

Review of linear systems (optional):

Definition: Finding a solution to 2 linear equations in 2 variables - values for both variables that make both equations true simultaneously - is called solving a **2x2 system of linear equations**.

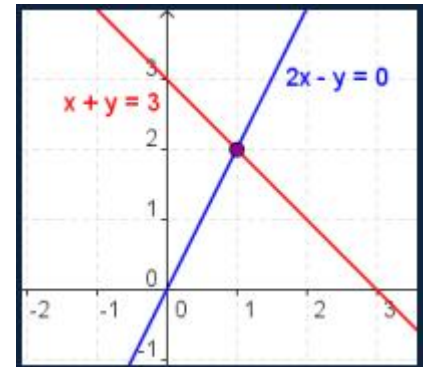
Sample problem: Solve the 2x2 linear system:
$$\begin{cases} 2x + y = 1 \\ x - y = 2 \end{cases}$$
 Answer: $(x, y) = (1, -1)$.

1. Look at the **sample problem** above.

- Check that the answer is correct – substitute the answer into both equations and check that both are true.

$2 \cdot 1 + (-1) \stackrel{?}{=} 1$	$1 - (-1) \stackrel{?}{=} 2$
$2 - 1 \stackrel{?}{=} 1$	$1 + 1 \stackrel{?}{=} 2$
$1 = 1$	$2 = 2$

- **Answer:** Substituting we have:



Both give true statements so the answer is correct.

2. Now look at the graph to the right.

- Write down the problem that matches this graph using the same words and symbols as above and including the answer.

• **Answer:** Solve the 2x2 linear system:
$$\begin{cases} 2x - y = 0 \\ x + y = 3 \end{cases}$$
 Answer: $(x, y) = (1, 2)$.

- Solve this problem using substitution or addition method. Check that your answer and the intersection point agree.

- **Answer** (using substitution method - harder):

$$\begin{aligned} \begin{cases} 2x - y = 0 \\ x = 3 - y \end{cases} &\Rightarrow \begin{cases} 2(3 - y) - y = 0 \\ x = 3 - y \end{cases} \Rightarrow \begin{cases} 6 - 2y - y = 0 \\ x = 3 - y \end{cases} \Rightarrow \begin{cases} 6 - 3y = 0 \\ x = 3 - y \end{cases} \Rightarrow \begin{cases} -3y = -6 \\ x = 3 - y \end{cases} \Rightarrow \\ &\Rightarrow \begin{cases} y = 2 \\ x = 3 - y \end{cases} \Rightarrow \begin{cases} y = 2 \\ x = 3 - 2 \end{cases} \Rightarrow \begin{cases} y = 2 \\ x = 1 \end{cases} \end{aligned}$$

Answer: $(x, y) = (1, 2)$.

(using addition method - easier):

$$\begin{cases} 2x - y = 0 \\ x + y = 3 \end{cases} \Rightarrow \begin{cases} x + y = 3 \\ 3x = 3 \end{cases} \Rightarrow \begin{cases} x + y = 3 \\ x = 1 \end{cases} \Rightarrow \begin{cases} 1 + y = 3 \\ x = 1 \end{cases} \Rightarrow \begin{cases} y = 3 - 1 \\ x = 1 \end{cases} \Rightarrow \begin{cases} y = 2 \\ x = 1 \end{cases}$$

Answer: $(x, y) = (1, 2)$.

3. Again, look at the sample problem above.

- Graph this system either by hand or using GeoGebra.

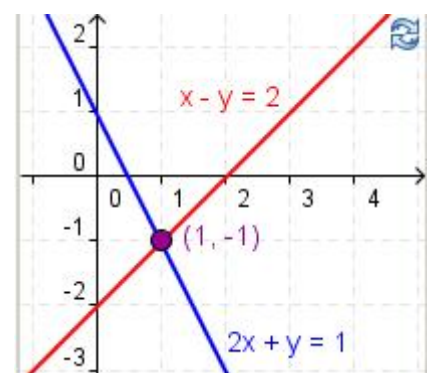
• **Answer:** We graph the sample system
$$\begin{cases} 2x + y = 1 \\ x - y = 2 \end{cases}$$

- Determine the coordinates of the intersection point. Label the lines and your point.

• **Answer:** Coordinates are $(x, y) = (1, -1)$.



- Check that the answer given above and the intersection point of the two lines are the same.

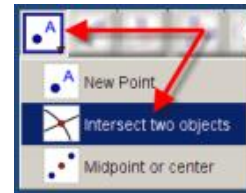
• **Answer:** They are the same.



Directions for using GeoGebra to graph a 2x2 linear system

Sample problem: Solve the system $\begin{cases} 2x + y = 1 \\ x - y = 2 \end{cases}$ graphically using GeoGebra.

1. **Open GeoGebra**
2. It is good to have Algebra window open at left. If it is not, select the command: **View -> Algebra window** (or press Ctrl+Shift+A).
3. Check that the Input Field at bottom of GeoGebra window is visible. If not, select the command: **View -> Input field.**
4. **Click in the Input Field and type in $2x+y=1$ and hit Enter.**
You should see the graph of this line in the drawing pad.
5. **Click in the Input Field and type in $x-y=2$ and hit Enter.**
You should see the graph of this line in the drawing pad.
6. Select the Move drawing pad tool  and then click and drag the drawing pad to a good place.
7. Select the Intersection two objects  from the Point Menu.
8. Click on the intersection point of the two lines.
You should get the point A at the intersection.



Labeling and Decorating.

1. Select the command: **Options -> Font size -> 14 pt .**
2. Right-click on line **a** and choose Properties from the drop down menu.
 - On the Basic tab, select Show Label and choose Value from the drop down menu.
 - On the Color tab, select a blue color square.
3. In the left pane of the Properties dialog box, click on line **b**.
 - On the Color tab, select a red color square.
 - On the Basic tab, select Show Label and choose Value from the drop down menu.
4. In the left pane of the Properties dialog box, click on point **A**.
 - On the Basic tab, select Show Label and choose Value from the drop down menu.
 - On the Color tab, select a purple color square.

