

Section 10 Systems of Linear Equations and Elimination

A system of linear equations can be solved by multiplying one (or both) equations by a number and then adding the equations together. If the numbers are chosen carefully, then one of the coefficients (or both) will be eliminated.

Example 1: Solving a system using elimination

Solve $\begin{cases} 4x - 2y = 0 \\ 4x + 3y = 20 \end{cases}$ using elimination.

Solution: In the system $\begin{cases} 4x - 2y = 0 & (1) \\ 4x + 3y = 20 & (2) \end{cases}$, we notice that the x 's have the same coefficient. If we multiply equation (1) by -1 , we have:

$$\begin{array}{rcl} -1(4x - 2y = 0) & \Rightarrow & -4x + 2y = 0 \\ 4x + 3y = 20 & & 4x + 3y = 20 \end{array}$$

Next, we add the two sides of the equation together. When we do this, the x 's will be eliminated.

$$\begin{array}{r} -4x + 2y = 0 \\ 4x + 3y = 20 \\ \hline 5y = 20 \end{array}$$

Then $y = 4$. In order to solve the system, we still have to solve for x . Substitute 4 for y into equation (1):

$$\begin{array}{l} 4x - 2y = 0 \\ 4x - 2(4) = 0 \\ 4x - 8 = 0 \\ 4x = 8 \\ x = 2 \end{array}$$

The solution of the system is the ordered pair $(2, 4)$.

Example 2: Solving a system using elimination

Solve the system $\begin{cases} 9x - 2y = 7 \\ 3x - y = 6 \end{cases}$ using elimination.

Example 3: Solving a system using elimination

Solve the system $\begin{cases} 6x + 9y = 12 \\ 4x + 6y = 5 \end{cases}$ using elimination.

Example 4: Solving a system using elimination

Solve the system $\begin{cases} x - 2y = 3 \\ 3x = 6y + 9 \end{cases}$ using elimination.

Example 5: Solving a system using elimination

Solve the system $\begin{cases} 4x - 20 = 5y \\ 8x - 10y = 12 \end{cases}$ using elimination.

Example 6: Word problems involving systems

Two angles are complementary. Find the measures of the angles if the larger of the two angles is 15° more than two times the smaller angle.

Example 7: Word problems involving systems

There were 200 tickets sold for a volleyball game. Tickets for students were \$2 each and for adults were \$3 each. The total amount collected was \$530. How many of each type of ticket were sold?

Example 8: Word problems involving systems

Clear Shine window cleaner is 12% alcohol and Sunstream window cleaner is 30% alcohol. How much of each should be used to make 90 ounces of a cleaner that is 20% alcohol?

Example 9: Word problems involving systems

Emilio wishes to mix peanuts worth \$2.52 per pound with almonds worth \$3.80 per pound to make 480 pounds of a mixture worth \$3.44 per pound. How much of each should he use?

Example 10: Word problems involving systems

Mike mixes Ethiopian coffee worth \$19 a pound with Columbian coffee worth \$22 per pound. How much of each should he use to get 300 pounds of a mixture worth \$20 per pound?