Solving Simultaneous Equations by Elimination

A pair of linear simultaneous equations[1] have the form:

$$a_{11}x + a_{12}y = b_1 \qquad (1)$$
$$a_{21}x + a_{22}y = b_2 \qquad (2)$$

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 elimination we multiply either equation (1) or equation 2 (or both) through by a constant so that either the coefficient of x or y are equal (though their sign may or may not be the same). Through subtracting or adding the two equations one of the unknowns is then *eliminated*. The existing unknown can then be found. Once found, it 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 be elimination

$$2x + y = 7 \qquad (1)$$
$$3x + 2y = 12 \qquad (2)$$

Answer 1

Doubling the coefficients in equation (1) results in y having the same coefficient in both equations:

$$4x + 2y = 14 \qquad (1a)$$
$$3x + 2y = 12 \qquad (2)$$

Subtracting equation (2) from equation (1a) gives:

$$x = 2 .$$

Substituting this back into equation (1) gives:

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

hence $y = 3$.

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

[1] Solving a pair of simultaneous linear equations