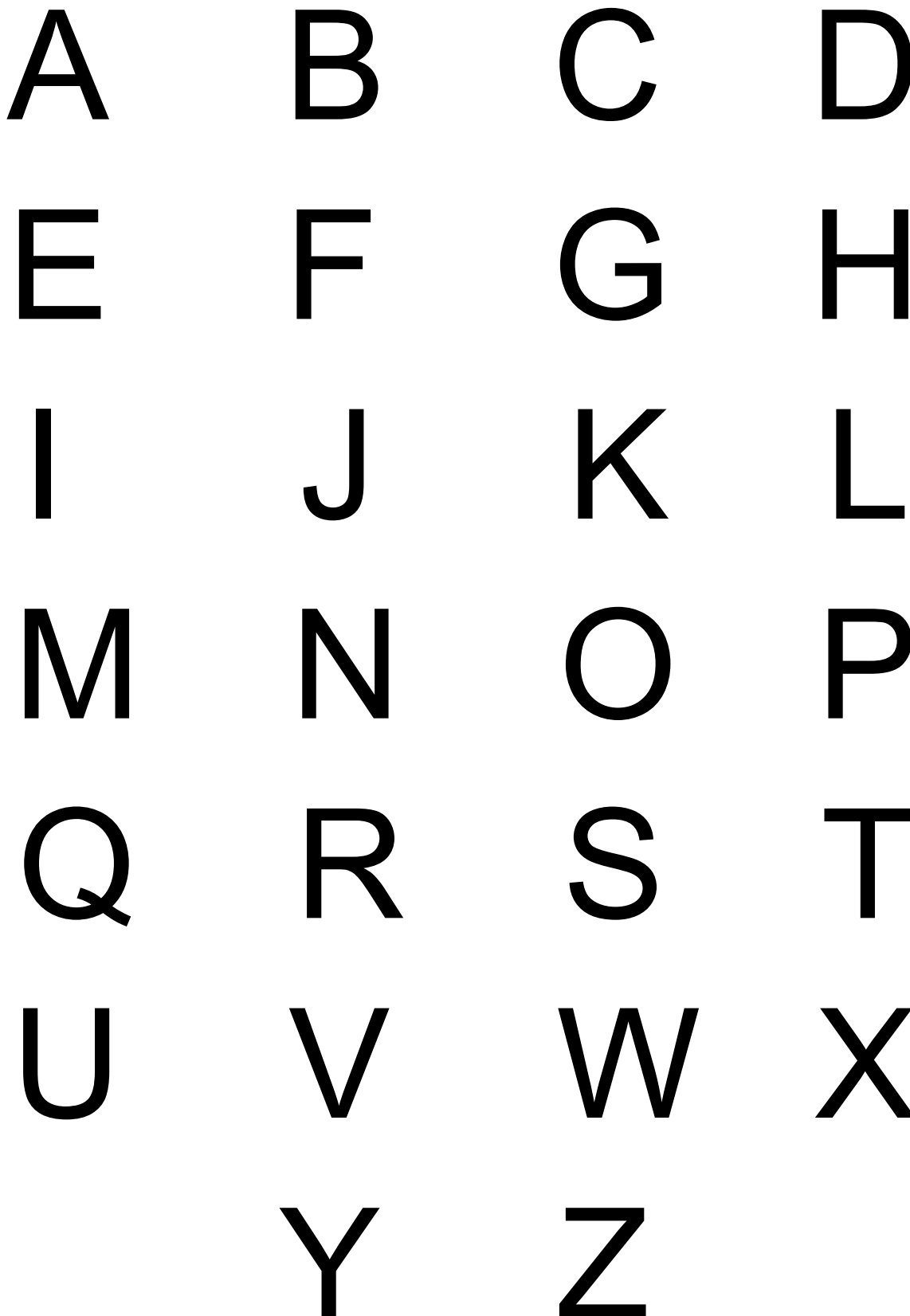


## Symmetry Handouts

I created this packet to accompany the lesson plans in the symmetry unit which can be found at [www.MathEducation.page/symmetry](http://www.MathEducation.page/symmetry). However the activities in here can be carried out independently of the unit. If you don't want to read the lesson plans cover to cover, you can start by looking at the handouts in this packet, and use this list to find the relevant lessons when needed — those include lists of materials and suggested sequencing and organization.

	<b>Packet</b>	<b>Lessons</b>
<b>Recognizing Symmetries</b> .....	pp. 1-4	pp. 4-6
<b>Mirror Puzzles</b> .....	pp. 5-11	pp. 8-9
Note that the “ $\Delta$ ” set is more challenging than the “ $\varepsilon$ ” set.		
<b>Pentomino Puzzles</b> .....	pp. 12-16	pp. 10-11
<b>Snowflakes</b> .....	pp. 17-18	pp. 12-13
<b>Pattern Block Puzzles</b> .....	p. 19	pp. 14-15
<b>Friezes</b> .....	pp. 20-24	pp. 18-20
<b>Tiling</b> .....	pp. 12, 25	pp. 23-25
<b>Wallpapers</b> .....	pp. 26-30	pp. 26-27



Print on transparencies. Cut to separate the letters. Put each set in an envelope.

# Alphabet

Write all the capital letters in the right place.

A

Z

Mirror symmetry only

Turn symmetry only

Both kinds of symmetry

No symmetry

X

R

## Recognizing Symmetries

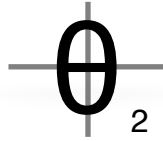
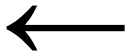
If a figure has mirror symmetry, draw the line of symmetry.

If it has more than one line of symmetry, draw them all.

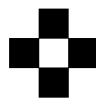
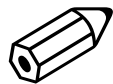
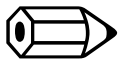
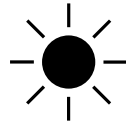
Next to each figure, write its turn symmetry number.

