The equation:

$$x-2=3$$

has the solution:

$$x=3+2\Rightarrow x=5$$

While in this second equation:

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

the solution is:

$$3x-2x=2+3\Rightarrow x=5$$

When two equations have the same solution it is said that they are equivalent equations.

There are a couple of basic rules to generate equivalent equations:

1. When we add or subtract the same number on both members of an equation an equivalent equation is obtained.

In the first example, if we add 3 on both sides of the equality, we obtain:

$$x-2+3=3+3\Rightarrow x+1=6$$

This equation is completely equivalent to the first one. It is possible to verify it by checking that they have the same result:

$$x+1=6\Rightarrow x=6-1\Rightarrow x=5$$

1. If we multiply or divide both members of the equation by the same number, an equivalent equation is obtained.

For instance, if we multiply both sides of the first equation by 2, we obtain:

$$2(x-2)=2(3)\Rightarrow 2x-4=6$$

The obtained equation is equivalent to the first one. It is verified by solving it:

$$2x=6+4\rightarrow 2x=10\Rightarrow x=\frac{10}{2}=5$$

The latter point is interesting in order to eliminate denominators of the equations, so they are simplified, thereby making them easier to solve.

In the following equation:

$$-5-\frac{x}{3}=11$$

If we multiply by 3, the denominator is eliminated:

$$3\left(-5-\frac{x}{3}=11\right)\Rightarrow -15-x=33$$

This second equation is equivalent to the first one and it is very easy to solve:

$$-x=33+15\Rightarrow -x=48\Rightarrow x=-48$$

A certain agility to generate equivalent equations is useful when creating exercices. The starting point for raising an equation is to know its result in advance.

For instance, if we want $x=2$, the following equation is a possibility:

$$2x-5=-1$$

Since if we replace the result the equality is supported:

$$2\cdot 2-5=-1\Rightarrow 4-5=-1\Rightarrow -1=-1$$

Now we can generate an equivalent equation to make the equation seem more complicated. For example, we can write -5 as the expression $-3-2$ and move their position:

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

We can also break down the unknown. For example: we can express $2x$ as $5x-3x$, but moving $-3x$ to the other side of the equality, with its change in the sign:

$$-3+5x-2=-1+3x$$

Now, operating the first member, we get:

$$5x-5=3x-1$$

In this case it is possible to extract common factor for the first member (5), so we can introduce brackets:

$$5(x-1)=3x-1$$

Finally, we can multiply the whole equation by the same number, for example 2:

$$2\cdot[5\cdot(x-1)=3x-1]\Rightarrow 10\cdot(x-1)=6x-2$$