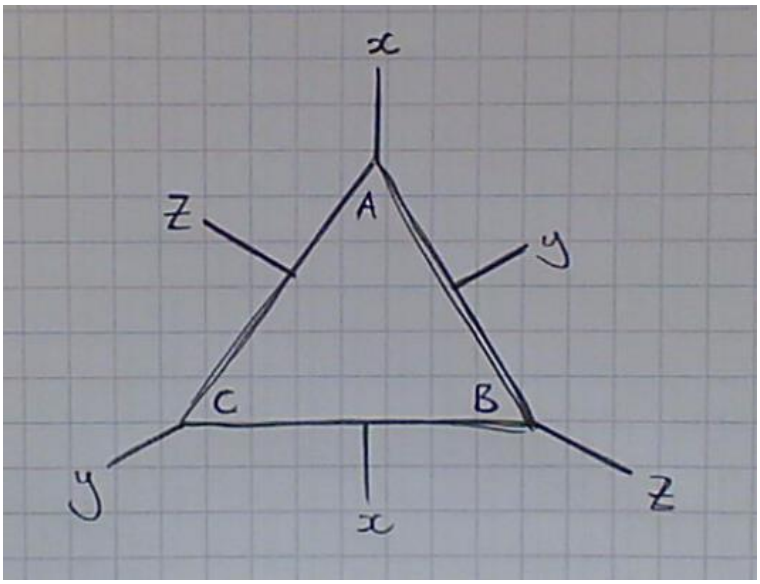
Symmetry Groups

An equilateral triangle can be transformed in 6 ways such that it looks the same (aside from the labels on the corners). These transformations are:

I – don't move it. The identity transformation
R – rotate 120° clockwise
L – rotate 120° anticlockwise
X – Reflect in the line x-x
Y – reflect in the line y-y
Z – reflect in the line z-z



Because there are the only 6 possible transformations, it stands to reason that any combination of these will result in the same orientation as one of these.

Copy and complete (or print and complete if you prefer) the cayley table below showing the outcomes of these combinations of transformations. Use your finely crafted equilateral triangle to help you.

		Second Transformation					
First Transformation		I	R	L	X	Y	Z
	I						
	R						
	L						
	X						
	Y						
	Z						

- Is this a group? Check the group axioms.
- Is this operation commutative?
- What is the period of each element?

This specific type of group is called a **Symmetry Group** as it is formed from the rotational and mirror symmetries of a regular shape and is written as D_3. In general a symmetry group D_n has 2n elements.

Task:

Draw the Cayley Table for symmetry group D_4.