Solving Systems of Equations - Graphing
Mathematics 3

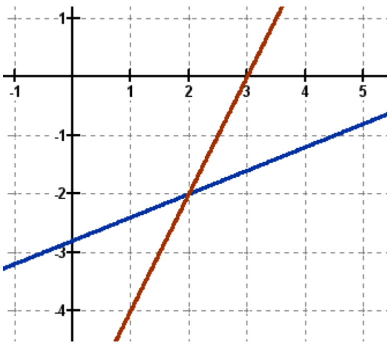
- The LETV Ax + By + C = 0 has an infinite number of solutions as represented by all the ordered pairs (x_1, y_1) that will satisfy the linear equation.
- The graph of the linear equation Ax + By + C = 0 is represented by a line and the points in this line represents all the ordered pairs that will satisfy the linear equation.
- If we plot two lines L_1 and L_2 on the cartesian plane, we have three possibilities:
  1. The two lines will intersect on one point.
  2. The two lines will intersect on all points (i.e., L_1 is the same as L_2)
  3. The two lines are parallel and will not intersect.

Case 1: The two lines will intersect on one point.

The point where the two lines intersect is the **solution of the system** of the two linear equations. This is because this point is a **common solution of the two linear equations**. The system of linear equations with one solution is referred to as **consistent**.

Examples: Find the solution of the following system of equations by graphing the lines.

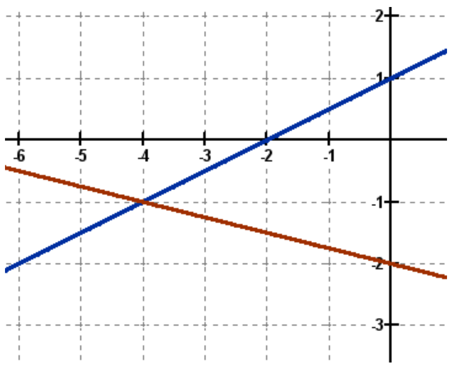
1. L1: 2x – 5y – 14 = 0 (blue)
   L2: 2x – y – 6 = 0 (red)



Answer: (2, -2)

2. L1: $y=\frac{x}{2}+1$ (blue)

   L2: $y=-\frac{x}{4}-2$ (red)



Answer: (-4, -1)

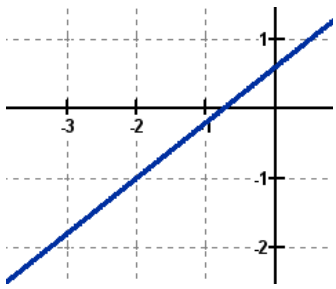
Case 2: The two lines will intersect on all points (i.e., L_1 is the same as L_2)

If L1 and L2 are equivalent equations, then the two linear equations will have the same graphs. The two lines will then intersect on all points, and any point on the line will satisfy both equations. This system is referred to as an **identity** or a **dependent system**.

Examples: Find the solutions of the following systems of equations by graphing the lines:

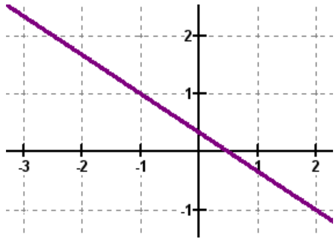
1. L1: 4x – 5y + 3 = 0
   L2: -4x + 5y – 3 = 0

   Answer: There are infinitely many solutions.



2. L1: $2x + 3y - 1 = 0$
   L2: $4x + 6y - 2 = 0$

   Answer: There are infinitely many solutions.



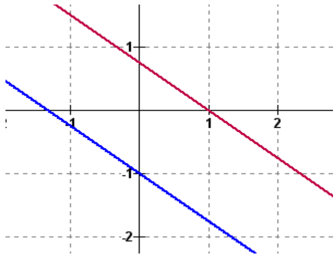
Case 3: The two lines are parallel and will not intersect.

If the graphs of the two linear equations are parallel lines and do not intersect, they will not have a common solution. This is the **<u>No Solution</u>** case and is also referred to as an **<u>inconsistent system</u>**.

Examples: Find the solutions of the following system of equations by graphing the lines.

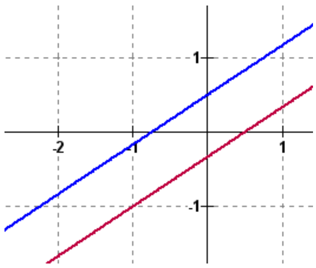
1. L1: $3x + 4y - 3 = 0$ (red)
   L2: $3x + 4y + 4 = 0$ (blue)

   Answer: No Solution



2. L1: $2x - 3y - 1 = 0$ (red)
   L2: $4x - 6y + 3 = 0$ (blue)

   Answer: No Solution



Exercises:

1. L1 passes through A(5,4) and B(2, -5). L2 is perpendicular to L1 and passes through (9, -4). Find the solution of the system of equations of L1 and L2 by graphing.

2. Find the solution of the system of the equations of L1 and L2 if L1 passes through A(9, -4) and B(4, -3), and L2 passes through C(-1, 2) and D(4, 1).

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