Solving by Substitution

Ex/ Determine the solution to $y = 4x + 1$
$y = -2x - 5$

$4x+1 = -2x-5$ (+2x, +2x)
$-1 \quad\quad -1$

$4x + 2x = -5 - 1$
$\frac{6x}{6} = \frac{-6}{6}$
$x = -1$

$y = 4x + 1$
$= 4(-1) + 1$
$= -3$

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

- When equations do not have the same letter isolated, we can use a different method to solve them.

Solving by Substitution
- Substitute one of the equations into the other one.

Ex/ Solve.

a) $x = 4$
$3x + 2y = 2$

Replace x with 4

$3(4) + 2y = 2$

multiply $\hookrightarrow$ $12 + 2y = 2$ (−12, −12)

$2y = 2 - 12$
$\frac{2y}{2} = \frac{-10}{2}$
$y = -5$

Numbers on one side, letters on other

We knew x already

$\therefore$ POI $(4, -5)$
$x \quad y$

b) $y = 3$
$6x - 2y = -12$

$6x - 2(3) = -12$
$6x - 6 = -12$ (+6, +6)
$6x = -12 + 6$
$\frac{6x}{6} = \frac{-6}{6}$
$x = -1$

POI $(-1, 3)$

c) $x = y + 1$
$2x + y = -4$

Replace x with $y+1$

$2(y+1) + y = -4$

multiply bracket out

$2y + 2 + y = -4$ (−2, −2)

collect

$3y = -4 - 2$
$\frac{3y}{3} = \frac{-6}{3}$
$y = -2$

$x = y + 1$
$= -2 + 1$
$x = -1$

POI $(-1, -2)$

d) $y = 3x - 2$
$2x + 4y = 6$

$2x + 4(3x - 2) = 6$
$2x + 12x - 8 = 6$
$14x = 6 + 8$
$\frac{14x}{14} = \frac{14}{14}$
$x = 1$

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

POI $(1, 1)$

e) $x = 2 + 3y$
$2x + y = 11$

$2(2+3y)+y=11$

$4+6y+y=11$

$7y = 11-4$

$\frac{7y}{7} = \frac{7}{7}$

$y = 1$

$x = 2+3y$
$= 2+3(1)$
$x = 5$

$\therefore$ POI $(5,1)$

f) $y = 2x + 1$
$3x - 2y = 13$

$3x-2(2x+1)=13$

$3x-4x-2=13$

$-1x = 13+2$

$-1x = 15$

$x = -15$

$y = 2x+1$
$= 2(-15)+1$
$= -29$

$\therefore$ POI $(-15,-29)$

Ex/ When two numbers are added, their total is 365. One of the numbers is larger than the other by 37. Determine the numbers.

$x + y = 365$
$y = x + 37$

$x + x + 37 = 365$

$2x = 365 - 37$

$\frac{2x}{2} = \frac{328}{2}$

$x = 164$

$y = x + 37$
$= 164 + 37$
$= 201$

$\therefore$ The numbers are 164 and 201

Practice: Handout - Solving by Substitution