Substitution

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

From ②: $x=2y-2$ ②'

Sub into ①:

$6(2y-2)+3y=-4$

$12y-12+3y=-4$

$15y=12-4,\quad 15y=8,\quad y=\frac{8}{15}$ ✓

Sub into ②': $x=2\left(\frac{8}{15}\right)-2$

$x=\frac{16}{15}-\frac{30}{15}=\frac{-14}{15}$

POI: $\left(-\frac{14}{15},\frac{8}{15}\right)$

$$\begin{cases} 2(x-4)+y=6 \\ 3x-2(y-3)=13 \end{cases} \qquad \begin{cases} 2x-8+y=6 \\ 3x-2y+6=13 \end{cases}$$

$$\begin{cases} 2x+y=14 & ① \\ 3x-2y=7 & ② \end{cases}$$

From ①: $y=-2x+14$ ①'

Sub into ②': $3x-2(-2x+14)=7$

$3x+4x-28=7$

$7x=35,\quad x=\frac{35}{7}=5$

$y=-2(5)+14,\quad y=-10+14$

$y=4$

POI: $(5,4)$

$$\begin{cases} 2(x-1)-3(y-3)=0 \\ 3(x+2)-(y-7)=0 \end{cases}$$

POI: $\left(-\frac{32}{7}, \frac{-5}{7}\right)$ ✓

Comparison:

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

$4x = 4x$

$4x = -y+1$

$4x = 2y+3$

$-y+1 = 2y+3$

$3y = 1-3$

$3y = -2, \quad y = -\frac{2}{3}$

Sub ①: $4x + \left(-\frac{2}{3}\right) = 1$

$4x = 1 + \frac{2}{3}, \quad 4x = \frac{3}{3} + \frac{2}{3}$

$4x = \frac{5}{3}$

$x = \frac{5}{12}$

POI: $\left(\frac{5}{12}, -\frac{2}{3}\right)$

Method of Elimination

$12x + (-12x) = 0$

↑ coefficient of the same magnitude (absolute value) different sign, we add

$7x - 7x = 0$

↑ ↑ same magnitude, same sign → subtract

Example: Solve

$$\begin{cases} 4x + 7y = 23 & ① \\ 6x - 5y = -12 & ② \end{cases}$$

Eliminate x

① $\times 3$: $12x + 21y = 69$ ①'

② $\times 2$: $12x - 10y = -24$ ②'

①' − ②': $0 + 31y = 93$

$y = \frac{93}{31} = 3$

Sub $y = 3$ into ①':

$4x + 7(3) = 23$

$4x + 21 = 23$

$4x = 23 - 21$

$4x = 2$

$x = \frac{2}{4} = \frac{1}{2}$

POI: $(\frac{1}{2}, 3)$

Step 1: Arrange in proper form

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

Step 2: Choose a variable to eliminate:

Step 3: Arrange for coefficients of same magnitude on variable chosen in both eq-ns.

Step 4: Add/Subract to eliminat a var.

Step 5: Solve for the remaining var

Step 6: Solve for the other var.

Step 7: Record: POI.