

Let's begin with a few particular cases:

We have to transport 5 office chairs (that weigh 10 kg each one) and three tables (weighing 20 kg each). We have a truck that can transport 1000 kg. Obviously, since it is satisfied that the total weight of chairs plus the weight of the tables ($5 \cdot 10 \text{ kg} + 3 \cdot 20 \text{ kg} = 110 \text{ kg}$) is lower than the weight that the truck can transport, it will be possible to do it all in one trip. It is possible to express this mathematically, affirming that the following inequality is satisfied:

$$5 \cdot 10 \text{ kg} + 3 \cdot 20 \text{ kg} < 1000 \text{ kg}$$

Now we have to transport twenty 10 kg chairs and 40 tables of 20 kg each. This time we have to see if it is satisfied that the total weight of tables plus chairs is lower than or equal to the weight that the truck can transport

$$20 \cdot 10 \text{ kg} + 40 \cdot 20 \text{ kg} = 1000 \text{ kg}$$

So we will be able to transport everything in just one trip.

Then if we have an indeterminate number x of 10 kg chairs and a number of tables which is also indeterminate y , we will know that the weight limit that the truck can take in only one trip is:

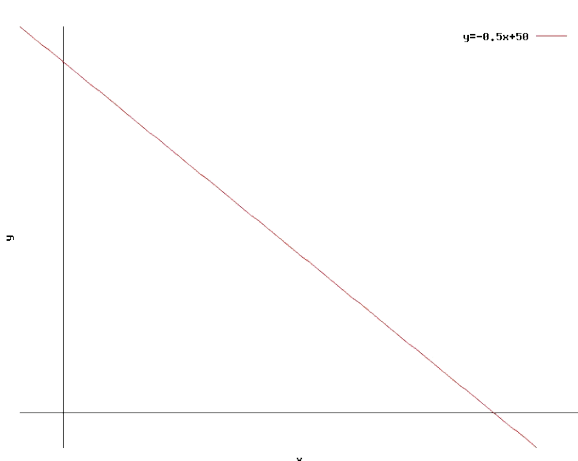
$$x \cdot 10 \text{ kg} + y \cdot 20 \text{ kg} \leq 1000 \text{ kg}$$

This last expression is what is known as a linear inequation (\leq) of two variables (x and y). Linear means that the inequation depends only on a linear combination of x and y (no higher power of the variables appears). It is read: the weight of the chairs ($x \cdot 10 \text{ kg}$) plus the weight of the tables ($y \cdot 20 \text{ kg}$) is equal to or lower than the weight that the truck can transport (1000 kg).

It is interesting to determine what set of points (x,y) satisfy the inequation. To know this, it is possible to draw the inequation in the plane XY . It is necessary to isolate y in the inequation:

$$y \leq -0.5x + 50$$

Taking strictly the equality sign ($=$) we have the equation of a straight line of slope $-10 \text{ kg} / 20 \text{ kg} = -0.5$ and ordinate at the origin (that is to say, the point where it crosses the axis y) $1000 \text{ kg} / 20 \text{ kg} = 50$.



This straight line separates the points where the inequation is satisfied (the validity regionity) from the points where it is not satisfied. To recognise which side each one is we have to try some point in the inequation to see if it is satisfied or not. For example, it is possible to try with the point $(x=0,y=55)$. The inequation at this point is:

$$0 \cdot 10 \text{ kg} + 55 \cdot 20 \text{ kg} \not\leq 1000 \text{ kg}$$