

§12 Rosettes

The goal for this part is to identify and classify rosette patterns.

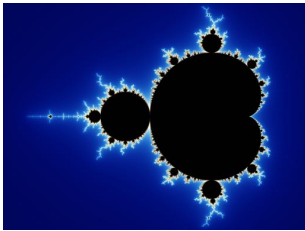
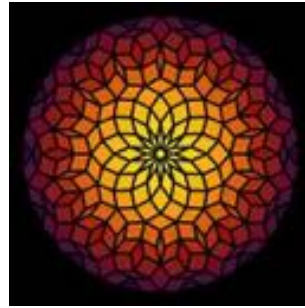
Reference:

- *Symmetries of Things*, pp. 7 - 13

Supplies:

- Paper and scissors and tape for snowflakes
- Ambigram sheet

For each picture, decide if it goes in the left pile or the right.



A *rosette pattern* is a pattern that has either of the following types of symmetry:

Cyclic Symmetry: rotation symmetry around a center point, but no mirror lines



Dihedral Symmetry: rotation symmetry around a center point with mirror lines through the center point.



C_n means that the smallest angle of rotation that preserves the figure has _____ degrees. This rotation has order _____ .

Example:



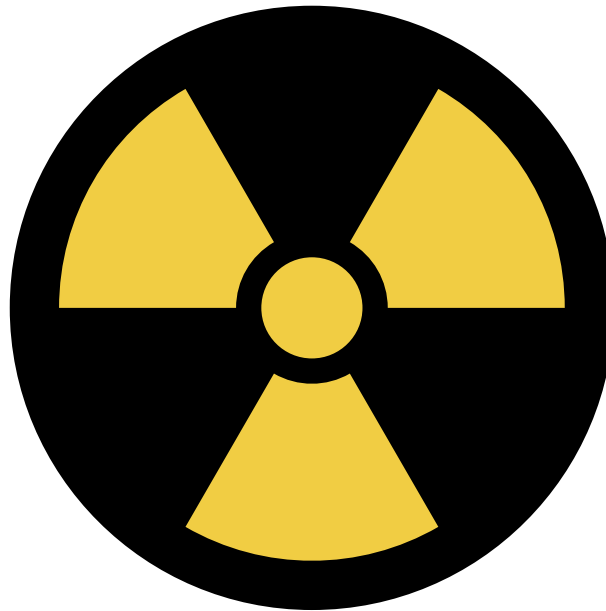
D_n means that there are _____ mirrors meeting at the center, and the (largest) order of rotation is _____ .

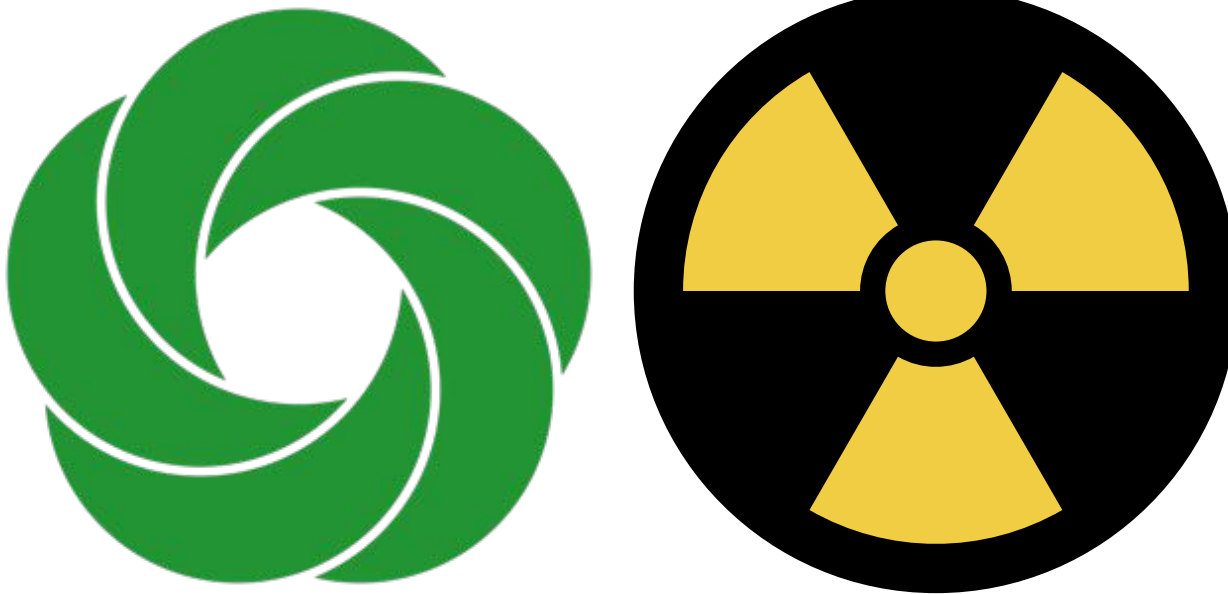
Example:



When trying to figure out n , count the "number of petals".

