

Part XIII

Wallpaper Patterns

The goal for this part is to identify wallpaper patterns.

What are wallpaper patterns?

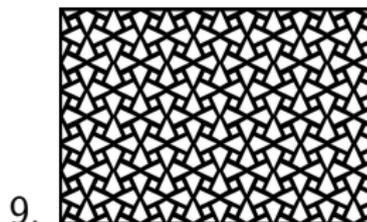
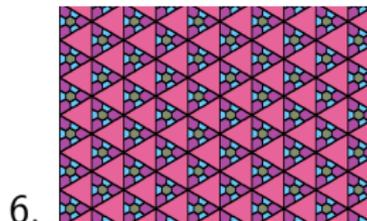
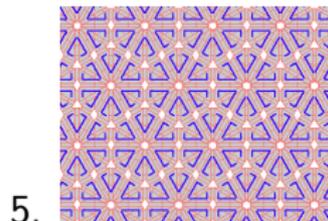
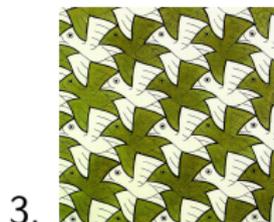
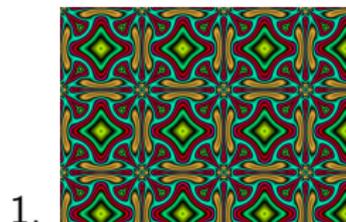
A wallpaper pattern is a pattern with translation symmetry in *two or more* non-parallel directions.



Like frieze patterns, wallpaper patterns can contain other types of symmetry, including rotation, reflection, and glide symmetry.

What symmetries do you see in this pattern?

Wallpaper Examples



Symmetries in wallpaper patterns

For each of the patterns, mark the following features:

- ▶ rotocenters: mark with a dot and write the order of rotation
- ▶ mirror lines: mark with a solid line
- ▶ glide reflections that are not also mirror lines: mark with a dotted line

Hint: to find glide reflections, look for two mirror images of a motif that you can join with a path that does not cross a mirror line

Also, outline a smallest fundamental domain.

We'll say that a roto-center that does not include any mirror symmetry is a *gyration point*, and a roto-center that does include mirror symmetry is a *mirror point* (also called a *kaleidoscope point*).

Orbifold notation

To find a pattern's *signature* in orbifold notation

- ▶ write the numbers for the orders of all distinct gyration points first, in descending order
- ▶ then write * if there are any mirror lines
- ▶ then list the numbers for the orders of all distinct mirror points after the star.
- ▶ write down an x for each distinct glide reflection
- ▶ if there are non-intersecting mirror lines, write down * for each distinct mirror line (but if there are intersecting mirror lines, then only use a single * as described above)
- ▶ if there are no symmetries except for translation, then write down \circ

Homework

1. Read Chapter 2 of The Symmetries of Things and start reading Chapter 3.
2. Find the orbifold signature of these 6 Escher wallpaper patterns.

