LINEAR SIMULTANEOUS EQUATIONS

Example 1 — Self Tutor

Solve simultaneously by substitution: $y = x + 5$, $3x - y = 1$

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

Since $y = x + 5$, $3x - (x + 5) = 1$
$\therefore\ 3x - x - 5 = 1$
$\therefore\ 2x = 6$
$\therefore\ x = 3$

When $x = 3$, $y = 3 + 5$ (substituting $x = 3$ into (1))
$\therefore\ y = 8$

The solution is $x = 3$, $y = 8$.

Check: (1) $8 = 3 + 5$ ✓
(2) $3(3) - 8 = 9 - 8 = 1$ ✓

Notice that $(x + 5)$ is substituted for y in the other equation.

Example 2 — Self Tutor

Solve simultaneously by substitution: $-2y + x = 5$, $x = 7 + 3y$

$-2y + x = 5$ .....(1)
$x = 7 + 3y$ .....(2)

Substituting (2) into (1) gives

$-2y + (7 + 3y) = 5$
$\therefore\ -2y + 7 + 3y = 5$
$\therefore\ y + 7 = 5$
$\therefore\ y = -2$

Substituting $y = -2$ into (2) gives
$x = 7 + 3(-2) = 1$.

The solution is $x = 1$, $y = -2$.

Check: (1) $-2(-2) + 1 = 4 + 1 = 5$ ✓
(2) $7 + 3(-2) = 7 - 6 = 1$ ✓

There are infinitely many points (x, y) which satisfy the first equation. Likewise there are infinitely many which satisfy the second. However, only one point satisfies both equations at the same time.

1 Solve simultaneously:

a $x = 8 - 2y$
$2x + 3y = 13$

b $y = 4 + x$
$5x - 3y = 0$

c $x = -10 - 2y$
$3y - 2x = -22$

d $x = -1 + 2y$
$x = 9 - 2y$

e $3x - 2y = 8$
$x = 3y + 12$

f $x + 2y = 8$
$y = 7 - 2x$

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2 Solve simultaneously:

a $x = -1 - 2y$
$2x - 3y = 12$

b $y = 3 - 2x$
$y = 3x + 1$

c $x = 3y - 9$
$5x + 2y = 23$

d $y = 5x$
$7x - 2y = 3$

e $x = -2 - 3y$
$3x - 2y = -17$

f $3x - 5y = 26$
$y = 4x - 12$

3 **a** Try to solve by substitution: $y = 3x + 1$ and $y = 3x + 4$.

b What is the simultaneous solution for the equations in **a**?

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