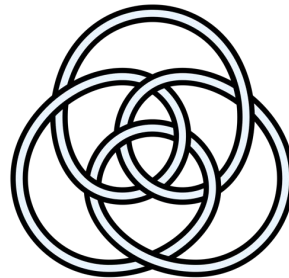
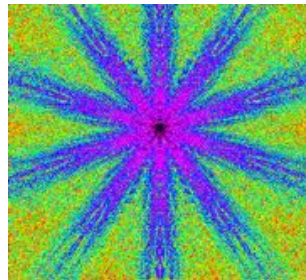
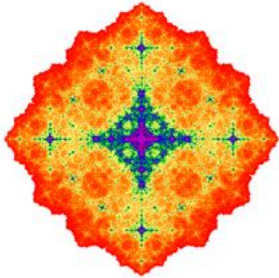
In *The Symmetries of Things*, John Conway et al. use the notation $n\cdot$ for C_n and $*n\cdot$ for D_n .



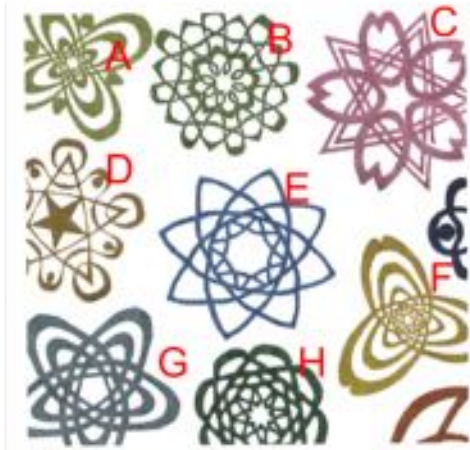


- For a figure with C_5 symmetry, how many distinct isometries preserve the figure? Include the "do nothing" isometry, also called the identity isometry.
- For a figure with D_3 symmetry,
 - How many distinct rotations preserve the figure? (Include do nothing as a 0° rotation.)
 - How many distinct reflections preserve the figure?
 - In total, how many distinct isometries preserve the figure?

Classify these figures.



1. Read Chapter 1 of *The Symmetries of Things*. (pages 7 - 12)
2. Identify the signatures for the snowflakes picture on page 8. Don't worry about small partial snowflakes, just do the ones labelled A - H on the version below.



3. Identify the signatures for the hubcaps picture on page 9. Don't worry about small partial hubcaps, just do the ones labelled A - E.



4. Group the letters of the alphabet according to their symmetry types using C_n , D_n notation: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Ambigrams

Each design on this page is really half of a word. Can you figure out what each design says? To read a design, take two copies of this page, place one copy on top of the other, and slide them around until the two copies of the design meet. Hold the papers up to a light so you can see through both sheets. You may have to rotate or flip over one of the pages. For instance, the second design makes the word "mirror". (Scott Kim, 2000)

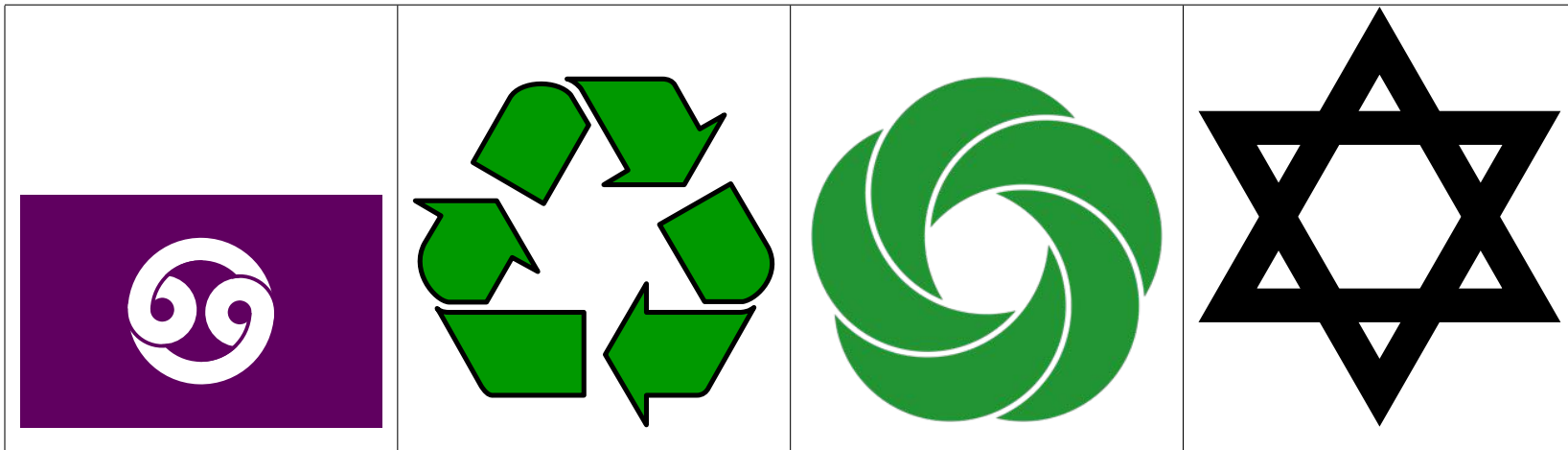


Draw your name as an ambigram.

Fundamental domains

A *fundamental domain* for a symmetry pattern is a piece (of the smallest possible area) that can be repeated by isometries to generate the entire pattern.

Find a fundamental domain for each of the patterns below.



Is it possible for a finite figure to have two different fundamental domains that have different shapes? If so, give an example. If not, explain why not.