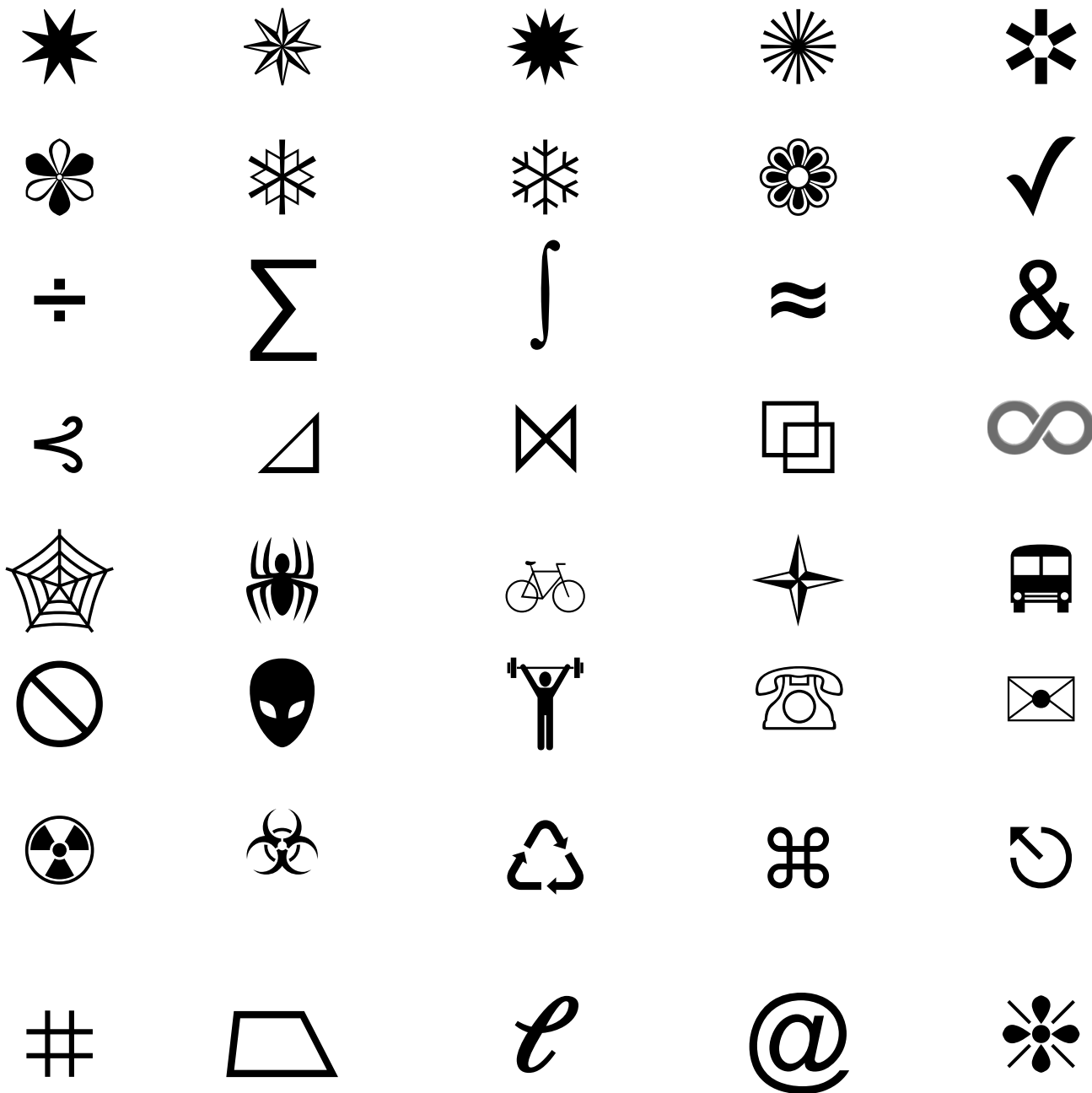


1



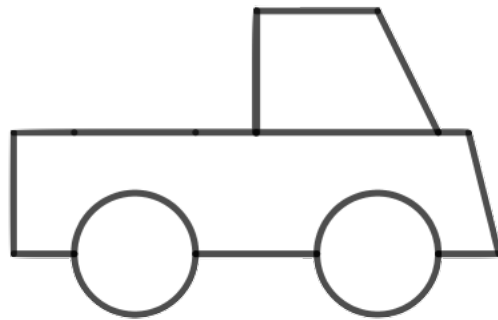
2





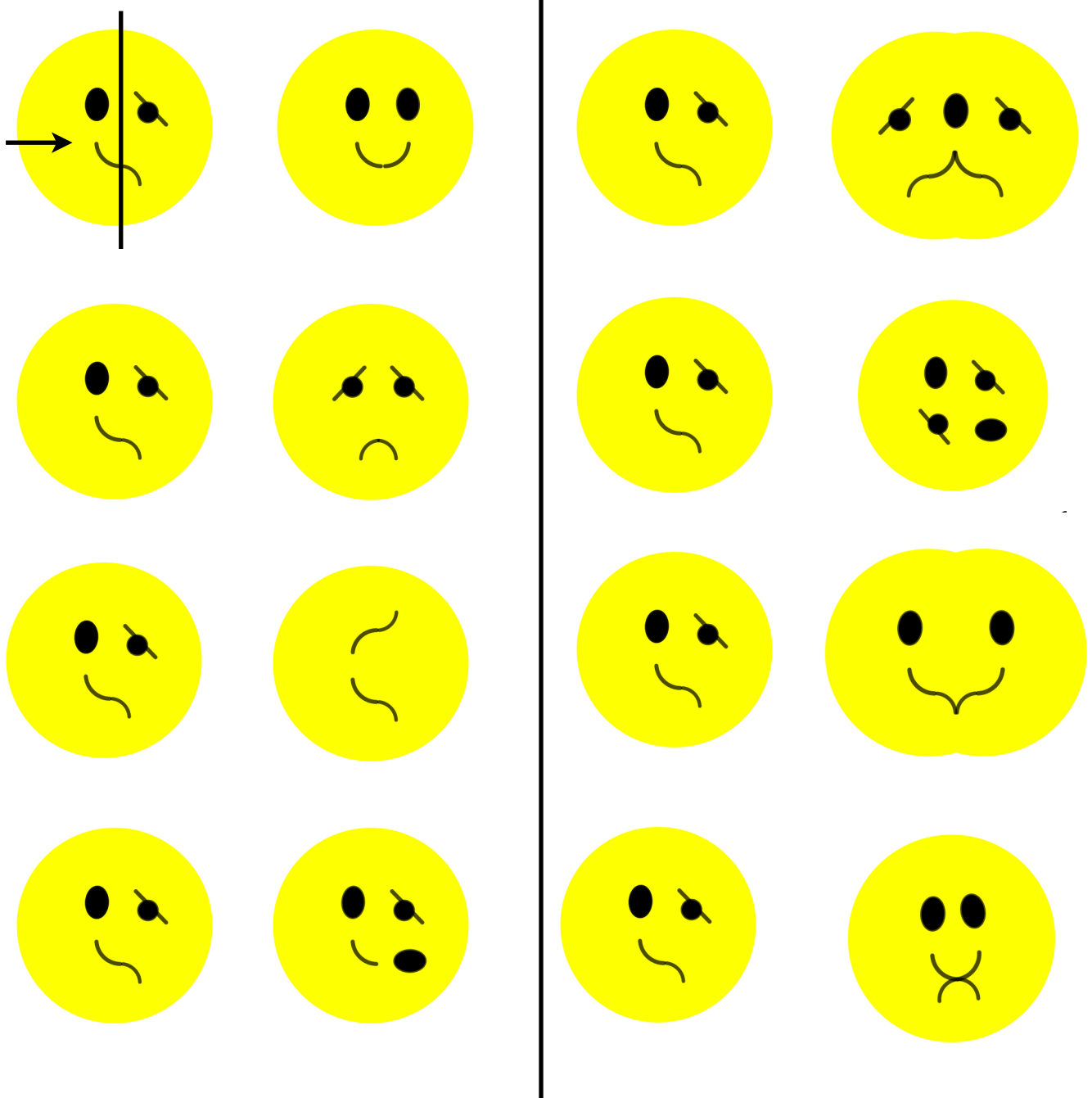
Make your own symmetric shapes here:

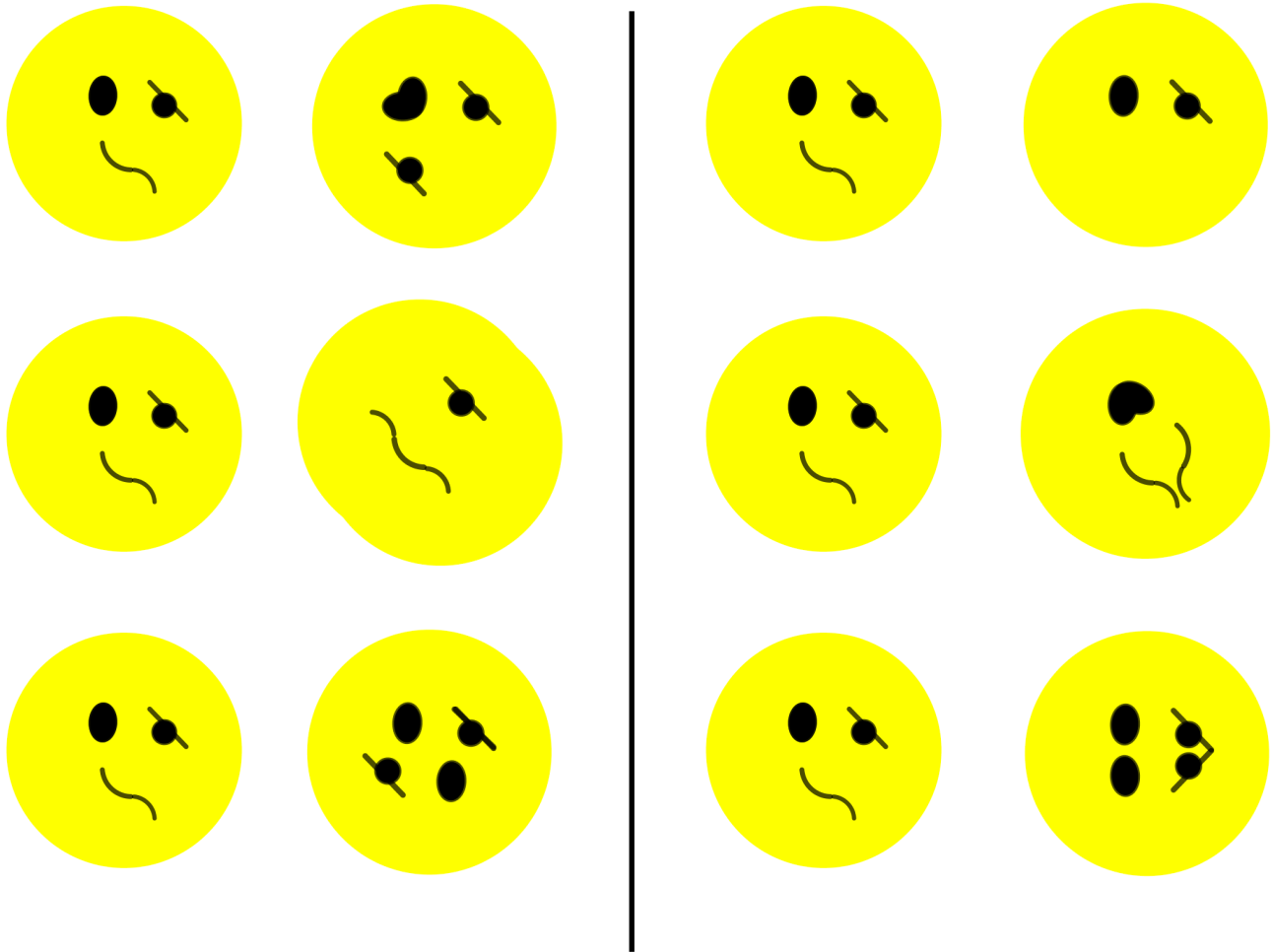
# Mirror Originals



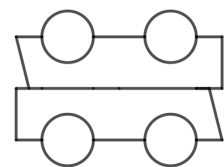
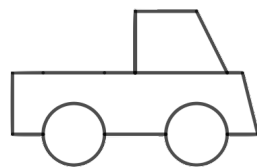
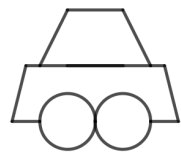
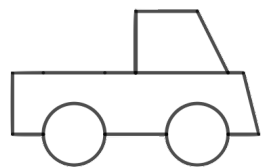
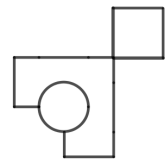
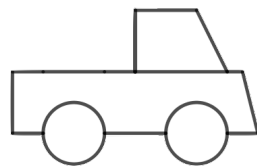
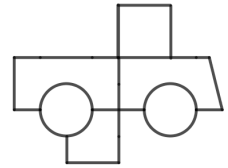
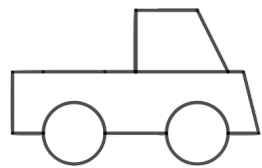
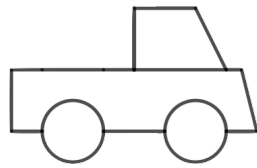
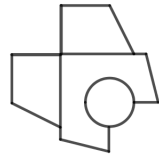
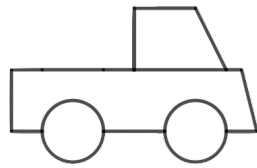
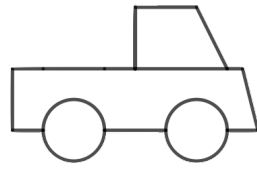
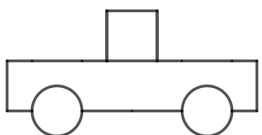
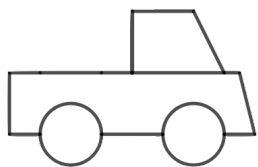
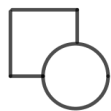
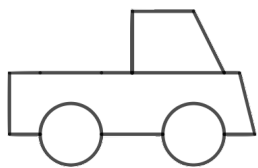
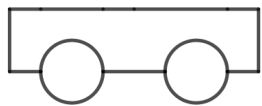
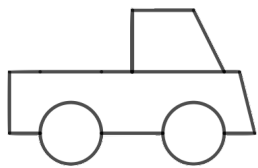
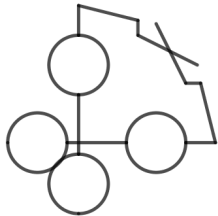
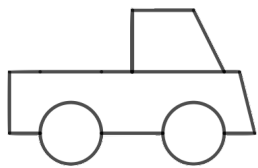
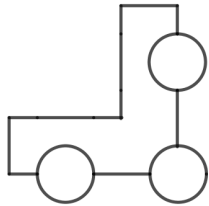
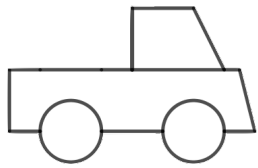
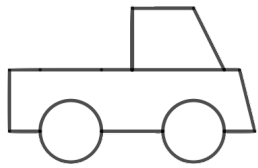
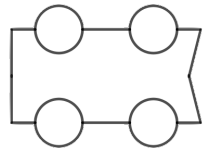
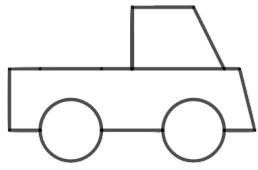
## Mirror Puzzles $\varepsilon$

- ◇ Place a mirror on the original figure (on the left) to create the target figure (on the right.)
- ◇ Draw a line on the original figure to show where you placed the mirror, and put an arrow to show which side you looked from.
- ◇ *Not all are possible.*



