Introduction to Substitution

(Used to Solve Linear Systems)

Substitution – is an algebraic technique used to determine the point of intersection of two lines.

Examples

Use substitution to determine the point of intersection for each pair of lines.

a) ① $y = 2x + 3$

② $y = 4x + 1$

Sub ② into ①

$(4x+1) = 2x+3$

$4x - 2x = 3 - 1$

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

③ $x = 1$

Sub ③ into ①

$y = 2(1) + 3$

$y = 2 + 3$

$y = 5$

The P.O.I. is $(1, 5)$

b) ① $C = 5n + 250$

② $C = 10n$

Sub ② into ①

$(10n) = 5n + 250$

$10n - 5n = 250$

$\frac{5n}{5} = \frac{250}{5}$

③ $n = 50$

Sub ③ into ②

$C = 10(50)$

$C = 500$

The P.O.I. is $(50, 500)$ (n, C)

c) ① $2x + y = 1$

② $x = 2y + 8$

Sub ② into ①

$2(2y+8) + y = 1$

$4y + 16 + y = 1$

$5y = 1 - 16$

$\frac{5y}{5} = \frac{-15}{5}$

③ $y = -3$

Sub ③ into ②

$x = 2(-3) + 8$

$x = -6 + 8$

$x = 2$

The P.O.I. is $(2, -3)$ (x, y)

d) ① $5x + 2y = 9$

② $3x + y = 5$

Isolate y in ②

③ $y = (5 - 3x)$ new ②

Sub ③ into ①

$5x + 2(5 - 3x) = 9$

$5x + 10 - 6x = 9$

$-1x + 10 = 9$

$-1x = 9 - 10$

$\frac{-1x}{-1} = \frac{-1}{-1}$

④ $x = 1$

Sub ④ into ③

$y = 5 - 3(1)$

$y = 2$

The P.O.I. is $(1, 2)$

Practice – Using Substitution to Solve Linear Systems

For each pair of equations below, use substitution to determine the point of intersection. Verify your answers using DESMOS.

a) $y = 2x - 11$
$y = -3x + 4$

b) $y = 3x + 7$
$y = x + 3$

c) $x = y + 3$
$2x + 3y = 16$

d) $3x + 2y = 1$
$y = x - 7$

e) $2x + y = 5$
$3x - 5y = 14$

f) $3x - 2y = -4$
$x + 2y = 12$

Answers: a) (3, -5) b) (-2, 1) c) (5, 2) d) (3, -4) e) (3, -1) f) (2, 5)