

Math 101: Solving Systems of Linear Equations by Elimination

Suppose you want to find x and y that simultaneously satisfy both of these equations:

$$0.7x + 0.9y = 2.65$$

$$2.0x + 1.5y = 5.75$$

One great approach is to add or subtract equations to “eliminate” one of the variables.

But if you look at the coefficients in this problem, you won’t find any that work.

There’s a cookbook rule for handling this situation: **Pick a variable (it doesn’t matter which one), and multiply each equation by that variable’s coefficient from the other equation.**

Suppose we pick y . Then we proceed like this:

$$\begin{aligned} 1.5 * (0.7x + 0.9y) &= 1.5 * 2.65 \\ 0.9 * (2.0x + 1.5y) &= 0.9 * 5.75 \end{aligned}$$

Expand and simplify:

$$\begin{array}{lcl} 1.5 * (0.7x + 0.9y) = 1.5 * 2.65 & \text{becomes} & 1.5 * 0.7x + \boxed{1.5 * 0.9y} = 1.5 * 2.65 \\ 0.9 * (2.0x + 1.5y) = 0.9 * 5.75 & & 0.9 * 2.0x + \boxed{0.9 * 1.5y} = 0.9 * 5.75 \end{array}$$

$$1.05x + 1.35y = 3.975$$

$$1.80x + 1.35y = 5.175$$

Notice that by construction, both equations now have the same coefficient on y .

This lets us subtract one equation from the other to eliminate the y ’s.

$$\begin{array}{rcl} 1.05x + 1.35y & = & 3.975 \\ -1.80x - 1.35y & = & -5.175 \\ \hline -0.75x & = & -1.2 \\ x = \frac{-1.2}{-0.75} & = & 1.6 \end{array}$$

Then we can “back-substitute” to figure out what y has to be. Plug $x = 1.6$ into one equation and solve for y .

$$0.7 * 1.6 + 0.9y = 2.65$$

$$1.12 + 0.9y = 2.65$$

$$0.9y = 2.65 - 1.12 = 1.53$$

$$y = \frac{1.53}{0.9} = 1.7$$

The final answer is $x=1.6, y=1.7$. Plug the numbers back into the original equations to check!