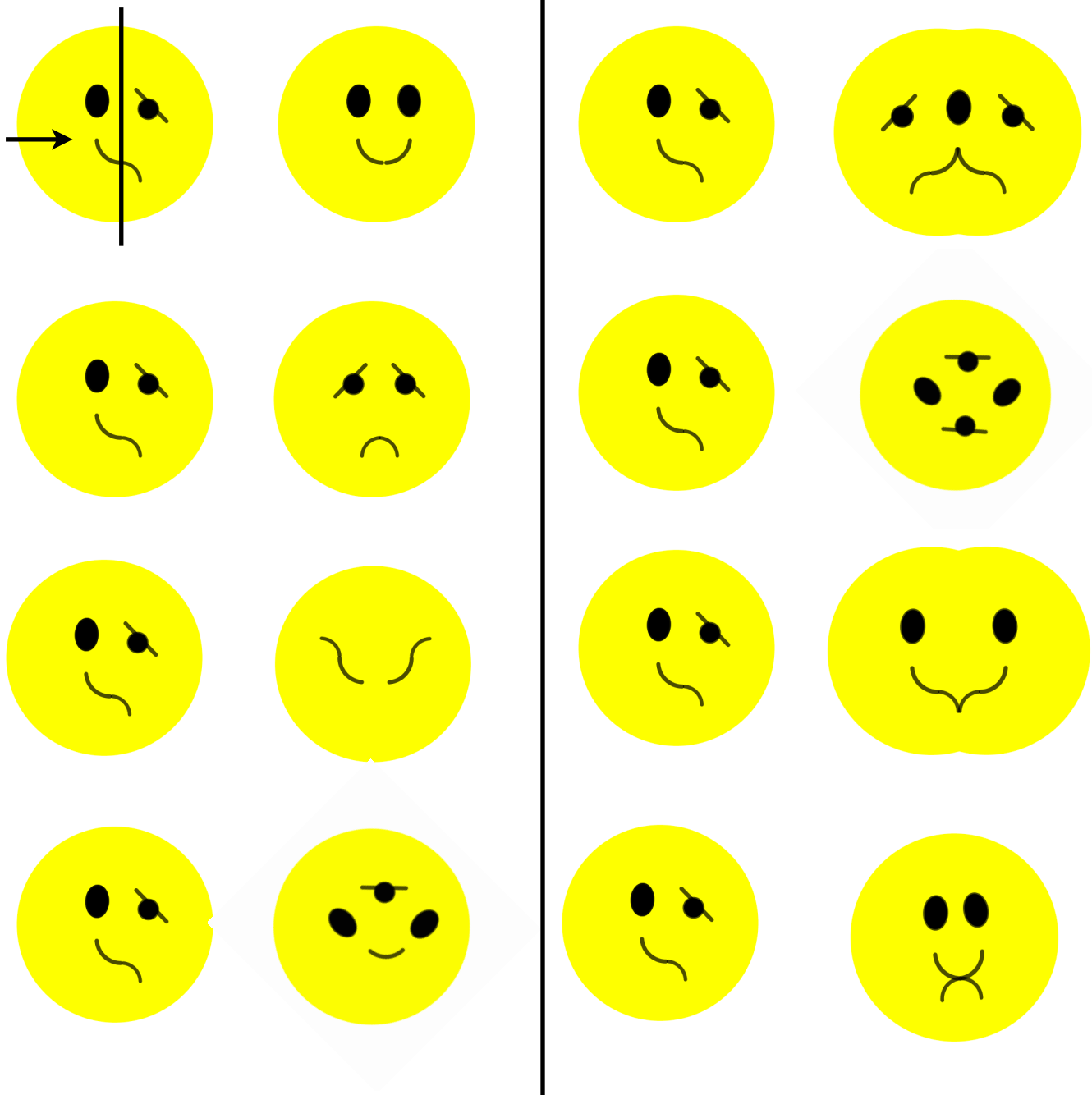


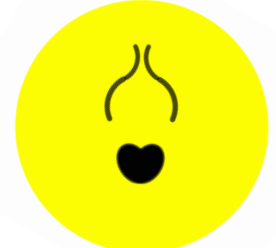


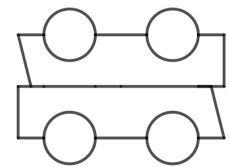
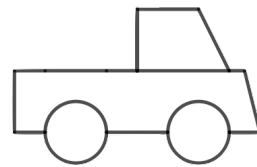
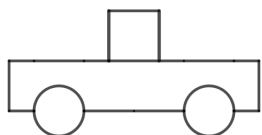
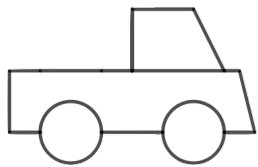
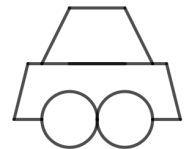
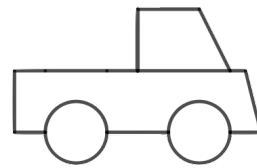
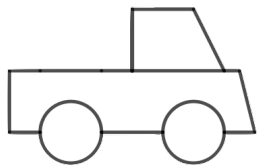
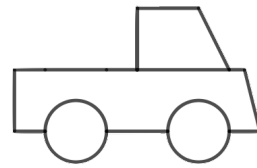
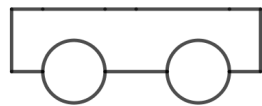
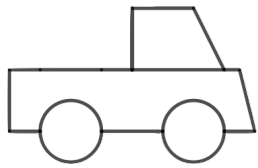
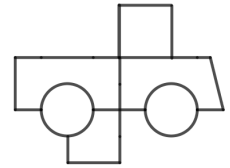
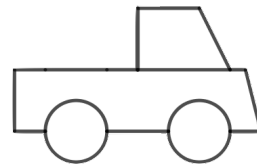
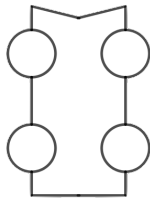
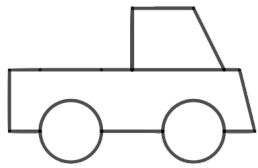
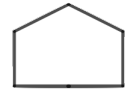
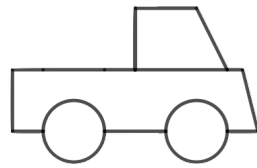
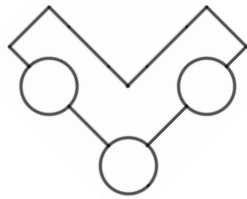
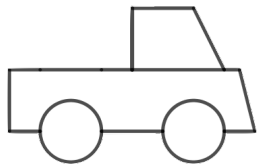
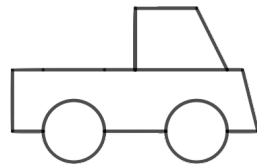
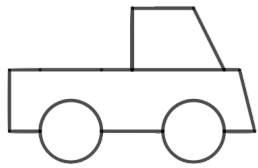
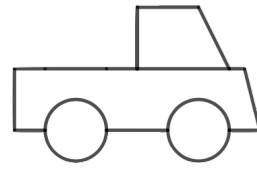
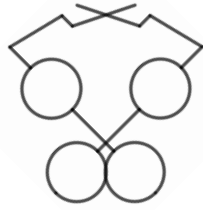
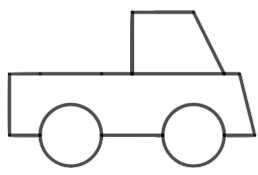


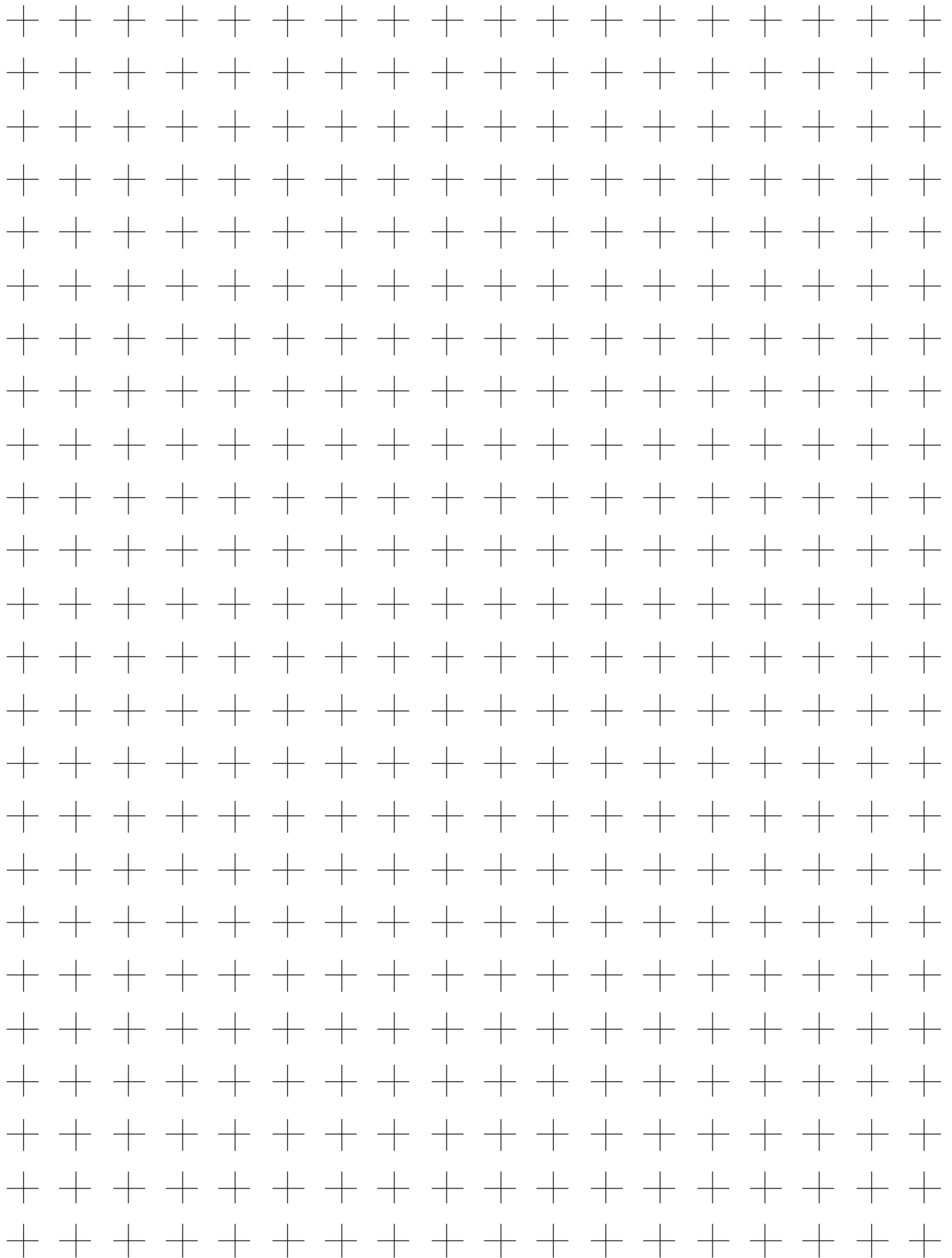
## Mirror Puzzles $\Delta$

- ◇ Place a mirror on the original figure (on the left) to create the target figure (on the right.)
- ◇ Draw a line on the original figure to show where you placed the mirror, and put an arrow to show which side you looked from.
- ◇ You might need to turn the paper around!
- ◇ *Not all are possible.*



