Solving Linear Systems by Substitution
(Replacement)

$$\begin{cases} ax + by = c & ① \\ dx + ey = f & ② \end{cases}$$

a, b, c, d, e, f are constants

Step 1: Pick a variable with the coefficient of the smallest magnitude (absolute value)

magnitude = absolute value = distance from the number to zero on a number line.

Symbolically, $|a|$

Example: $|3| = 3$, $|-5| = 5$

Ideally the coefficient is 1 or -1

Step 2: Solve for that variable in the eq-n where it has the coefficient of the least magnitude.

Step 3: Substitute expression for that variable in the other eq-n. Solve for var.

Step 4: solve for 2nd var.

Example 1:

$$\begin{cases} 2x + y = -4 & ① ✓ \\ 4x + 3y = -6 & ② \end{cases}$$

prime

From ①: $y = -2x - 4$. ①'

Sub into ②: $4x + 3(-2x - 4) = -6$

$4x - 6x - 12 = -6$

$-2x - 12 = -6$

$-2x = -6 + 12$

$-2x = 6$, $x = \frac{6}{-2} = -3$

Sub into ①': $y = -2(-3) - 4$

$y = 6 - 4$, $y = 2$

$\therefore$ POI: $(-3, 2)$

Example 2: **Solving by Comparison.**

↳ Particular case of substitution.

$$\begin{cases} y = m_1 x + b_1 \\ y = m_2 x + b_2 \end{cases}$$

$y = y$, $m_1 x + b_1 = m_2 x + b_2$

Solve for x...

$$\begin{cases} y = -2x + 3 & ① \\ y = 4x - 3 & ② \end{cases}$$

$y = y$.

$-2x + 3 = 4x - 3$

$4x + 2x = 3 + 3$, $6x = 6$, $x = 1$

Sub ①: $y = -2(1) + 3$

$y = -2 + 3$, $y = 1$

$\therefore$ POI: $(1, 1)$