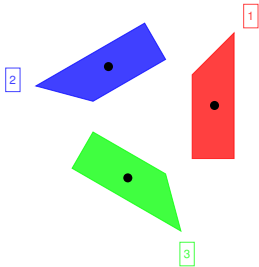


What are...the seventeen wallpaper groups?

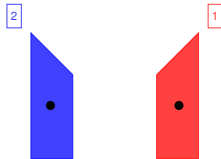
Or: Mathematics, architecture and decorative art

Rule1: Use these four operations

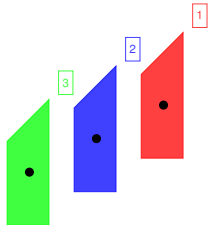
Operation 1: Rotation



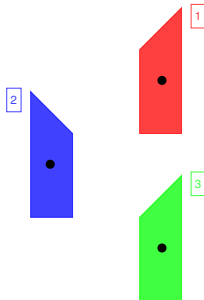
Operation 2: Reflection



Operation 3: Translation

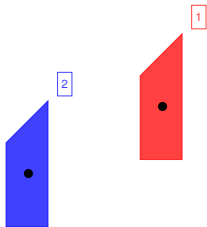


Operation 4: Glide reflection

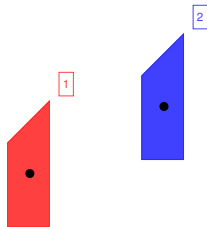


Rule2: Include undos and compositions

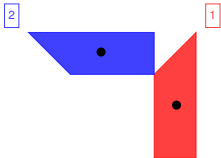
Operation A



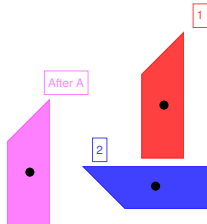
Operation undo(A)



Operation B

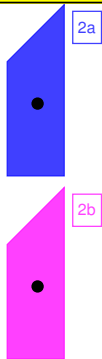


Operation First A then B

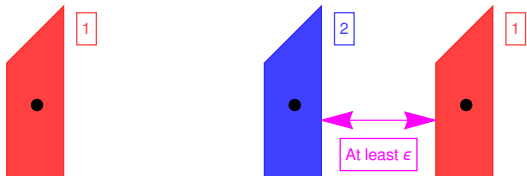


Rule3: Be discrete, please!

Want 1: Two different translations



Want 2: Not too small translations

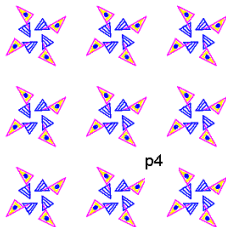
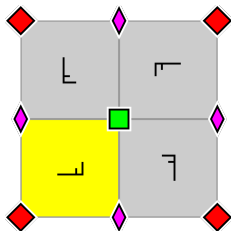
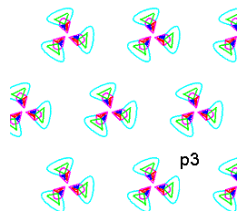
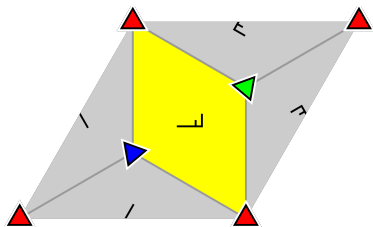


In other words, we want two linearly independent translation directions, and a minimal $\epsilon > 0$ for translations

Enter, the theorem!

A wallpaper group is a plane symmetry group. There are **exactly 17** such groups (up to the reasonable notion of equivalence)

Two examples (p3 and p4)



The Alhambra



Around 14 of the 17 wallpaper groups are present in the Alhambra (constructed in 889 CE) – predating their mathematical construction by hundreds of years

Thank you for your attention!

I hope that was of some help.