SOLVING LINEAR SYSTEMS – ELIMINATION METHOD

If you have a linear system, you can solve it by adding or subtracting the equations in order to eliminate a variable.
BUT…what happens when the coefficients are NOT THE SAME????

Steps:
1) Choose the equation with only an x or y (coefficient of 1) and multiply it by a number to create a term that is the same as in the other equation.
2) Add or subtract the two equations so that you eliminate either of the variables "x" or "y".
3) Find the solution for one variable.
4) Substitute the solution into either of the original equations and solve for the other variable.
5) Write a concluding statement "$\therefore$ the solution is (x, y)."

Examples:

1. Solve: ① $x + 3y = 11$
② $3x + 2y = 19$

Multiply one of the equations: ① × $3(x + 3y = 11)$ $3x + 9y = 33$ ③		
Add or subtract the equations to eliminate one of the variables and then solve: ② & ③	Solve for the other variable:	Solution:
$3x + 2y = 19$ $-\; 3x + 9y = 33$ $\varnothing \quad [2y - 9y] = [19 - 33]$ $\frac{-7y}{-7} = \frac{-14}{-7}$ $\boxed{y = 2}$	Sub $y = 2$ in $x + 3y = 11$ $x + 3(2) = 11$ $x + 6 = 11$ $x = 11 - 6$ $\boxed{x = 5}$	PoI is $(5, 2)$

Check $(5, 2)$
 x y

LS	RS
$x + 3y$	11
$= (5) + 3(2)$	
$= 5 + 6$	✓
$= 11$	

LS	RS
$3x + 2y$	19
$= 3(5) + 2(2)$	
$= 15 + 4$	✓
$= 19$	

2. Solve: $3x - 4y = 16$ ①
$2x + y = 7$ ②

<table>
<tr><td colspan="3">Multiply one of the equations: ② × 4 $4(2x+y=7)$
$8x+4y=28$ ③</td></tr>
<tr><td>Add or subtract the equations to eliminate one of the variables and then solve: ① & ③</td><td>Solve for the other variable:</td><td>Solution:</td></tr>
<tr><td>$3x - 4y = 16$
$+\ 8x + 4y = 28$
$[3x+8x]\ \varnothing = [16+28]$
$\frac{11x}{11} = \frac{44}{11}$
$\boxed{x = 4}$</td><td>Sub $x=4$ in ②
$2x + y = 7$
$2(4) + y = 7$
$8 + y = 7$
$y = 7-8$
$\boxed{y = -1}$</td><td>POI is $(4, -1)$</td></tr>
</table>

Example:

A company hosted a winter holiday reception at a local banquet hall and served two different dinners. There were 200 people who attended the function.

Let x represent the # roast beef dinners and y represent the # of grilled chicken dinners.

This is represented by the equation: $x + y = 200$ ①

The roast beef dinner cost \$21 per plate and the grilled chicken dinner cost \$15 per plate. The dinner cost the company a total of \$3720.

This is represented by the equation: $21x + 15y = 3720$ ②

Q: How many roast beef dinners and grilled chicken dinners were served?

<table>
<tr><td colspan="3">Multiply one of the equations: ① × 21 $21(x+y=200)$
$21x+21y=4200$ ③</td></tr>
<tr><td>Add or subtract the equations to eliminate one of the variables and then solve: ② & ③</td><td>Solve for the other variable:</td><td>Solution:</td></tr>
<tr><td>$21x + 15y = 3720$
$-\ 21x + 21y = 4200$
$\varnothing\ [15y - 21y] = [3720 - 4200]$
$\frac{-6y}{-6} = \frac{-480}{-6}$
$\boxed{y = 80}$</td><td>Sub $y=80$ in ①
$x + y = 200$
$x + (80) = 200$
$x = 200 - 80$
$\boxed{x = 120}$</td><td>POI is $(120, 80)$
Roast Beef   Chicken
∴ At the function 120 Roast beef & 80 Chicken dinners were served.</td></tr>
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