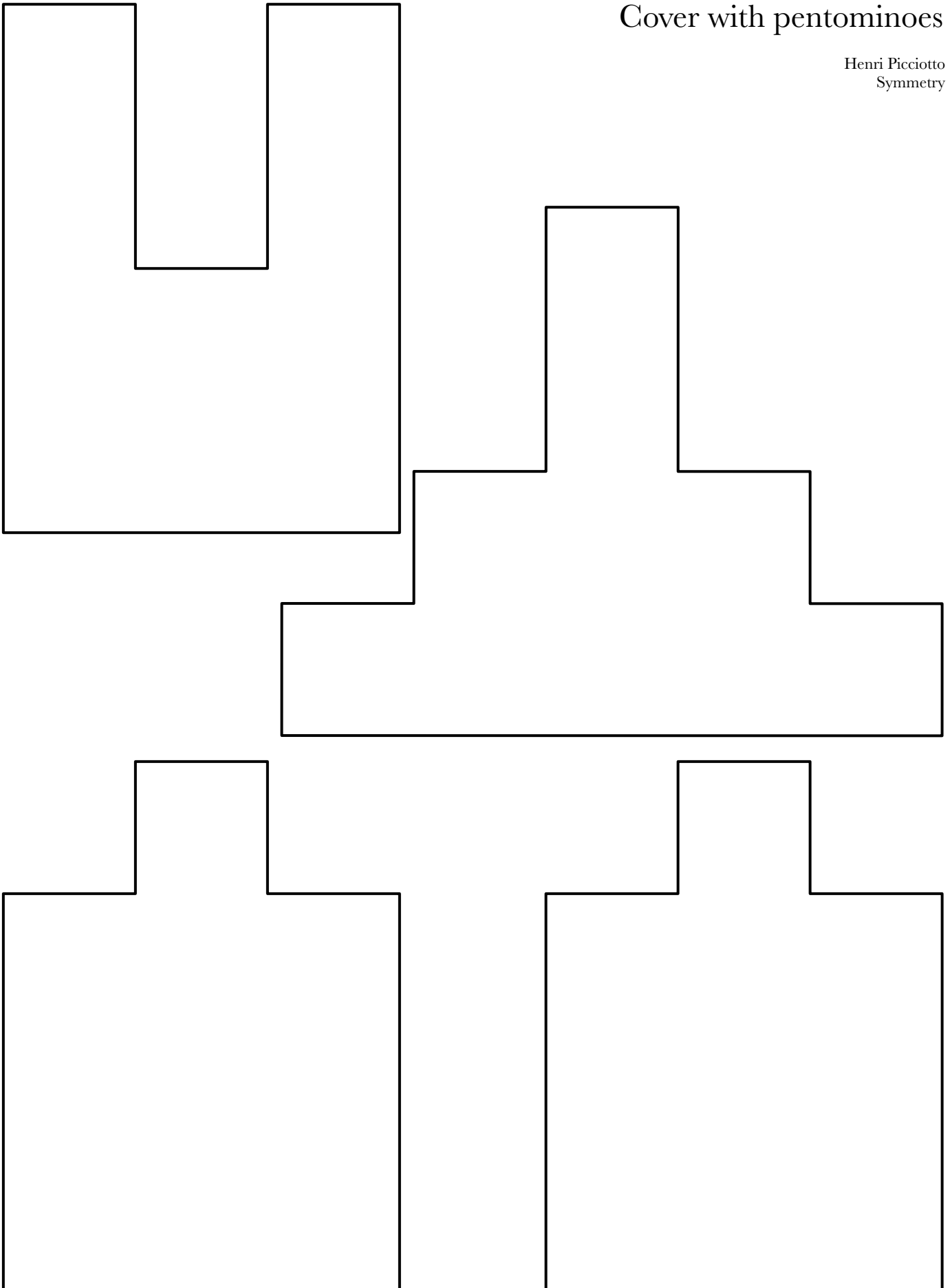


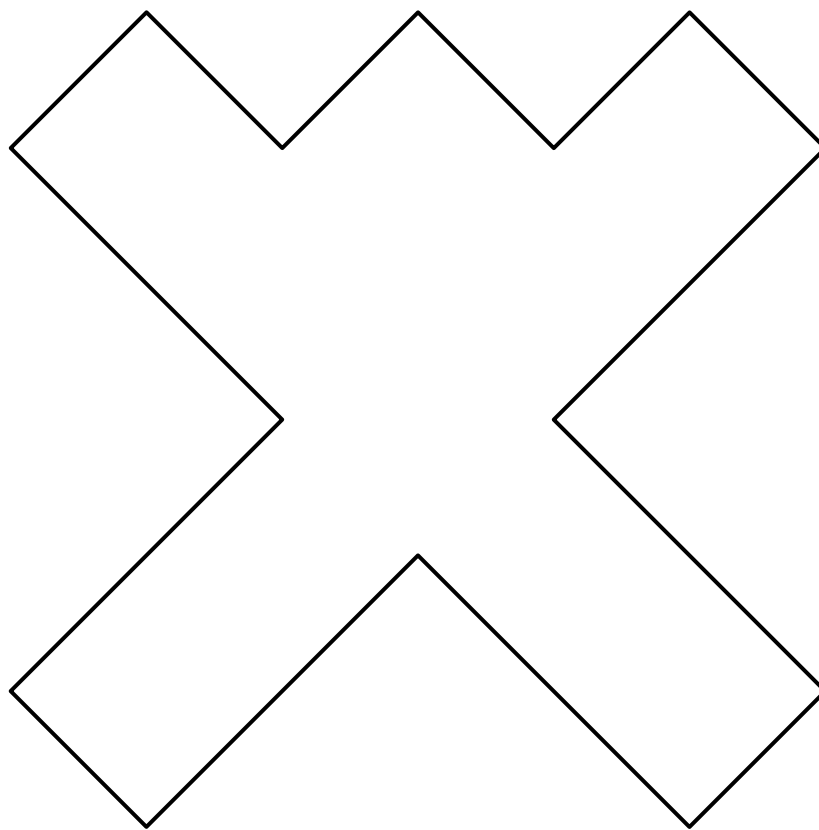
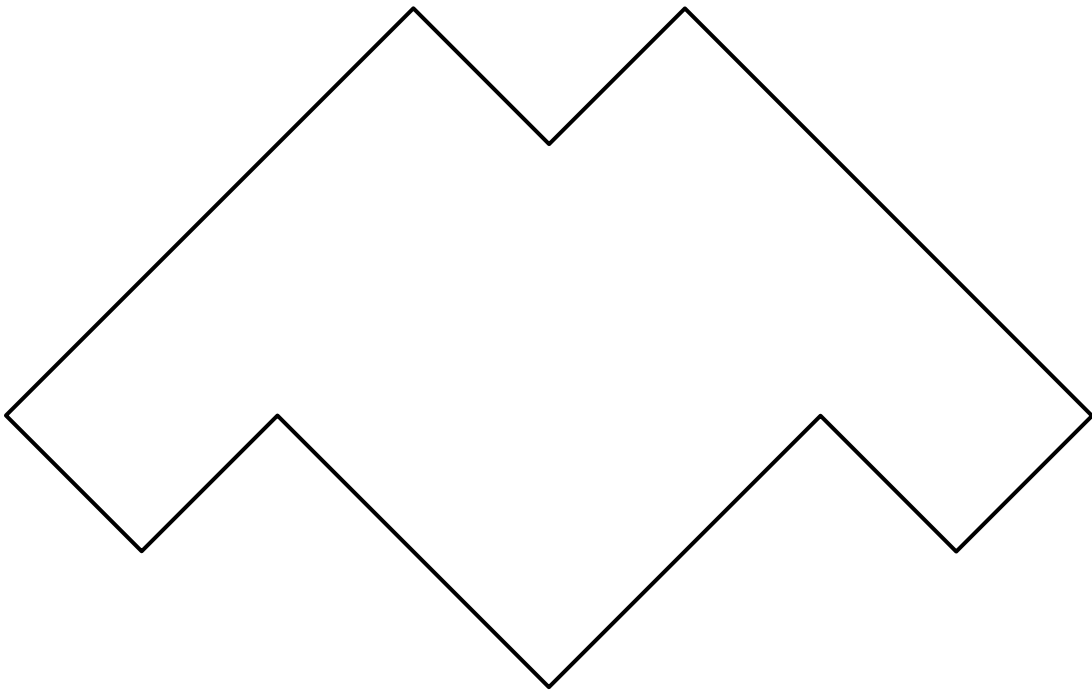


