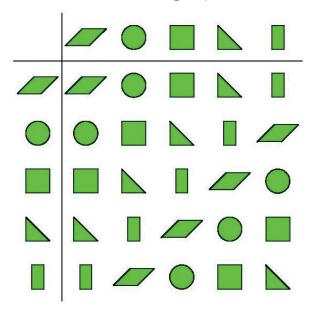
3. Algebraic Structures / Expressions

MATERIALS NEEDED: 11 or more of each shape per group

The aim of this activity is to develop the ability to pick relevant elements and to recognise recurring patterns in a group of objects. We are going to define 'operations' on our group of five kinds of shapes, and will build a variety of algebraic structures. Based on the characteristics of said structures, we will ask pupils to complete a given sequence of objects or to choose a structure, which will enable us to solve a certain problem. The advantage of employing our shapes, hence of working with concrete finite groups of objects, is that we can define operations in such a manner that makes certain features 'visible', and highlight's the difference amongst the various algebraic structures.

Let us define following operations:



O.1
With this operation, our set of 5 shapes constitutes an abelian group* (also called a commutative group*), with the rhombus as the neutral element.

*A group in which the result of applying the group operation to two group elements does not depend on their order (the axiom of commutativity).

- O.2
 With this operation, our set of 5 shapes constitutes a commutative monoid*, with the rhombus as the neutral element.
- *A monoid is an algebraic structure with a single associative binary operation and an identity element. A monoid whose operation is commutative is called a commutative monoid (or, less commonly, an abelian monoid). Commutative monoids are often written additively.

