

Solving Systems of Equations Using Elimination Notes

Steps:

1. Place both equations in Standard Form, $Ax + By = C$.
2. Determine which variable to eliminate with Addition or Subtraction.
3. Solve for the variable left.
4. Go back and use the found variable in step 3 to find second variable.
5. Check the solution in **both** equations of the system.

Examples:

$$\begin{array}{r}
 1) \quad 5x + 3y = 11 \\
 \quad 5x = 2y + 1 \\
 -(5x - 2y = 1) \\
 \hline
 \quad 5y = 10 \\
 \quad y = 2 \\
 \quad 5x + 3(2) = 11 \\
 \quad 5x + 6 = 11 \\
 \quad 5x = 5 \\
 \quad x = 1 \\
 \quad (1, 2)
 \end{array}$$

$$\begin{array}{r}
 2) \quad x + y = 10 \\
 \quad 5x - y = 2 \\
 \quad 6x = 12 \\
 \quad x = 2 \\
 \quad 2 + y = 10 \\
 \quad y = 8 \\
 \quad (2, 8)
 \end{array}$$

$$\begin{array}{r}
 3) \quad 5x + 5y = 20 \\
 \quad 6x - 10y = 8 \\
 \quad 10x + 10y = 40 \\
 \quad 16x = 48 \\
 \quad x = 3 \\
 \quad 5(3) + 5y = 20 \\
 \quad 5y = 5 \\
 \quad y = 1 \\
 \quad (3, 1)
 \end{array}$$

$$\begin{array}{r}
 4) \quad -2x = 3y - 13 \\
 \quad -2(-5x + 7y = 11) \\
 5(-2x - 3y = -13) \\
 \hline
 \quad 10x - 14y = -22 \\
 \quad -10x - 15y = -65 \\
 \hline
 \quad -29y = -87 \\
 \quad y = 3 \\
 \quad -2x = 3(3) - 13 \\
 \quad -2x = -4 \\
 \quad x = 2 \\
 \quad (2, 3)
 \end{array}$$

$$\begin{array}{r}
 5) \quad 2x - 3y = 1 \\
 \quad 5x = 7y + 4
 \end{array}$$

$$\begin{array}{r}
 2(5x - 7y = 4) \\
 -5(2x - 3y = 1) \\
 \hline
 10x - 14y = 8 \\
 -10x + 15y = -5 \\
 \hline
 \quad y = 3
 \end{array}$$

$$\begin{array}{r}
 y = 3 \\
 2x - 3(3) = 1 \\
 2x - 9 = 1 \\
 2x = 10 \\
 x = 5 \\
 (5, 3)
 \end{array}$$

$$\begin{array}{r}
 6) \quad -9x + 15y = -18 \\
 3(3x - 5y = -18) \\
 \quad 9x - 15y = -54 \\
 \quad 0 = -72
 \end{array}$$

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$$\begin{array}{r}
 7) \quad -3x + 4y = 4 \\
 \quad 6x - 8y = -8
 \end{array}$$

$$\begin{array}{r}
 -6x + 8y = 8 \\
 \quad 0 = 0
 \end{array}$$

All Reals / Infinite Solutions

Using elimination to solve a word problem:

The sum of 2 numbers is 70 and their difference is 24. Find the 2 numbers.

$$\begin{aligned}x + y &= 70 \\x - y &= 24 \\ \hline 2x &= 94 \\ x &= 47\end{aligned}$$
$$\begin{aligned}47 + y &= 70 \\ y &= 23\end{aligned}$$

Find two numbers who sum is 18 and whose difference is 22.

$$\begin{aligned}x + y &= 18 \\x - y &= 22 \\ \hline 2x &= 40 \\ x &= 20\end{aligned}$$
$$y = -2$$

The sum of two numbers is 128 and their difference is 114. Find the numbers.

$$\begin{aligned}x + y &= 128 \\x - y &= 114 \\ \hline 2x &= 242 \\ x &= 121\end{aligned}$$
$$y = 7$$

Application:

Bob purchases 100 pens and 200 erasers for \$125. Grant purchases 500 pens and 200 erasers for \$425. How much does each pen and eraser cost?

$$\begin{aligned}100x + 200y &= 125 \\ - (500x + 200y &= 425) \\ \hline -400x &= -300 \\ x &= \frac{3}{4} = .75\end{aligned}$$

pens 75¢
erasers 25¢

$$\begin{aligned}100(.75) + 200y &= 125 \\ 75 + 200y &= 125 \\ 200y &= 50 \\ y &= .25\end{aligned}$$