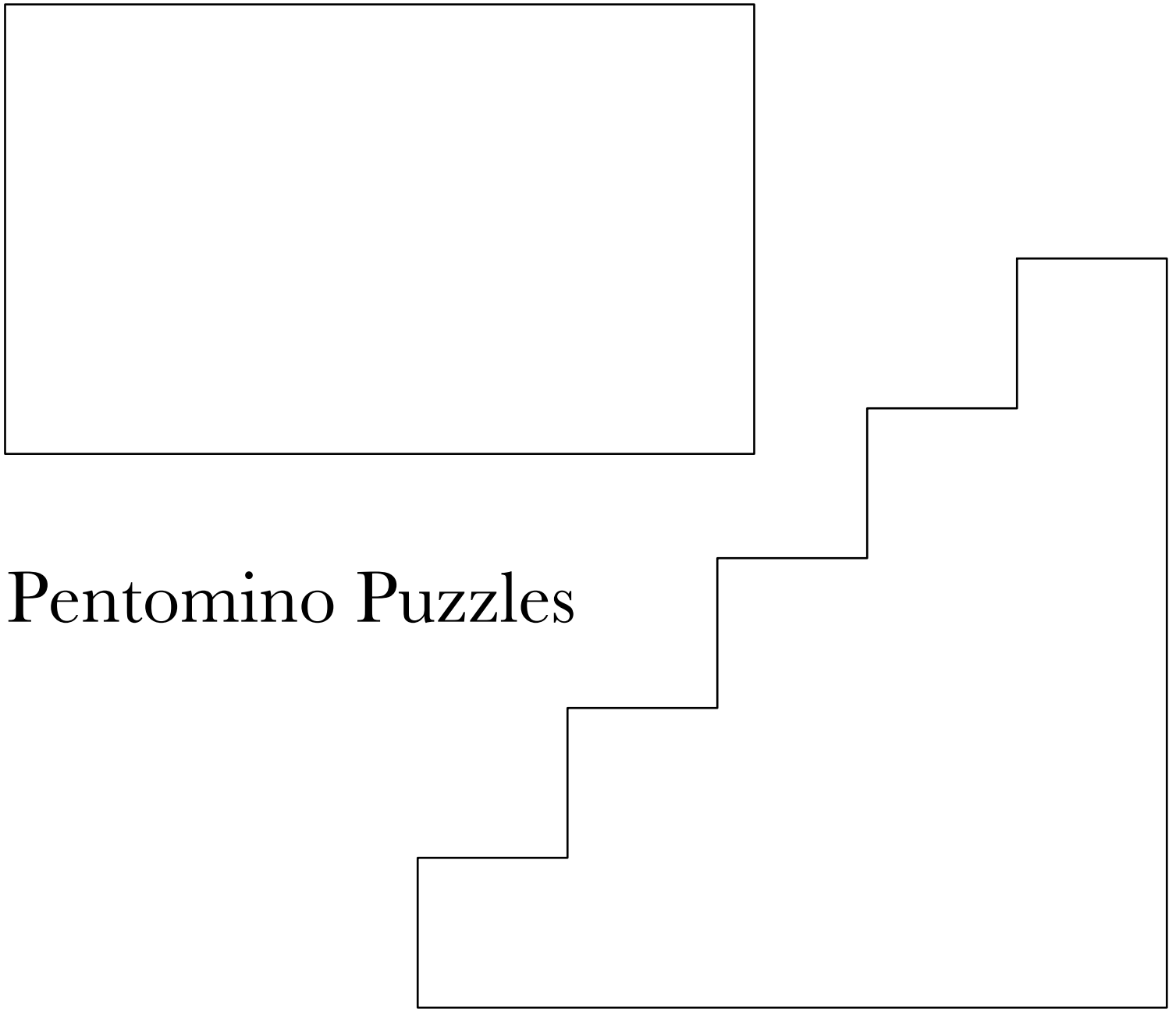


# Cover with pentominoes

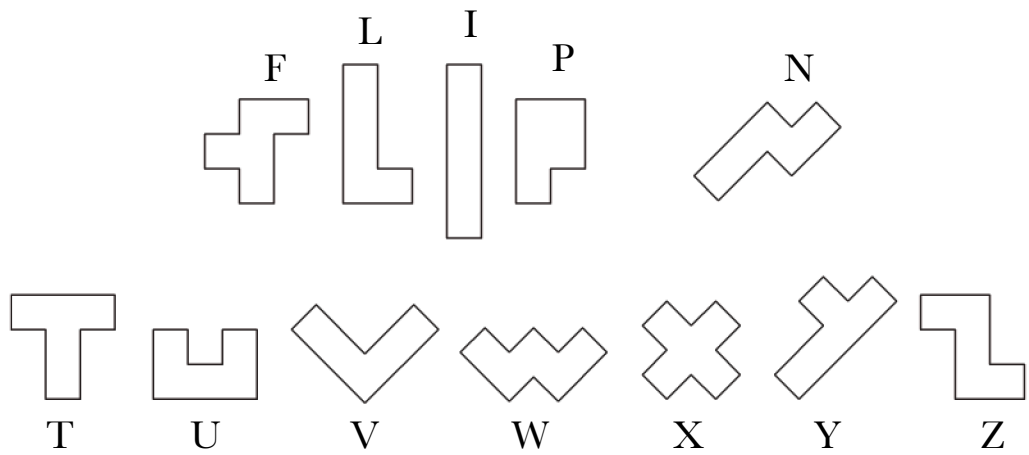
Henri Picciotto  
Symmetry



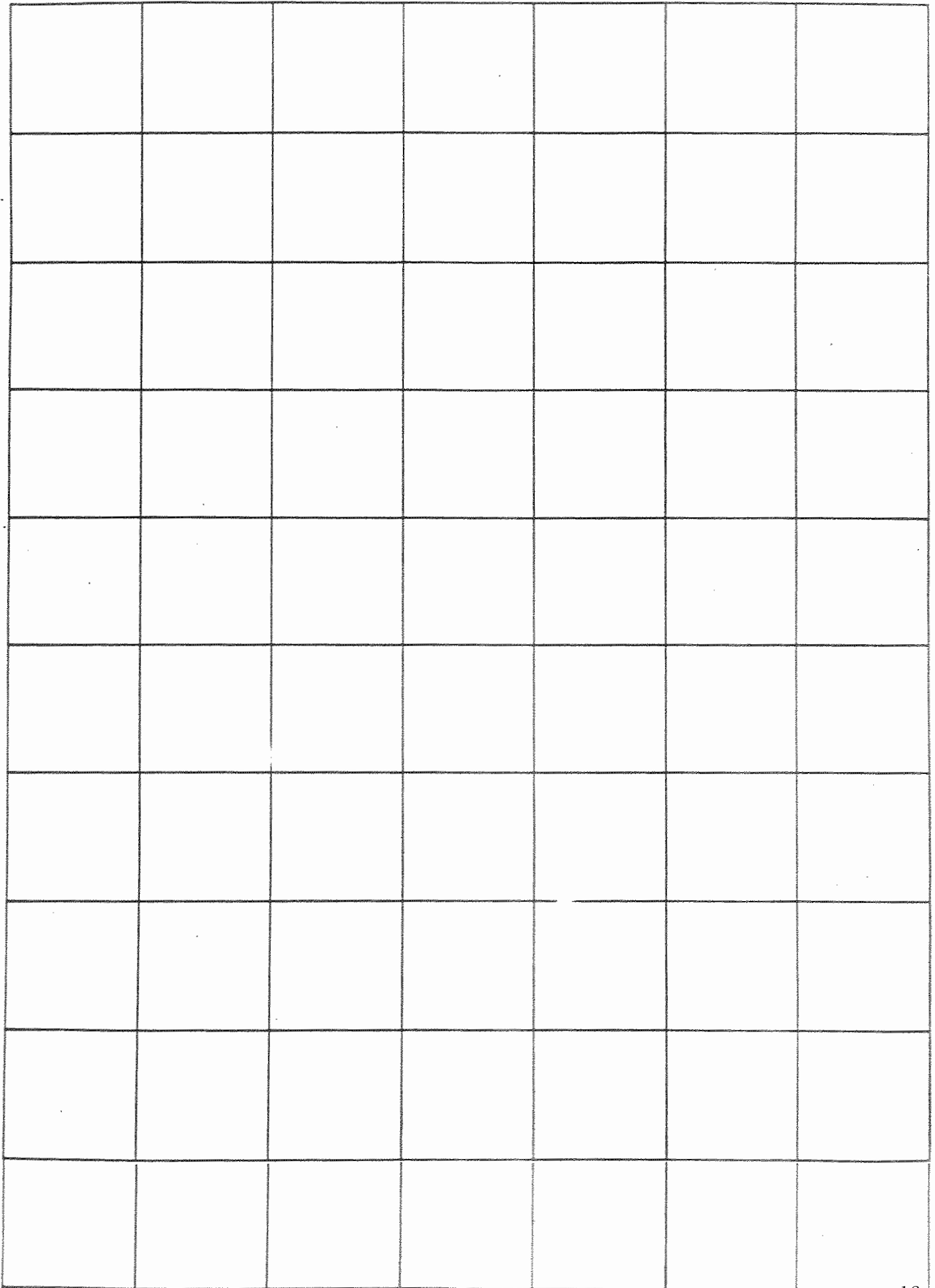




# Pentomino Puzzles

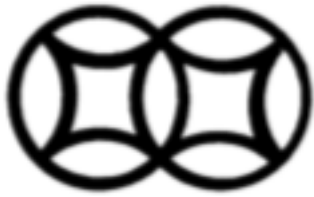






# Cut and Fold

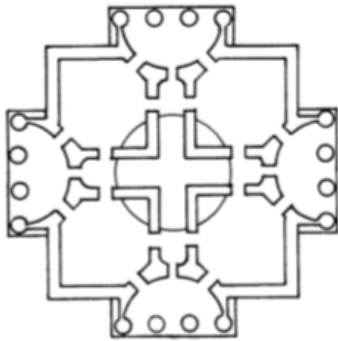
Cut out the shapes, and fold to show the lines of symmetry.



Chinese "gold coin" design



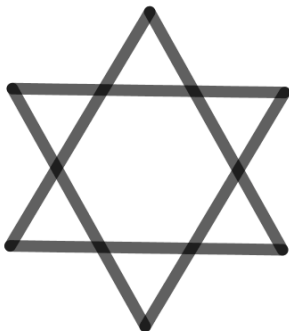
"Biological hazard" warning



Architectural plan

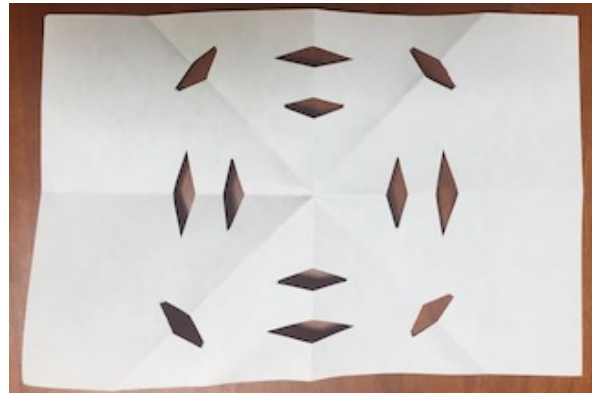
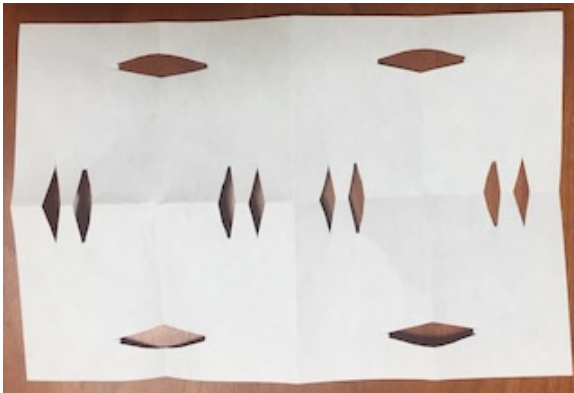
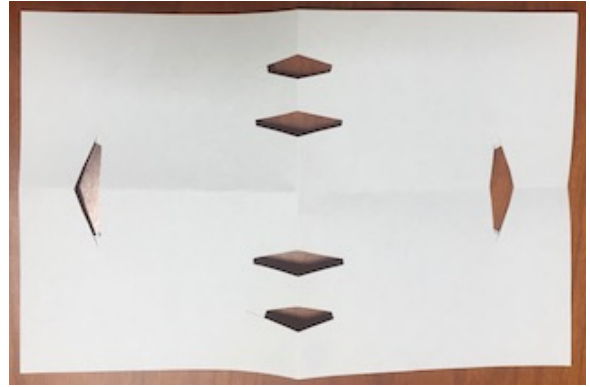
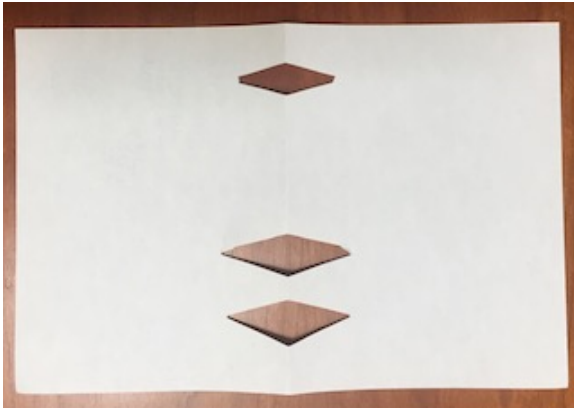


Army general insignia



Star of David

## Fold and Cut



To make these designs, I started by making one, two, or three folds. Each time, I folded the paper in half.

1. Draw the fold lines in the above figures.

After folding, I cut out three small triangles on the fold lines.  
The unfolded paper shows a symmetric design.

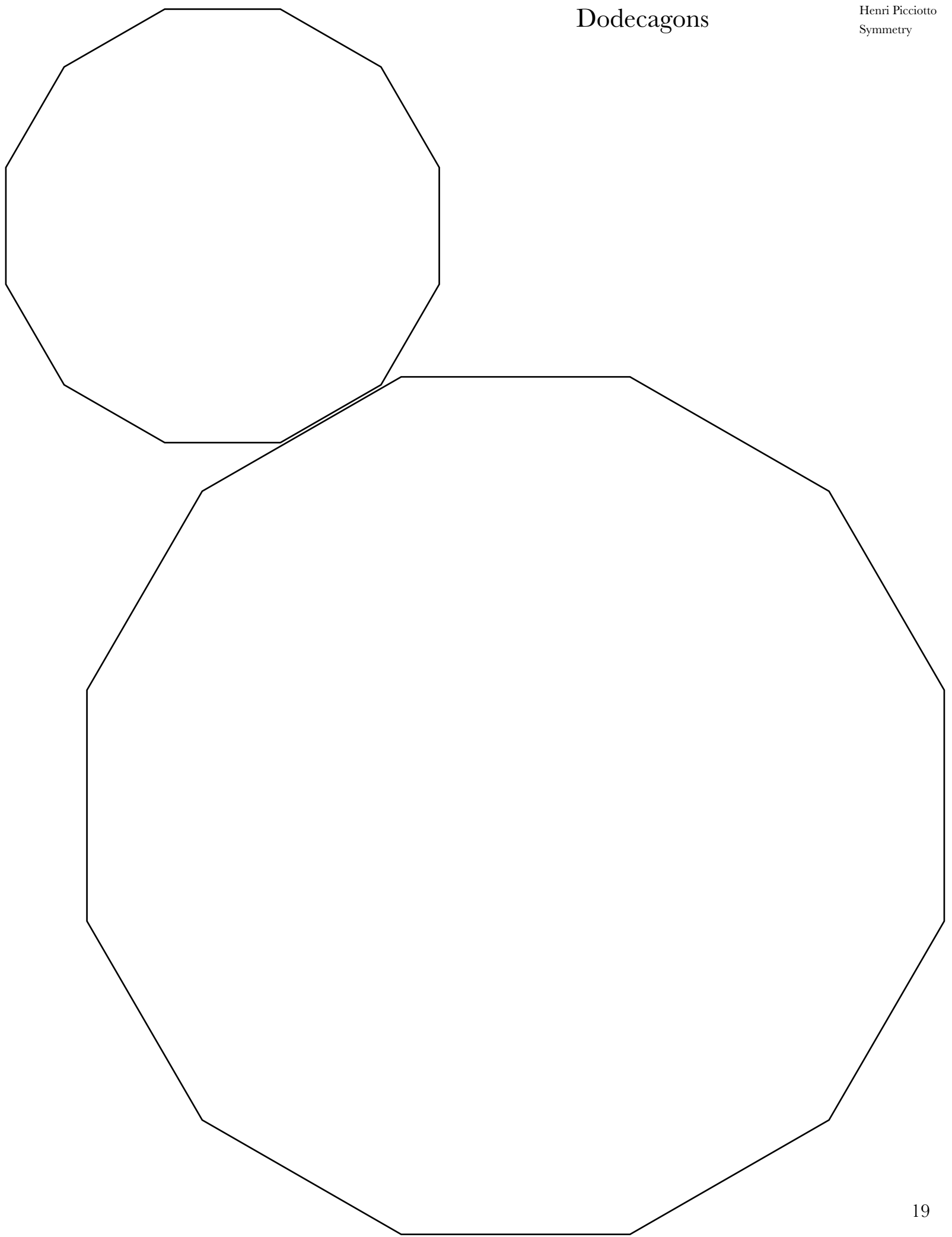
2. Do the figures have turn symmetry? Write what kind next to each one.

