

## Solving Simultaneous Equations by Substitution

A pair of linear simultaneous equations<sup>1</sup> have the form:

$$a_{11}x + a_{12}y = b_1 \quad (1)$$

$$a_{21}x + a_{22}y = b_2 \quad (2)$$

where  $a_{11}$ ,  $a_{12}$ ,  $a_{21}$ , and  $a_{22}$  are constant coefficients and  $b_1$  and  $b_2$  are constants. The task is to find the values of  $x$  and  $y$ .

In solving by substitution we make either  $x$  or  $y$  the subject of one of the equations then substitute the resulting expression for  $x$  or  $y$  into the other equation. The existing unknown can then be found. Once found, the other unknown can also be found through the substitution of the known value into one of the original equations.

### Example

Solve the simultaneous equations by elimination

$$2x + y = 7 \quad (1)$$

$$3x + 2y = 12 \quad (2)$$

Answer

Making  $y$  the subject of equation (1) gives

$$y = 7 - 2x.$$

Substituting this into equation (2) gives

$$3x + 2(7 - 2x) = 12.$$

Hence

$$3x + 14 - 4x = 12$$

$$14 - x = 12$$

$$x = 2.$$

Substituting this back into equation (1) gives:

$$2 \times 2 + y = 7,$$

hence  $y = 3$ .

The complete solution is  $x = 2, y = 3$ .

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<sup>1</sup> Solving a pair of simultaneous linear equations