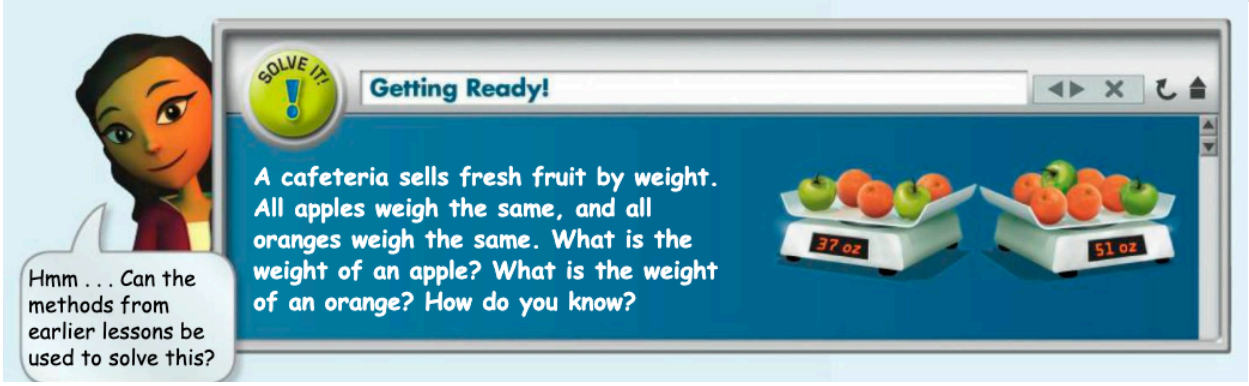
6-3 Solving Systems Using Elimination



By the Addition and Subtraction Properties of Equality, if $a = b$ and $c = d$, then $a + c = b + d$ and $a - c = b - d$. For example, $5 + 1 + 6$ and $3 + 4 = 7$, so $(5 + 1) + (3 + 4) = 6 + 7$. In the ***elimination method***, *you use these properties to add or subtract equations in order to eliminate a variable in a system.*

There is more than one way to solve a system of equations. Some systems are written in a way that makes eliminating a variable a good method to use.

PROBLEM 1: SOLVING A SYSTEM BY ADDING EQUATIONS

Solve each system using elimination. Check your solutions.

1. $\begin{cases} 2x + 5y = 17 \\ 6x - 5y = -9 \end{cases}$

2. $\begin{cases} 3x + 5y = 10 \\ x - 5y = -10 \end{cases}$

3. $\begin{cases} x - y = -11 \\ 3x + y = -1 \end{cases}$

PROBLEM 2: SOLVING A SYSTEM BY SUBTRACTING EQUATIONS

Solve each system using elimination. Check your solutions.

4. $\begin{cases} -3x + 3y = 18 \\ 9x + 3y = 30 \end{cases}$

5. $\begin{cases} -5x - 2y = 29 \\ x - 2y = -13 \end{cases}$

6. $\begin{cases} -2x - 4y = -24 \\ 4x - 4y = 24 \end{cases}$

In Problems 1 and 2, a variable is eliminated because the sum or difference of its coefficients is zero. From the Multiplication Property of Equality, you know that you can multiply each side of an equation to get a new equation that is equivalent to the original. That is, $a + b = c$ is equivalent to $d(a + b) = dc$, or $da + db = dc$. Since this is true, you can eliminate a variable by adding or subtracting, if you first multiply an equation by an appropriate number. You can prove that the results are the same simply by substituting the values for the variables in the original equations to show that the equations are true.

PROBLEM 3: SOLVING A SYSTEM BY MULTIPLYING ONE EQUATION

Solve each system using elimination. Check your solutions.

7. $\begin{cases} -2x + 15y = -32 \\ 7x - 5y = 17 \end{cases}$

8. $\begin{cases} -5x - 2y = 6 \\ 3x + 6y = 6 \end{cases}$

9. $\begin{cases} 2x + 5y = -22 \\ 10x + 3y = 22 \end{cases}$

10. $\begin{cases} -18x - 10y = -6 \\ -9x - 7y = -15 \end{cases}$

PROBLEM 4: SOLVING A SYSTEM BY MULTIPLYING BOTH EQUATIONS

Solve each system using elimination. Check your solutions.