3. Make these designs using paper, three folds, and three triangle cuts.

4. Make your own symmetric designs! Use one, two or three folds, and cut out any shapes you want, wherever you want, before unfolding.

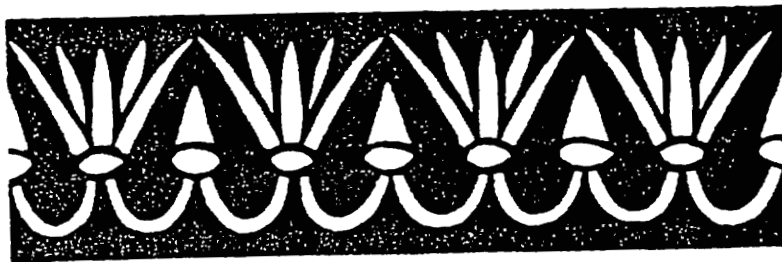
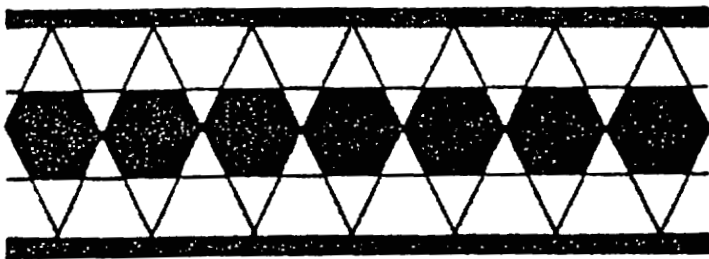
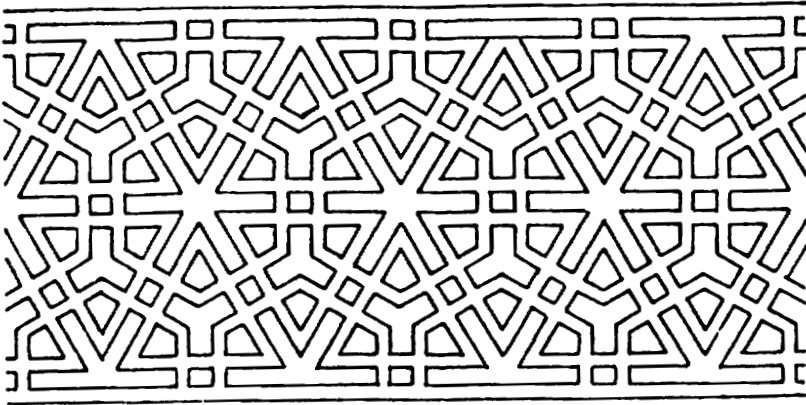
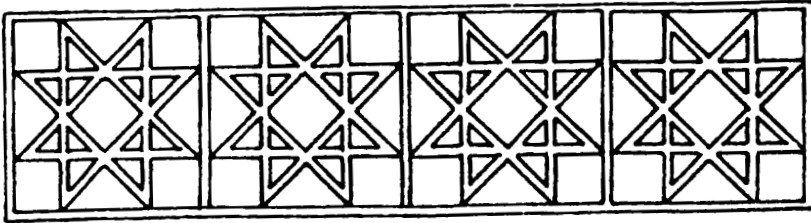
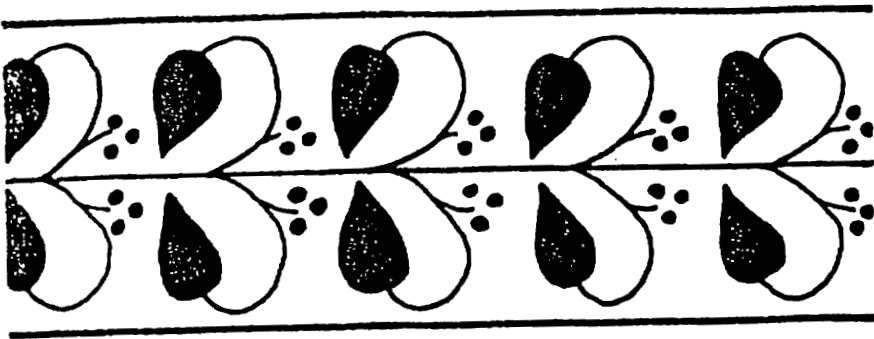
# Dodecagons

Henri Picciotto  
Symmetry



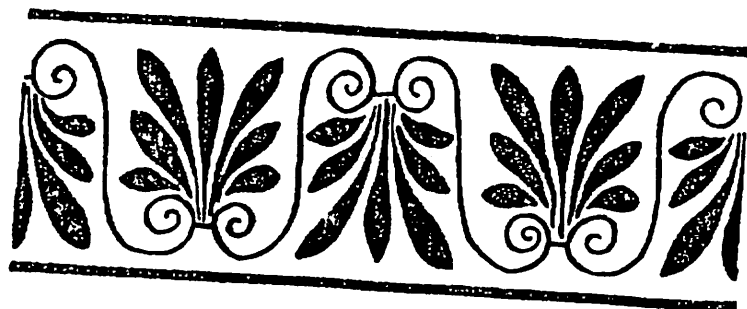
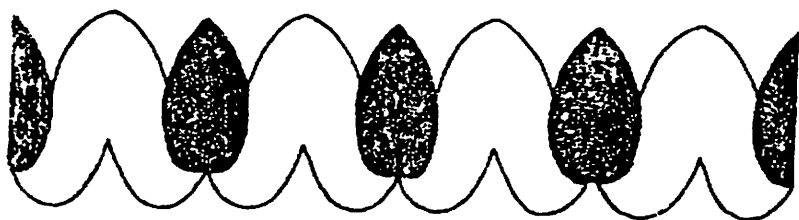
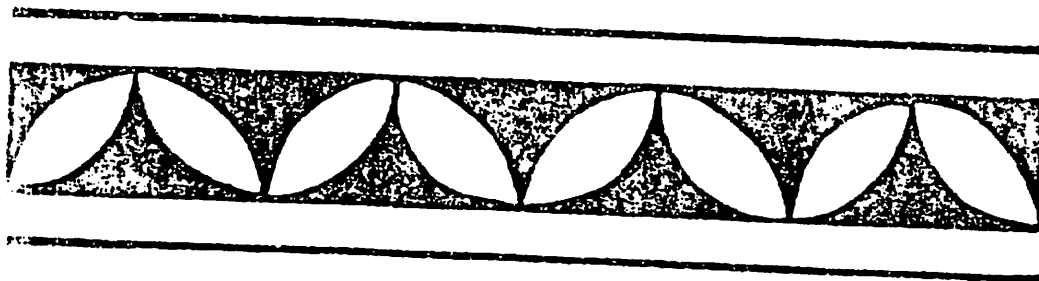
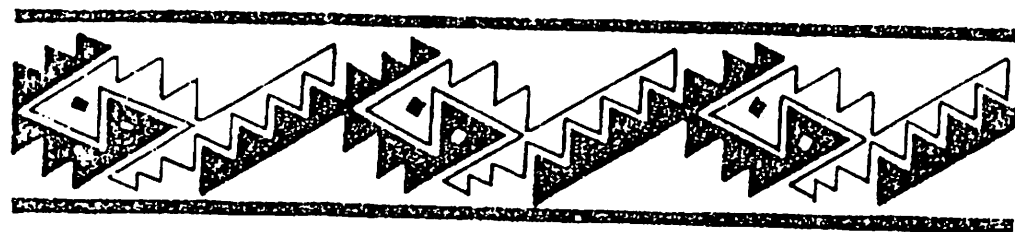
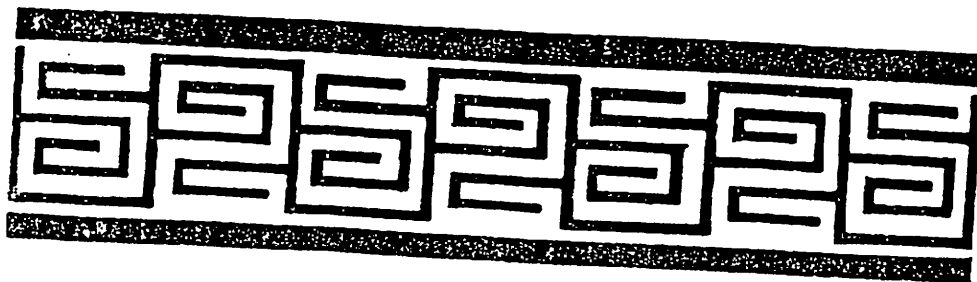
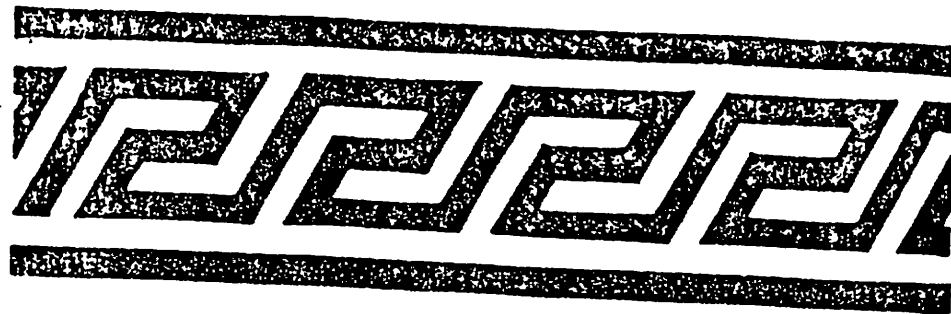
# Friezes 1

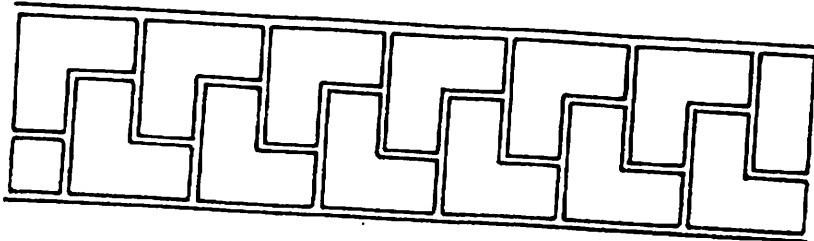
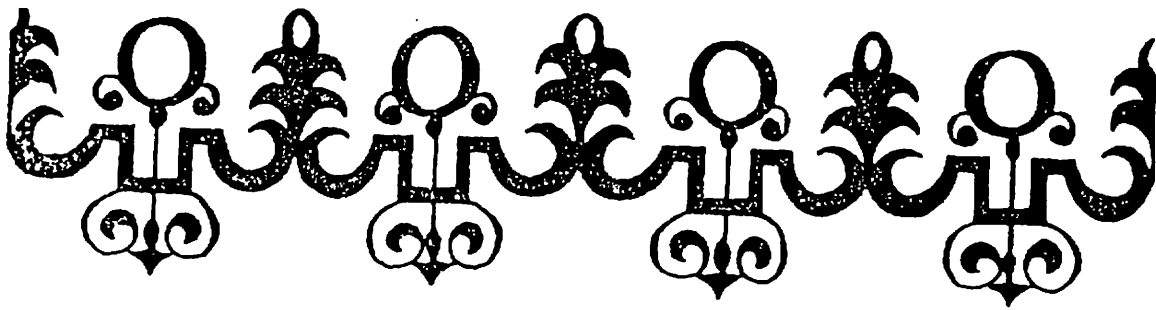
from Stevens'  
*Handbook of Regular Patterns*



