## Lesson 13: Solving Systems of Equations

Let’s solve systems of equations.

### 13.1: True or False: Two Lines



Use the lines to decide whether each statement is true or false. Be prepared to explain your reasoning using the lines.

1. A solution to $8=-x+10$ is 2.
2. A solution to $2=2x+4$ is 8.
3. A solution to $-x+10=2x+4$ is 8.
4. A solution to $-x+10=2x+4$ is 2.
5. There are no values of $x$ and $y$ that make $y=-x+10$ and $y=2x+4$ true at the same time.

### 13.2: Matching Graphs to Systems

Here are three **systems of equations** graphed on a coordinate plane:



1. Match each figure to one of the systems of equations shown here.
	1. $\left\{\begin{matrix}y=3x+5\\y=-2x+20\end{matrix}\right.$
	2. $\left\{\begin{matrix}y=2x−10\\y=4x−1\end{matrix}\right.$
	3. $\left\{\begin{matrix}y=0.5x+12\\y=2x+27\end{matrix}\right.$
2. Find the solution to each system and check that your solution is reasonable based on the graph.

### 13.3: Different Types of Systems

Your teacher will give you a page with some systems of equations.

1. Graph each system of equations carefully on the provided coordinate plane.
2. Describe what the graph of a system of equations looks like when it has . . .
	1. 1 solution
	2. 0 solutions
	3. infinitely many solutions

#### Are you ready for more?

The graphs of the equations $Ax+By=15$ and $Ax−By=9$ intersect at $\left(2,1\right)$. Find $A$ and $B$. Show or explain your reasoning.

### Lesson 13 Summary

Sometimes it is easier to solve a system of equations without having to graph the equations and look for an intersection point. In general, whenever we are solving a system of equations written as

$\left\{\begin{matrix}y=[some stuff]\\y=[some other stuff]\end{matrix}\right.$

we know that we are looking for a pair of values $\left(x,y\right)$ that makes both equations true. In particular, we know that the value for $y$ will be the same in both equations. That means that

$[some stuff]=[some other stuff]$

For example, look at this system of equations:

$\left\{\begin{matrix}y=2x+6\\y=-3x−4\end{matrix}\right.$

Since the $y$ value of the solution is the same in both equations, then we know $2x+6=-3x−4$

We can solve this equation for $x$:

$\begin{matrix}2x+6&=-3x−4&&\\5x+6&=-4 &&add 3x to each side\\5x&=-10 &&subtract 6 from each side\\x&=-2 &&divide each side by 5 \end{matrix}$

But this is only half of what we are looking for: we know the value for $x$, but we need the corresponding value for $y$. Since both equations have the same $y$ value, we can use either equation to find the $y$-value:

$y=2\left(-2\right)+6$

Or

$y=-3\left(-2\right)−4$

In both cases, we find that $y=2$. So the solution to the system is $\left(-2,2\right)$. We can verify this by graphing both equations in the coordinate plane.



In general, a system of linear equations can have:

* No solutions. In this case, the lines that correspond to each equation never intersect.
* Exactly one solution. The lines that correspond to each equation intersect in exactly one point.
* An infinite number of solutions. The graphs of the two equations are the same line!



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