## Lesson 15: Solving More Systems

Let’s solve systems of equations.

### 15.1: Algebra Talk: Solving Systems Mentally

Solve these without writing anything down:

$\left\{\begin{matrix}x=5\\y=x−7\end{matrix}\right.$

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

$\left\{\begin{matrix}x=8\\y=-11\end{matrix}\right.$

### 15.2: Challenge Yourself

Here are a lot of systems of equations:

A $\left\{\begin{matrix}y=4\\x=-5y+6\end{matrix}\right.$

B $\left\{\begin{matrix}y=7\\x=3y−4\end{matrix}\right.$

C $\left\{\begin{matrix}y=\frac{3}{2}x+7\\x=-4\end{matrix}\right.$

D $\left\{\begin{matrix}y=-3x+10\\y=-2x+6\end{matrix}\right.$

E $\left\{\begin{matrix}y=-3x−5\\y=4x+30\end{matrix}\right.$

F $\left\{\begin{matrix}y=3x−2\\y=-2x+8\end{matrix}\right.$

G $\left\{\begin{matrix}y=3x\\x=-2y+56\end{matrix}\right.$

H $\left\{\begin{matrix}x=2y−15\\y=-2x\end{matrix}\right.$

I $\left\{\begin{matrix}3x+4y=10\\x=2y\end{matrix}\right.$

J $\left\{\begin{matrix}y=3x+2\\2x+y=47\end{matrix}\right.$

K $\left\{\begin{matrix}y=-2x+5\\2x+3y=31\end{matrix}\right.$

L $\left\{\begin{matrix}x+y=10\\x=2y+1\end{matrix}\right.$

1. Without solving, identify 3 systems that you think would be the least difficult to solve and 3 systems that you think would be the most difficult to solve. Be prepared to explain your reasoning.
2. Choose 4 systems to solve. At least one should be from your "least difficult" list and one should be from your "most difficult" list.

### 15.3: Five Does Not Equal Seven

Tyler was looking at this system of equations:

$\left\{\begin{matrix}x+y=5\\x+y=7\end{matrix}\right.$

He said,  "Just looking at the system, I can see it has no solution. If you add two numbers, that sum can’t be equal to two different numbers.”

Do you agree with Tyler?

#### Are you ready for more?

In rectangle $ABCD$, side $AB$ is 8 centimeters and side $BC$ is 6 centimeters. $F$ is a point on $BC$ and $E$ is a point on $AB$. The area of triangle $DFC$ is 20 square centimeters, and the area of triangle $DEF$ is 16 square centimeters. What is the area of triangle $AED$?

### Lesson 15 Summary

When we have a system of linear equations where one of the equations is of the form $y=[stuff]$ or $x=[stuff]$, we can solve it algebraically by using a technique called *substitution*. The basic idea is to replace a variable with an expression it is equal to (so the expression is like a substitute for the variable). For example, let's start with the system:

$\left\{\begin{matrix}y=5x\\2x−y=9\end{matrix}\right.$

Since we know that $y=5x$, we can substitute $5x$ for $y$ in the equation $2x−y=9$,

$2x−\left(5x\right)=9,$

and then solve the equation for $x$,

$x=-3.$

We can find $y$ using either equation. Using the first one: $y=5⋅-3$. So

$\left(-3,-15\right)$

is the solution to this system. We can verify this by looking at the graphs of the equations in the system:



Sure enough! They intersect at $\left(-3,-15\right)$.

We didn't know it at the time, but we were actually using substitution in the last lesson as well. In that lesson, we looked at the system

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

and we substituted $2x+6$ for $y$ into the second equation to get $2x+6=-3x−4$. Go back and check for yourself!



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