# Friezes 2

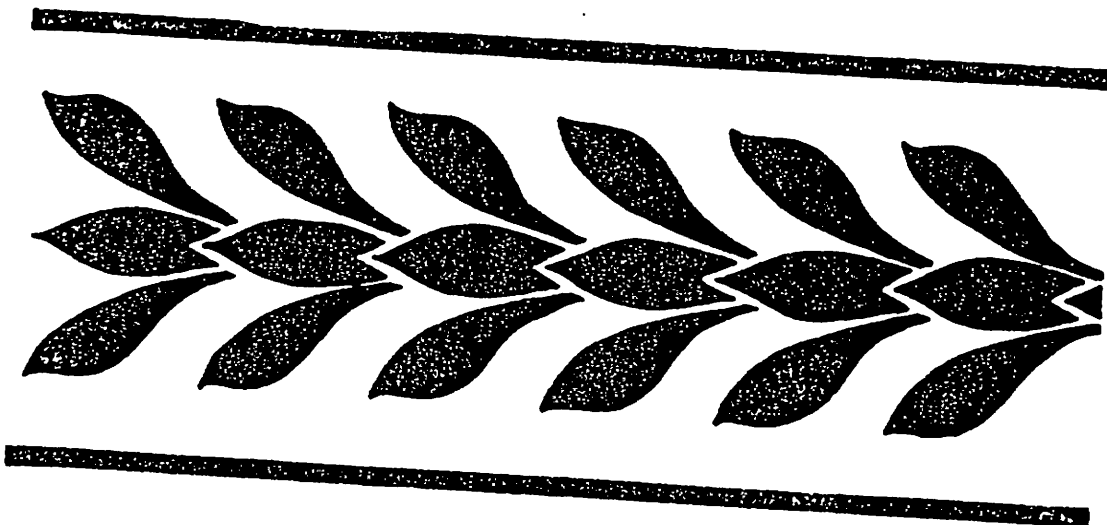
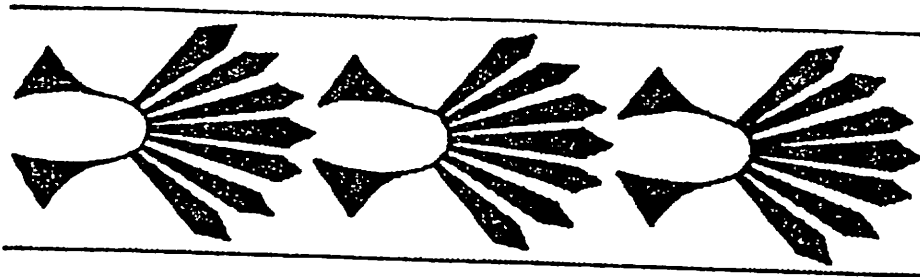
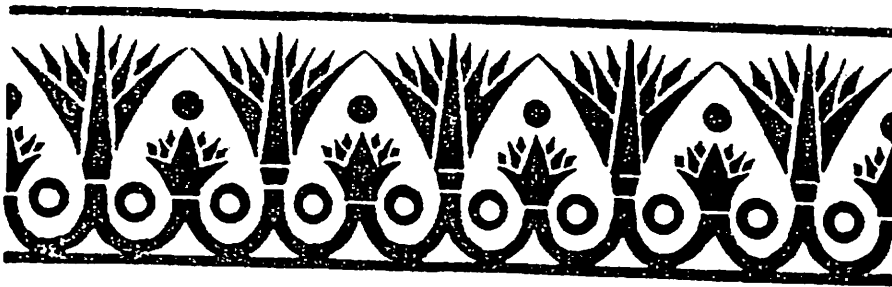
from Stevens'  
*Handbook of Regular Patterns*





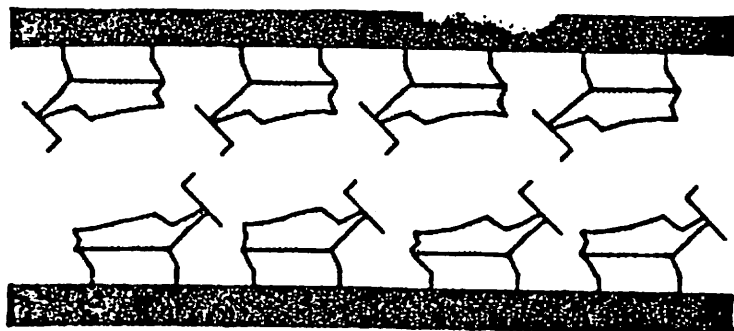
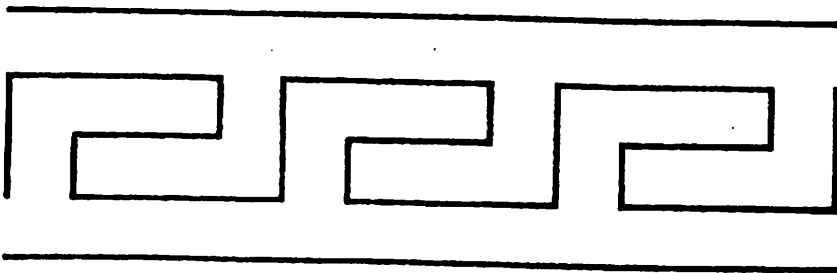
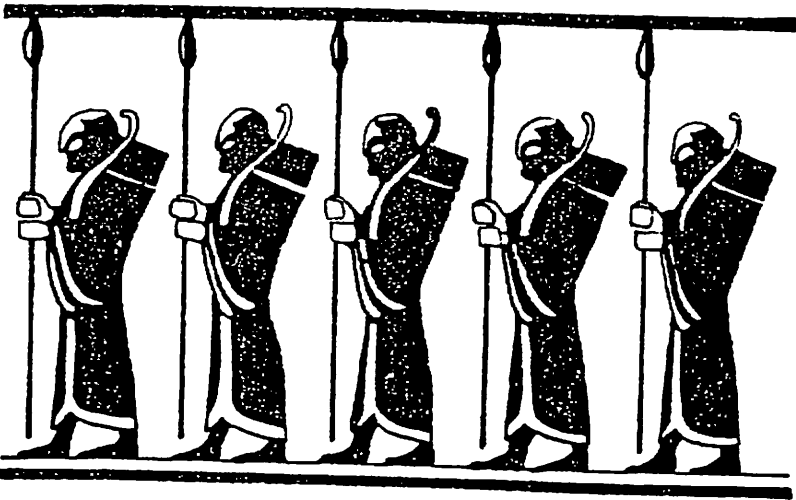
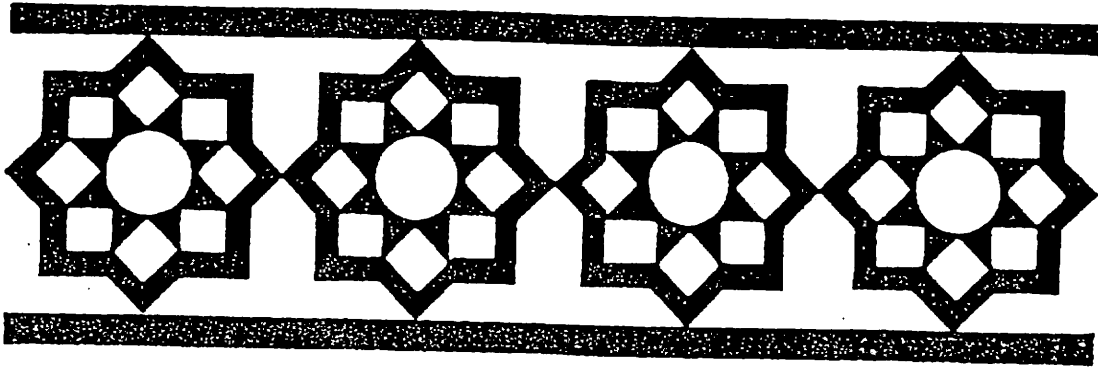
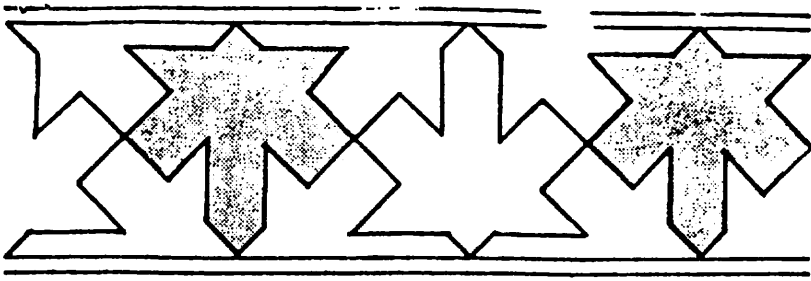
## Friezes 3

from Stevens'  
*Handbook of Regular Patterns*



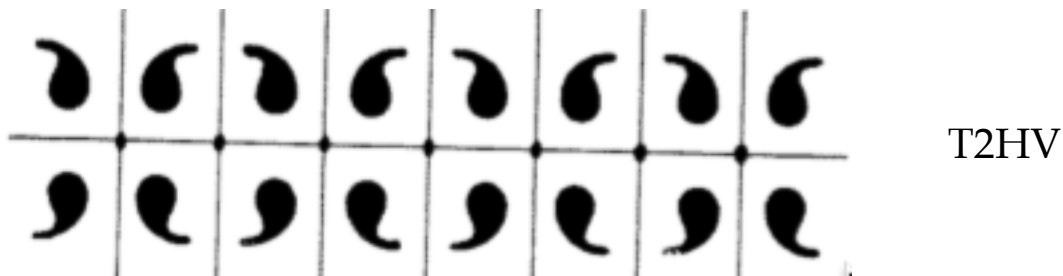
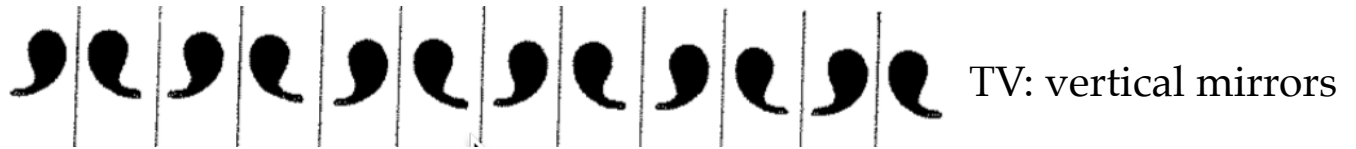
# Friezes 4

from Stevens'  
*Handbook of Regular Patterns*





### Frieze Patterns



Figures from Stevens *Handbook of Regular Patterns*



# Wallpapers

Imagine each figure extends forever.

