First method: substitution One way to solve two simultaneous equations involving two unknowns, x and y, is to solve one of the equations for one of the unknown values in terms of the other unknown value. In other words, either solve one equation for x in terms of y or solve one equation for y in terms of x. Once you have an expression for either x or y, substitute this expression into the other original equation. At this point, the equation has only one unknown quantity. This unknown can be found through algebraic manipulations and then can be used to determine the other unknown.

Example

Solve the following two simultaneous equations:

1. $5x + y = -8$
2. $2x - 2y = 4$

Solution

First solve for either x or y in one of the equations. We'll begin by solving equation 2 for x.

2. $2x - 2y = 4$
$2x = 4 + 2y$
$$x = \frac{4 + 2y}{2} = 2 + y$$

Next, we substitute this equation for x into equation 1 and solve for y.

1. $5x + y = -8$
$5(2 + y) + y = -8$
$10 + 5y + y = -8$
$6y = -18$

$$\boxed{y = -3}$$

To find x, substitute this value for y into the equation for x derived from equation 2.

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

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

There is always more than one way to solve simultaneous equations by substitution. In this example, we first solved equation 2 for x. However, we could have begun by solving equation 2 for y or equation 1 for x or y. Any of these processes would result in the same answer.