

## Solving Linear Systems of Equations – Elimination

### Problem 1: Linear Combination Method (Elimination)

1. Consider the system: 
$$\begin{cases} x + y = 324 \\ x - y = 34 \end{cases}$$

a. Add the two equations together.

$$\begin{array}{r} x + y = 324 \\ + \quad x - y = 34 \\ \hline 2x = 358 \end{array}$$

b. Solve the resulting equation.

$$\begin{aligned} 2x &= 358 \\ x &= 179 \end{aligned}$$

c. Substitute the value obtained in (b) into one of the original equations and solve.

$$\begin{array}{r} 179 + y = 324 \\ -179 \quad -179 \\ \hline y = 145 \end{array}$$

d. Write the solution to the system as an ordered pair.  $(x, y)$

$$(179, 145)$$

### 2. Solve the systems using the linear combination method:

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

Add:  $5x = 15$

Solve:  $x = 3$

find y: 
$$\begin{aligned} 2(3) + y &= 8 \\ 6 + y &= 8 \\ y &= 2 \end{aligned}$$

Solution:  $(3, 2)$

b. 
$$\begin{cases} x + 4y = 9 \\ -x - y = 12 \end{cases}$$

$$3y = 21$$

$$y = 7$$

$$x + 4(7) = 9$$

$$x + 28 = 9$$

$$x = -19$$

$$(-19, 7)$$



3. Consider the system:  $\begin{cases} 2x + 4y = 270 \\ 3x + 8y = 435 \end{cases}$

a. Multiply the first equation by 3 and multiply the second equation by -2.

$$\begin{aligned} 6x + 12y &= 810 \\ -6x - 16y &= -870 \end{aligned}$$

b. Add the resulting two equations together.

$$-4y = -60$$

c. Solve the resulting equation.

$$y = 15$$

d. Substitute the value obtained in (c) into one of the original equations and solve.

$$\begin{aligned} 2x + 4(15) &= 270 & x &= 105 \\ 2x + 60 &= 270 \\ 2x &= 210 \end{aligned}$$

e. Write the solution to the system as an ordered pair.

$$(105, 15)$$



4. Solve the systems using the linear combination method:

a.  $\begin{cases} 4x + 3y = 24 \\ 3x + y = -2 \end{cases} (-3)$

multiply:  
2<sup>nd</sup> eq.  
by (-3)

$$\begin{aligned} 4x + 3y &= 24 \\ -9x - 3y &= 6 \\ \hline \end{aligned}$$

Add:

$$-5x = 30$$

Solve:

$$x = -6$$

find y:

$$\begin{aligned} 4(-6) + 3y &= 24 \\ -24 + 3y &= 24 \\ 3y &= 48 \\ y &= 16 \end{aligned}$$

Solution:

$$(-6, 16)$$

b.  $\begin{cases} 3x + 5y = 17 \\ 2x + 3y = 11 \end{cases} (-2)$

$$\begin{aligned} -6x - 10y &= -34 \\ 2x + 3y &= 11 \\ \hline \end{aligned}$$

$$\begin{aligned} -y &= -1 \\ y &= 1 \end{aligned}$$

$$\begin{aligned} 2x + 3(1) &= 11 \\ 2x + 3 &= 11 \\ 2x &= 8 \\ x &= 4 \end{aligned}$$

$$(4, 1)$$

5. The Pizza Barn sells one customer 3 large pepperoni pizzas and 2 orders of breadsticks for \$30. They sell another customer 4 large pepperoni pizzas and 3 orders of breadsticks for \$41. How much does the Pizza Barn charge for each pepperoni pizza and each order of breadsticks?

a. Write a system of equations to represent the situation. Define your variables.

$$\begin{aligned} x &= \text{\$ of P. pizza sold} & 3x + 2y &= 30 \\ y &= \text{\$ of Breadsticks sold} & 4x + 3y &= 41 \end{aligned}$$

b. Solve the system using the linear combination method.

$$\begin{aligned} (-4)(3x + 2y = 30) & \Rightarrow \begin{array}{r} -12x - 8y = -120 \\ 12x + 9y = 123 \\ \hline y = 3 \end{array} & (8, 3) \\ (3)(4x + 3y = 41) & \end{aligned}$$

\$8 for pizza.  
\$3 for breadsticks.

$$\begin{aligned} 3x + 2(3) &= 30 \\ 3x + 6 &= 30 \\ 3x &= 24 \\ x &= 8 \end{aligned}$$

c. Is the system consistent or inconsistent? Explain.

Consistent, because it has a solution.

6. Nancy and Warren are making large pots of chicken noodle soup. Nancy opens 4 large cans and 6 small cans of soup and pours them into her pot. Her pot contains 115 ounces of soup. Warren opens 3 large cans and 5 small cans of soup. His pot contains 91 ounces of soup. How many ounces of soup does each large can and each small can contain?

a. Write a system of equations to represent the situation. Define your variables.

$$\begin{aligned} x &= \text{\# ounces for large} & 4x + 6y &= 115 \\ y &= \text{\# ounces for small} & 3x + 5y &= 91 \end{aligned}$$

b. Solve the system using the linear combination method.

$$\begin{aligned} (5)(4x + 6y = 115) & \Rightarrow \begin{array}{r} 20x + 30y = 575 \\ -18x - 30y = -546 \\ \hline 2x = 29 \\ x = 14.5 \end{array} & \begin{array}{l} 4(14.5) + 6y = 115 \\ 58 + 6y = 115 \\ 6y = 57 \\ y = 9.5 \end{array} \\ (-6)(3x + 5y = 91) & \end{aligned}$$

(14.5, 9.5)  
14.5 oz. of Large cans.  
9.5 oz of Small cans.

c. Is the system consistent or inconsistent? Explain.

Consistent because it has a solution.

