

## Solving Linear Systems by Graphing

A system of equations is a set of two or more equations with the same variables. In this chapter we will focus on the system consisting of two equations in two unknowns. The solution of such system is an ordered pair that satisfies both equations.

There are three ways to solve systems of linear equations in two variables:

- 1) Graphing method
- 2) Substitution method
- 3) Elimination method

**Rule 1:** One method for solving a system of equations is to graph the equations on the same coordinate plane. The coordinates of the point of intersection are the solution. So, we need to follow the steps listed below:

**Step 1:** Graph the first equation.

**Step 2:** Graph the second equation on the same coordinate system as the first.

**Step 3:** Find the coordinates of the point of intersection of the two lines which is the solution of the system

**Step 4:** Substitute the values in the two equations and check if the solution is valid.

If it makes **BOTH** equations true then you have your solution to the system.

If it makes **at least one** of them false, you need to go back and redo the problem.

### Remark:

- If two lines **intersect at one place**, then the point of intersection is the **solution** to the system.
- If the two lines are **parallel**, then they never intersect, so there is **no solution**.
- If the two lines **lie on top of each other**, then they are the same line and you have **an infinite number of solutions**.

In this case you can write down either equation as the solution to indicate they are the same line.

**Example 1:** Solve the system of equation by graphing

$$\begin{cases} x + y = 3 \\ x - y = 2 \end{cases}$$

To graph  $x + y = 4$  we need to fill the table below:

x	0	4
y	4	0

To graph  $x - y = 2$  we need to fill the table below:

x	0	2
y	-2	0

Graphing both equations on the same coordinate system, we obtain the graph below:

The point  $A(3,1)$  is the point of intersection of the two lines.

Let's check by substituting in both equations

$$x + y = 4$$

Substituting  $(3,1)$

$$\Rightarrow x + y = 3 + 1 = 4$$

Therefore,  $(3,1)$  is a solution of

$$x + y = 4$$

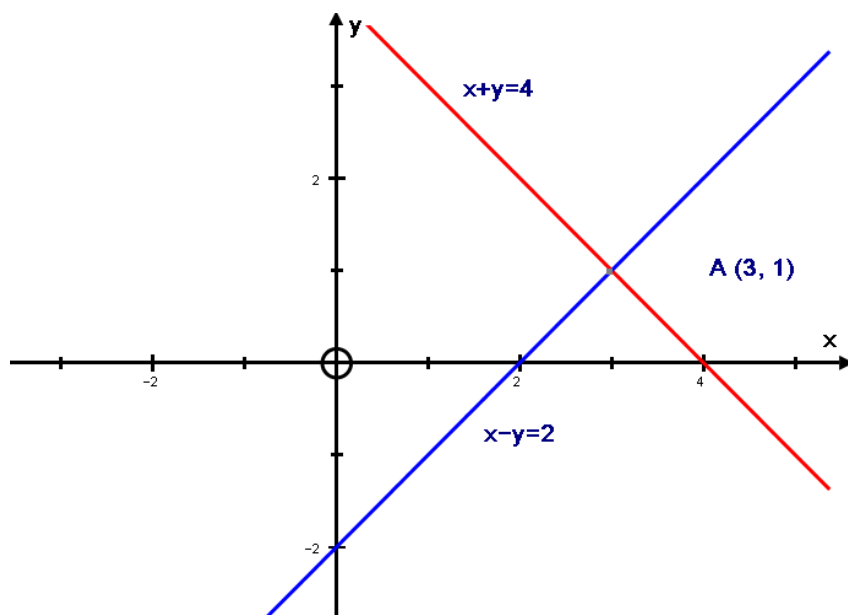
$$x - y = 2$$

Substituting  $(3,1)$

$$\Rightarrow x - y = 3 - 1 = 2$$

Therefore,  $(3,1)$  is a solution of

$$x - y = 2$$



Hence,  $(3,1)$  is the solution of the system of equations