MA111: Contemporary mathematics

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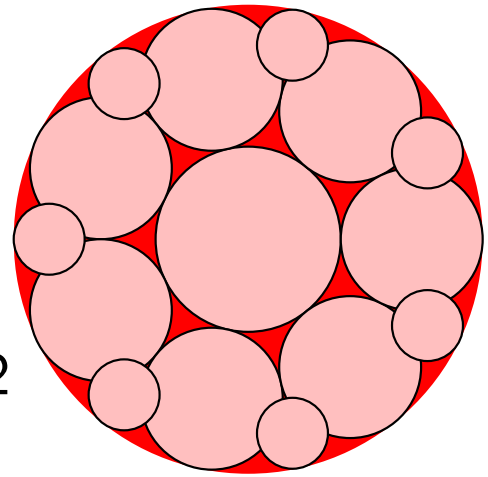


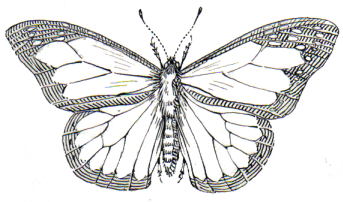
Entrance Slip (due 5 min past the hour):

- How many lines of symmetry does this have?
- Draw a simple version of it, and include the lines of symmetry.

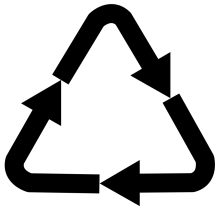
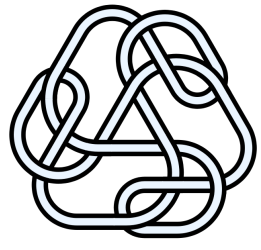
Today: Rosette groups

Context: How many different ways can a pattern repeat?

- We are interested in two kinds of repeats:
- **Reflection** - make the left half and the right half mirror images

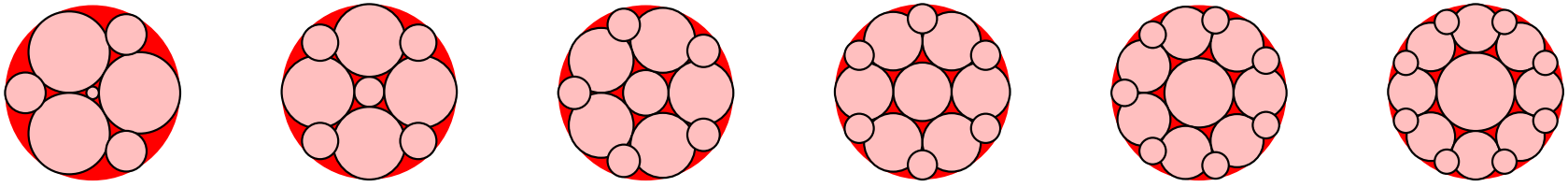


- **Rotation** - copy the picture around a circle

Activity: Putting them together

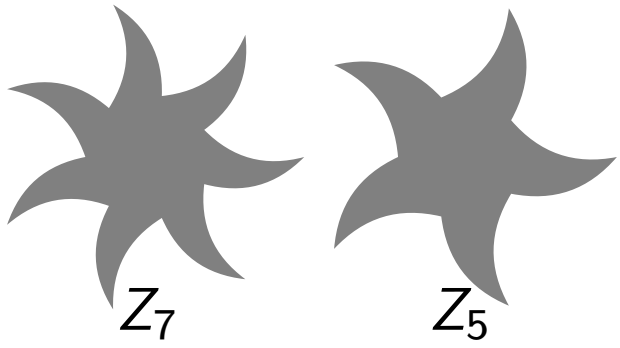
- Find the symmetry group (Z_n or D_n; what number is n?) of pictures



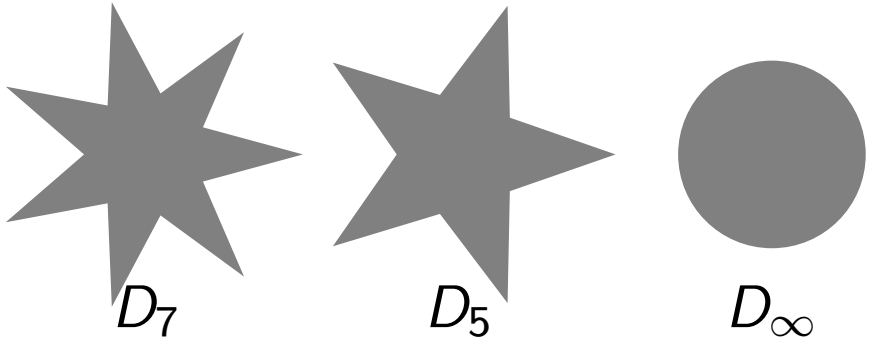
- How many lines of reflection does each picture have?
- How many times can you rotate it around the center?
- Draw a picture that has exactly two lines of reflection. How many times can it be rotated?
- Draw an item that has exactly three lines of reflection. Can you draw one with no rotations?

Fast: Rosette groups

- Every 2D picture has a symmetry group
- We are interested in pictures that fit on a page
  (so do not go one forever in any direction)
- In that case, the only possible symmetry groups are:
- Z_n (n-swirl) for $n = 1, 2, 3, \ldots$ like



- D_n (n-star) for $n = 1, 2, 3, \ldots, \infty$ like



Fast: Elements of symmetry

- Z_n has a rotation element of order n

  Rotation around the center, n times around

- D_n has a rotation element of order n

  and n lines of reflection.

- Rotation number and reflection number always match in D_n

- Z_n has no reflections.

Assignment and exit slip

- Skim chapter 11. Read 11.1, 11.2, 11.3, 11.6.
- Practice drawing feet. Friday is art class.
- **Exit slip:** Draw a (cool) shape with D_3 (3-star) symmetry