of the system on the same coordinate axes.
- *Step 2* **Find the coordinates of the point of intersection** of the graphs if possible. This is the solution of the system.
- *Step 3* **Always check** the solution in both of the original equations. Then write the solution set.

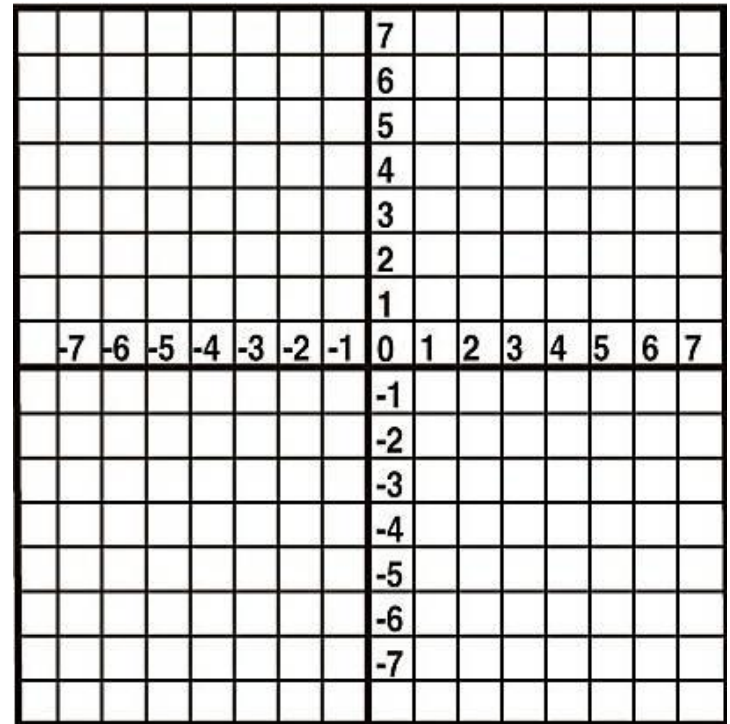
Solving the System by Graphing

□ $y = \frac{5}{3}x - 3$ $y = -\frac{1}{2}x + \frac{7}{2}$



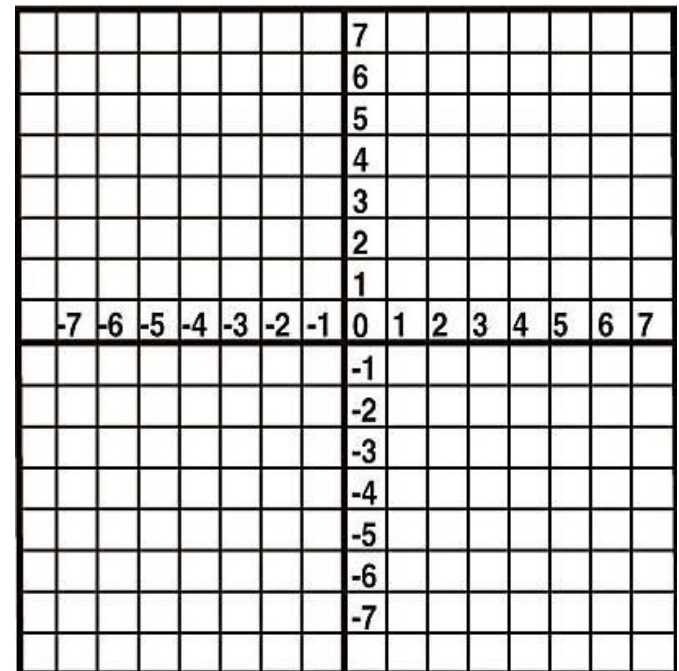
Solving the System by Graphing

□ $y = 3x - 4$ $6x - 2y = 12$



Solving a System by Graphing

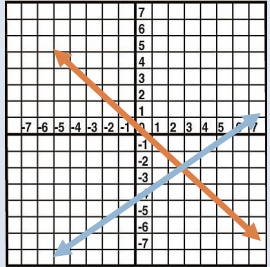
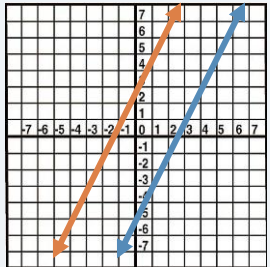
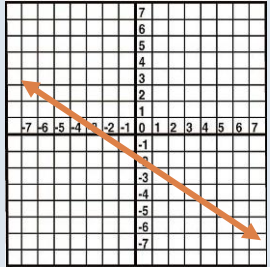
□ $-5y = -2x + 8$ $10y = 4x - 16$



Descriptions of Systems of Equations

- **Consistent system** – a system of equations with at least one solution.
- **Inconsistent system** – a system of equations with no solutions.
- **Independent equations** – equations of a system that have different graphs.
- **Dependent equations** – equations of a system that have the same graph (because they are different forms of the same equation.)

Graphs of Linear Systems in Two Variables

Graphs of Equations	Slopes of Lines	Description of System of Equations	Number of Solutions	Graph
Lines Intersect	Different Slopes	Consistent and Independent	One (x,y)	
Lines Parallel	Same Slope, Different Intercepts	Inconsistent and Independent	None $\emptyset$	
Lines Coincide (same line)	Same Slope, Same Intercepts	Consistent and Dependent	Infinite $\{(x,y) \mid \underline{\hspace{2cm}}\}$ (one equation)	

Solving a Linear System by Substitution

□ **Step 1**

□ **Step 2**

□ **Step 3**

□ **Step 4**

□ **Step 5**

Solving a Linear System by Substitution



$$2x + 7y = -12$$

$$x = -2y$$

Solving the System by Substitution

$$\begin{aligned}x + 3y &= -7 \\ 4x + 12y &= -28\end{aligned}$$

Solving the System by Substitution

$$y = 8x + 4$$
$$16x - 2y = 8$$

Solving the System by Substitution

$$-2x + 5y = 22$$

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

Solving the System by Substitution

$$6x - 2y = -22$$

$$-3x + 4y = 17$$