ELIMINATION

To solve a linear system by elimination:

If the two equations have the same x OR y coefficient, they can be solved by a process called 'Elimination'. We can do this by either **adding or subtracting the two equations!**

Step 1: Eliminate by *adding or subtracting* the two equations.

*Add if the signs are opposite, subtract if the signs are the same.

Step 2: Solve for the first variable by solving the equation

Step3: Substitute your solution from step 2 into one of the original equations (you may choose either one to use).

Step 4: Solve for the second variable by solving the equation

State the final answer as a coordinate (x, y)

You can **check** your work by completing a LS/RS check. Substitute your (x,y) solution into the original equation that you **DID NOT** use in step 3 above.

Example 1

① $2x + 5y = 30$

② $+\ 4x - 5y = 0$

$2x + 4x + 5y + (-5y) = 30 + 0$

$6x + 0 = 30$

$\frac{6x}{6} = \frac{30}{6}$

$x = 5$

① $2x + 5y = 30$

$2(5) + 5y = 30$

$-10 \quad -10$

$10 + 5y = 30$

$\frac{5y}{5} = \frac{20}{5}$

$y = 4$

(x , y)

(5, 4)

CHECK

② $4x - 5y = 0$

$4x - 5y$	0
$4(5) - 5(4)$	
$= 20 - 20$	
$= 0$	

LS = RS

∴ The solution is (5,4)

Example 2

① $3x + 4y = 22$

$-$ ② $3x - y = 17$

$3x - (3x) + 4y - (-y) = 22 - (17)$

$0 + 4y + y = 22 - 17$

$\frac{5y}{5} = \frac{5}{5}$

$y = 1$

$3x - y = 17$

$3x - 1 \ {}^{+1} = 17 \ {}^{+1}$

$\frac{3x}{3} = \frac{18}{3}$

$x = 6$

(x , y)

(6, 1)

CHECK

① $3x + 4y = 22$

$3x + 4y$	22
$3(6) + 4(1)$	22
$= 18 + 4$	
$= 22$	

LS = RS

∴ The solution is (6,1)

	Example 3	**Example 4**
	let's pick "y" to eliminate. LCM 5, 1 is 5	Pick the variable with the opposite sign.
	$6x + 5y = 3$ $5x + y = 14)$	$2(4x + 3y = 3)$ $3(3x - 2y = -19)$
Step 1: Eliminate by *adding or subtracting* the two equations. *Add if the signs are opposite, subtract if the signs are the same.	$6x+5y=3$ $-\ 5x+5y=70$ $6x-(5x)+5y-(5y)=3-(70)$	$8x+6y=6$ $+\ 9x-6y=-57$ $8x+(9x)+6y+(-6y)=6+(-57)$
	$x=-67$	$17x=-51$ $\frac{17x}{17}=\frac{-51}{17}$
	sub $x+y=14$ $+67 \quad +67$ $(-67)+y=14$	sub $x=-3$ $4x+3y=3$ $4(-3)+3y=3$ $+12 \quad +12$ $-12+3y=3$
Step3: Substitute your solution from step 2 into one of the original equations (you may choose either one to use).	$y=81$	$3y=15$ $\frac{3y}{3}=\frac{15}{3}$ $y=5$
Step 4: Solve for the second variable by solving the equation		
State the final answer as a coordinate (x, y)	**(x , y)** $(-67, 81)$	**(x , y)** $(-3, 5)$
You can **check** your work by completing a LS/RS check. Substitute your (x,y) solution into the original equation that you **DID NOT** use in step 3 above.	CHECK $6x+5y=3$ $6x+5y \mid 3$ $6(-67)+5(81) \mid 3$ $=-402+405$ $=3$ LS = RS	CHECK $3x-2y \mid -19$ $3(-3)-2(5) \mid -19$ $-9-10$ $-19 \mid -19$ LS = RS
	∴ The solution is $(-67, 81)$	∴ The solution is $(-3, 5)$

Practice: Solve by Elimination.

1. $4x + 2y = 3$
$3x + 2y = 5$

$4x-(3x)+2y-(2y)=3-(5)$

1) $x = -2$

sub

2) $3x + 2y = 5$
$3(-2)+2y=5$
$-6+2y=5$ (+6 +6)
$\frac{2y}{2} = \frac{11}{2}$
$y = 11/2$

3) $\therefore$ POI $(-2, 11/2)$

2. $3x - 5y = 8$
$10x + 5y = 44$

$3x+(10x)-5y+(5y)=8+(44)$

1) $\frac{13x}{13} = \frac{52}{13}$
$x = 4$

sub

2) $3x - 5y = 8$
$3(4) - 5y = 18$ (-12 -12)
$12 - 5y = 18$
$\frac{-5y}{-5} = \frac{6}{-5}$
$y = -6/5$

3) POI $(4, -6/5)$

3. $3(x - 3y = 0)$
$1(3x - 2y = -7)$

Eliminate "x"
LCM = 3

$3x - 9y = 0$
$3x - 2y = -7$

$3x-(3x)-9y-(-2y)=0-(-7)$
$-9y + 2y = 0 + 7$
$\frac{-7y}{-7} = \frac{7}{-7}$
$y = -1$

2) $x - 3y = 0$
$x - 3(-1) = 0$
$x + 3 = 0$ (-3 -3)
$x = -3$

$\therefore$ POI is $(-3, -1)$

4. $3(3x - 2y = 15)$
$2(-4x + 3y = -20)$

Eliminate either "x" or "y"
LCM is "6"

1) $9x - 6y = 45$
$-8x + 6y = -40$

$9x+(-8x)-6y+(6y)=45+(-40)$
$x = 5$

sub

2) $3x - 2y = 15$
$3(5) - 2y = 15$
$15 - 2y = 15$ (-15 -15)
$\frac{-2y}{-2} = \frac{0}{-2}$
$y = 0$

3) $\therefore$ POI is $(5, 0)$

ANSWERS: 1. (-2, 5.5), 2. (4, 0.8), 3. (-3, -1), 4. (5, 0)