One method to solve systems of linear equations is the method of reduction, which consists in simplifying the system using arithmetic operations between the equations.

$$\left.\begin{array}{r} x+y=2 \\ -x+y=-4 \end{array}\right\}$$

If we add both equations together, x disappears. We can express this like follows:

$$\begin{array}{r} -x+y=-4 \\ +\underline{\ \ x\ +y=\ 2} \\ 0\ +2y=2 \end{array}$$

The resulting equation is equivalent to the second one, so we can use it instead of the one we had in the initial system:

$$\left.\begin{array}{r} x+y=2 \\ 2y=-2 \end{array}\right\}$$

From this second equation we can obtain a value for y straight away:

$$2y=-2 \Rightarrow y=-\frac{2}{2}=-1$$

With this value we can use the first equation to obtain the value for x:

$$x+y=2 \Rightarrow x-1=2 \Rightarrow x=2+1=3$$

So that the solution to the system is $x=3, y=-1$.

Again, if we want to verify that this is indeed a solution we only have to put the obtained values back into the original system and check if the identities are satisfied.

Sometimes it will be necessary to multiply or to divide the whole equation by a certain number in order to make one of the variables disappear.

$$\left.\begin{array}{r} \frac{x}{2}+4y=\frac{3}{2} \\ -x-y=-4 \end{array}\right\}$$

We can multiply the second equation by 4 and add it to the first one, so we would eliminate y, or alternatively we can divide the first equation by 2 and then add it to the second one. We better use this second option since this way denominators disappear:

$$\left[\frac{x}{2}+4y=\frac{3}{2}\right]\cdot 2 \Rightarrow x+8y=3$$

This equation is equivalent to the first one, so we obtain a new and equivalent system:

$$\left.\begin{array}{r} x+8y=3 \\ -x-y=-4 \end{array}\right\}$$

The sum of both equations allows us to know the value of y straight away:

$$\begin{array}{r} x\ +8y=3 \\ +\underline{-x-y=-4} \\ 0\ +7y=-1 \end{array} \Rightarrow y=-\frac{1}{7}$$

Now it is possible to replace this value in the first equation to find x:

$$x=3-8y \Rightarrow x=3-8\cdot\left(-\frac{1}{7}\right) \Rightarrow x=\frac{21+8}{7}=\frac{29}{7}$$

Then, the solution to the system is $x=\frac{29}{7}, y=-\frac{1}{7}$.

Reminder:

The method of reduction or elimination consists in performing arithmetical operations between equations to obtain equivalent equations with less unknowns, easier to isolate and to calculate. It is necessary to remember that if all terms of an equation are added, subtracted, multiplied or divided with the same number (other than 0), then we obtain an equivalent equation.