

## MATH 1300, Mathematical Explorations

# Frieze Patterns

One 75-minute classes

### Activity

- Have students do exercises 47-53 in [Dance](#) (identify all the symmetries in the seven frieze patterns as illustrated by footsteps).
- Make sure class is clear about what the symmetries are: T = horizontal translation, R = 180 degree rotation, V = Reflection through a vertical mirror, H= Reflection through a horizontal mirror, G= glide reflection (a composition of a horizontal reflection and a translation)
- Have the class act out the footstep patterns. (Remind students that the line goes through the feet in spinning sidle, so it has G as a symmetry.) Have the class, in tables, act out a dance (or an audition for Monty Python's Ministry of Silly Walks), in a repeating pattern along a line. Then have them notate it in footsteps on the board. Then identify the symmetries. Share the results.
- Ask them to start discussing the HW assignment: why are there only 7 Frieze patters? That is, why does every frieze pattern exhibit one of the following sets of symmetries: T, TR, TV, TRVG, THG, TG, THRVG?
- Finish with some remarks about the activity of classification in mathematics.

### Assignments

This assignment refers to the handout distributed in class. It is from Chapter 2 of the book *Dance* by the Art of Mathematics group, which can be downloaded from:

<https://www.artofmathematics.org/books/dance>.

In class (and in Figure 2.12 in the handout) we saw frieze patterns exhibiting seven different sets of symmetries: T, TR, TV, TRVG, THG, TG, THRVG, where T denotes a translation, R a 180° rotation, V a reflection through an axis perpendicular to the frieze, H a reflection through an axis parallel to the frieze, and G a glide reflection.

- 1-8. For each of the examples of frieze patterns (see [FriezePatternPictures](#) pdf), list the symmetries it exhibits. Each answer should be one of the seven different possibilities listed above.

9. In your journals explain why there are only seven types of frieze pattern. That is, why does every possible frieze pattern exhibit one of the seven sets of symmetries?

### **References and resources**

[Art of Mathematics: Dance](#)

PDF of Geometry book section 7.6: Frieze Patterns

[Challenge Skills and Applications for section 7.6: Frieze Patterns](#)

### **Follow-on activities**

Symmetries and Dance