

## Developing an Understanding for the Elimination Method for Solving a System of Equations

We have solved a system of equations using graphs, tables, and substitution. The substitution method was introduced to provide you an analytical (or algebraic) way to work with a system of equations to find a solution to the system. In this activity you will explore using another analytic (or algebraic) way to solve a system of equations.

First let's think about some things we have done with equations.

*When you add equal quantities to each side of an equation, the resulting equation is equivalent and has the same solution as the original equation.*

$$\begin{array}{r} y - 4 = 12 \\ + \quad 4 = 4 \\ \hline y = 16 \end{array}$$

*Recall that  $y=16$  is a solution to the first equation and the last equation.*

$$\begin{array}{r} 3y - 2x = 1 \\ + \quad 2x = 2x \\ \hline 3y = 1 + 2x \end{array}$$

*Recall that  $(1,1)$ ,  $(4,3)$ , and  $(10,7)$  are solutions to first equation and the last equation.*

so

$$\begin{array}{r} a = b \\ + \quad c = d \\ \hline a + c = b + d \end{array}$$

Frank is thinking of two numbers, but he won't say what they are. Instead he plays a game. He tells you that the sum of the two numbers is 163 and that their difference is 33. Find the two numbers.

If the two numbers are  $x$  and  $y$ , you can write two equations based on Frank's statements.

- Write an equation based on the first description:
- Write an equation based on the second description:

From your equations, which is the larger number? How can you tell?

Use the property described above to add the equations together. You should see that this results in an equation with just one variable. Solve for the value of that variable.

Use this value to find the value of the other number. What is the solution to Frank's problem?

## How long is a paper clip? How wide is a penny?

- To write one equation, lay one paper clip along the long side of the paper and then add enough pennies to complete the 11 inch length. Write a statement that describe the 11" length of the paper using paper clips and pennies. Replace the word paper clips with C and pennies with P. You now have your first equation.
- To write the other equation for the system, lay two paper clips along the shorter side of the paper and add pennies to complete the 8.5 inch length. Write a statement that describe the 8.5" length of the paper using paper clips and pennies. Replace the word paper clips with C and pennies with P. You now have your second equation.
- Study your two equations. Notice that each variable has different coefficients on each equation.
- What could you do to both sides of one of the equations so that the variable C is eliminated when the two equations are added?
- Perform this operation to both sides of the one equation and then add the equations together.
- Once you have eliminated the C, solve the resulting equation for P.
- Substitute your P value back into either equation to solve for C.
- Find another way to solve this system by elimination.
- Explain the real-world meaning of the solution.
- Describe other experiments in measuring that you can solve using a system of equations.



From Science:

A molecule of hexane,  $C_6H_{14}$ , has six carbon atoms and fourteen hydrogen atoms.

Its molecular weight in grams per mole, the sum of the atomic weights of carbon and hydrogen is 86.178.

The molecular weight of octane,  $C_8H_{18}$ , is 114.232 grams per mole.

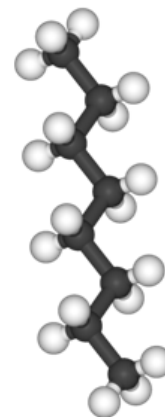
Octane has eight carbon atoms and eighteen hydrogen atoms per molecule.

Find the atomic weights of carbon and hydrogen.

hexane



octane



Try These:

1. Suppose you had the system of equations 
$$\begin{cases} 3x - 2y = 11 \\ -x + 6y = 7 \end{cases}$$

Show how you could solve this system by eliminating the x variable.

Show how you could solve this system by eliminating the y variable.

Show how you could use substitution to solve this system of equations.