Group Theory using Rubik's cube

Sheet 3

Here are the explorations following session 3

1. Enumerate the symmetries of an octahedron. An octahedron is a shape with 8 triangular faces, formed by joining two square pyramids at the base.

2. We have seen that all 24 symmetries of a cube can be obtained by rotation around an axis. Can all 12 symmetries of a tetrahedron also be obtained by rotations? If so, how?

3. Show that $(\boldsymbol{Z}_5,\ +)$ is a group.
4. Show that $(\boldsymbol{Z}_5 - \{0\},\ \times)$ is a group.
5. Show that $(\boldsymbol{Z}_{17} - \{0\},\ \times)$ is a group.
6. Show that $(\boldsymbol{Z}_{12} - \{0\},\ \times)$ is not a group.
7. Can you find for what values of n, will the set $(\boldsymbol{Z}_n - \{0\},\ \times)$ be a group?

8. Observe the move URU'R'U'F'UF. (U' denotes inverse of U). Find its order and cycle decomposition.