11. $\begin{cases} 3x + 2y = 3 \\ 4x + 3y = -2 \end{cases}$

12. $\begin{cases} 15x + 3y = 9 \\ 10x + 7y = -4 \end{cases}$

13. $\begin{cases} 10x - 60y = -20 \\ -3x + 18y = 6 \end{cases}$

14. $\begin{cases} 4x - 7y = -26 \\ 10x - 3y = 22 \end{cases}$

Recall that if you get a false statement as you solve a system, then the system has no solution. If you get an identity, then the system has infinitely many solutions.

PROBLEM 5: FINDING THE NUMBER OF SOLUTIONS

Tell whether the system has one solution, infinitely many solutions, or no solution.

15. $\begin{cases} 2x + 6y = 18 \\ x + 2y = 9 \end{cases}$

16. $\begin{cases} 4x - 10y = -14 \\ -2x + 5y = 12 \end{cases}$

WORD PROBLEMS

17. Your class sells a total of 64 tickets to a play. A student ticket costs $1, and an adult tickets costs $2.50. Your class collects $109 in total ticket sales. How many tickets of each type were sold?

18. Grandma's Bakery sells apple pies for $6.99 and cherry pies for $10.99. The total number of pies sold on a busy Friday was 36. If the amount collected for all of the pies that day was $331.64, how many pies of each type were sold?

19. Shopping at Savers Mart, Lisa buys her children four shirts and three pairs of pants for $85.50. She returns the next week and buys three shirts and five pairs of pants for $115.00. What is the price of each shirt and each pair of pants?

20. Half of a pepperoni pizza plus three-fourths of a ham-and-pineapple pizza contains 765 Calories. One-fourth of a pepperoni pizza plus a whole ham-and-pineapple pizza contains 745 Calories. How many Calories are in a whole pepperoni pizza? How many Calories are in a whole ham-and-pineapple pizza?

Lesson Check

Do you know HOW?

Solve each system using elimination.

1. $3x - 2y = 0$
   $4x + 2y = 14$
2. $3p + q = 7$
   $2p - 2q = -6$
3. $3x - 2y = 1$
   $8x + 3y = 2$

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Vocabulary** If you add two equations in two variables and the sum is an equation in one variable, what method are you using to solve the system? Explain.
5. **Reasoning** Explain how the Addition Property of Equality allows you to add equations.
6. **Writing** Explain how you would solve a system of equations using elimination.

Name _____ ***6-3 Practice Worksheet*** Period _____

Solve each system using elimination. Check your solution.

1. $\begin{aligned} 20x + 3y &= 20 \\ -20x + 5y &= 60 \end{aligned}$

2. $\begin{aligned} 2x + 4y &= 8 \\ 5x + y &= -7 \end{aligned}$

3. $\begin{aligned} 10x + 8y &= 2 \\ 8x + 6y &= 1 \end{aligned}$

4. Two groups of students order burritos and tacos at a local restaurant. One order of 3 burritos and 4 tacos costs $11.33. The other order of 9 burritos and 5 tacos costs $23.56. Write a system of equations that describes this situation. Solve by elimination to find the cost of a burrito and the cost of a taco.

5. A company sells brass and steel machine parts. One shipment contains 3 brass and 10 steel parts and costs $48. A second shipment contains 7 brass and 4 steel parts and costs $54. Find the cost of each type of machine part.

Solve each system using any method. Tell why you chose the method you used.

6. $\begin{cases} x = 12y - 14 \\ 3y + 2x = 26 \end{cases}$

7. $\begin{cases} -20x + 7y = 137 \\ 4x + 5y = 43 \end{cases}$

8. $\begin{cases} 5y = x \\ 2x - 3y = 7 \end{cases}$

Solve each system by elimination. Check your solution.

9. $\begin{cases} -0.2x + 4y = -1 \\ x + 0.5y = -15.5 \end{cases}$

10. $\begin{cases} \frac{2}{3}x - y = 70 \\ \frac{1}{3}x - \frac{2}{3}y = 43 \end{cases}$

11. $\begin{cases} x + y + z = 41 \\ x - y + z = 15 \\ 3x - z = 4 \end{cases}$

12. ***Find the value of*** n ***such that the x-value of the solution of the system is 4.***

$\begin{cases} 5x - 10y = 50 \\ nx + 10y = 6 \end{cases}$