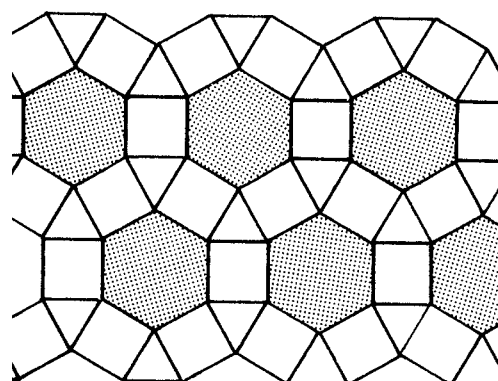
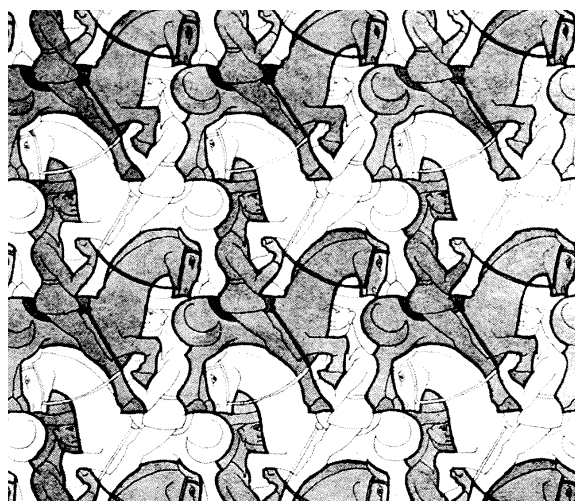
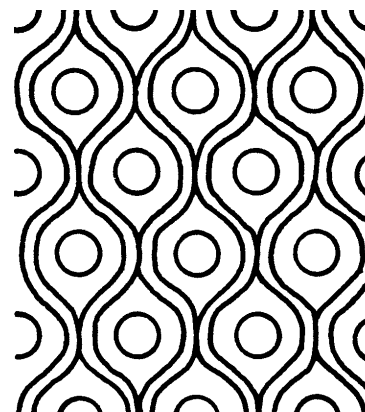
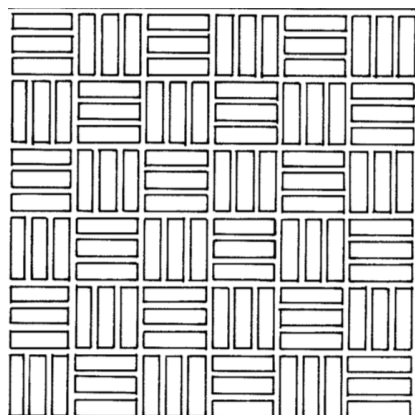
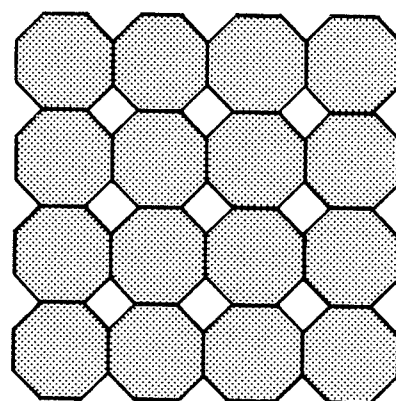
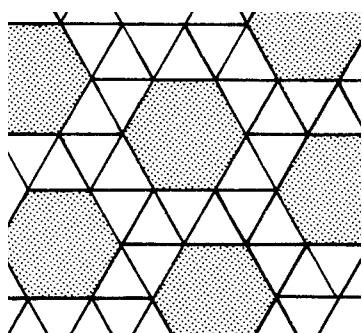
Next to each figure, write its rotation number.

On each figure:

Draw two arrows, pointing in different directions, to show translation symmetry.

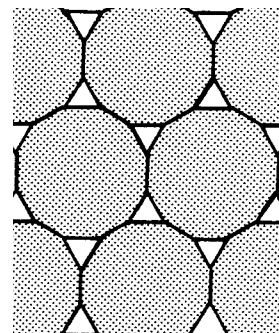
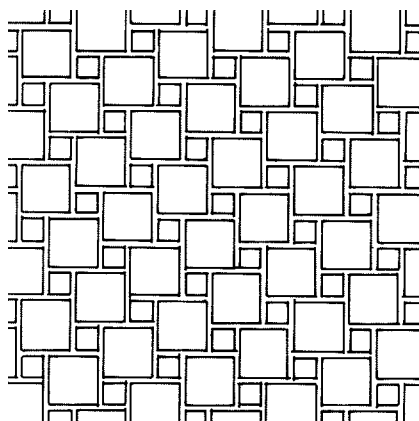
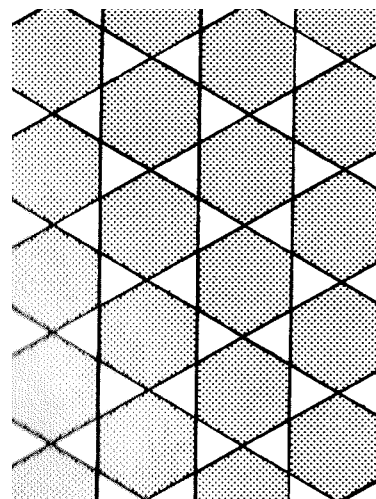
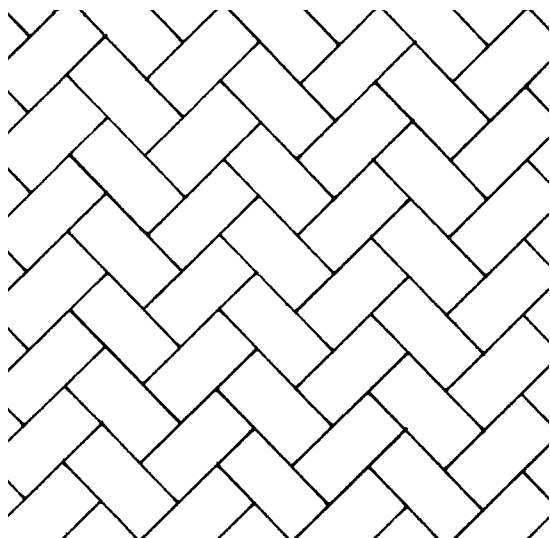
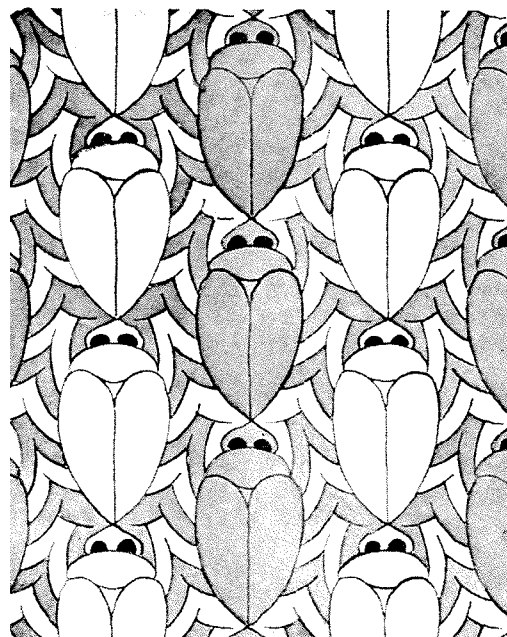
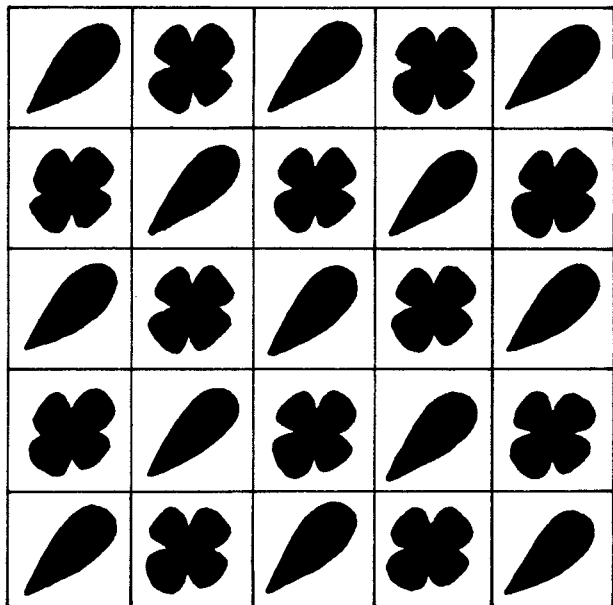
Draw some of the lines of reflections, if there are any.

Use dotted lines to show glide reflections, if there are any.

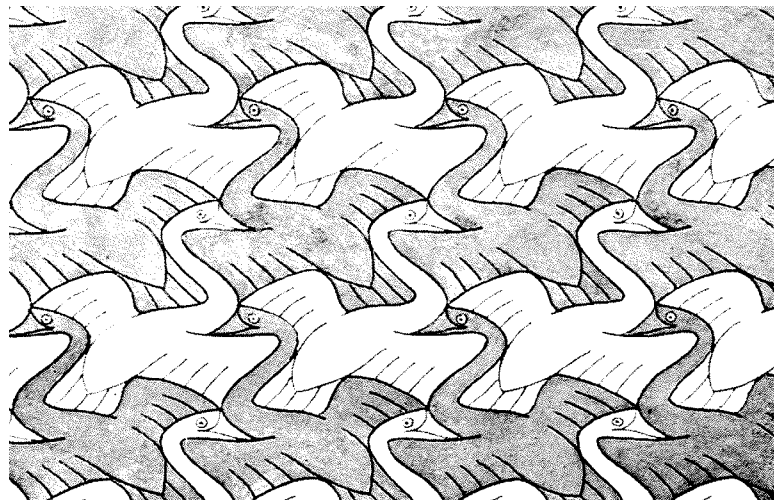
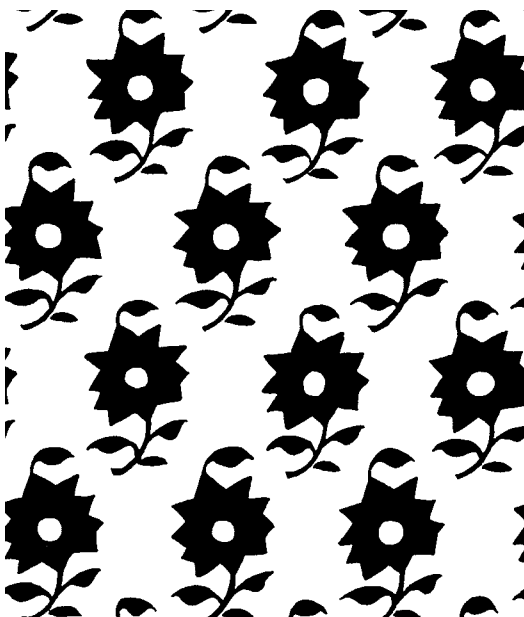
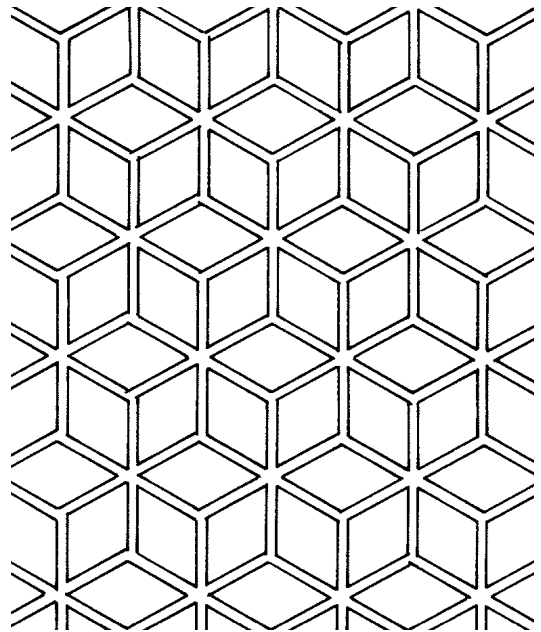
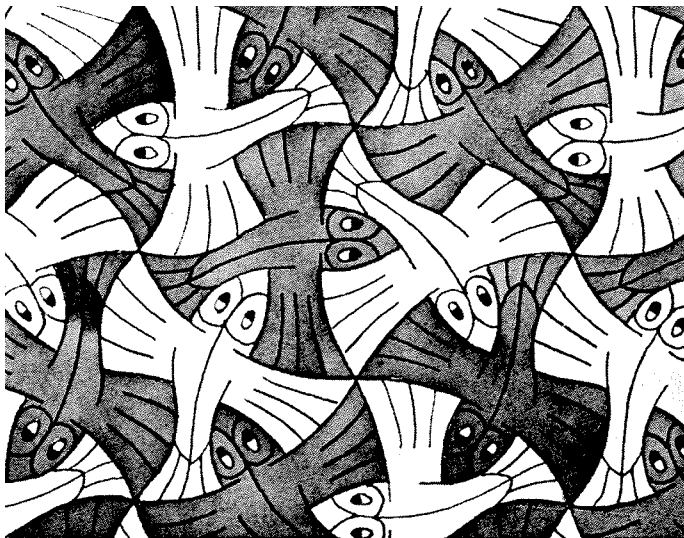
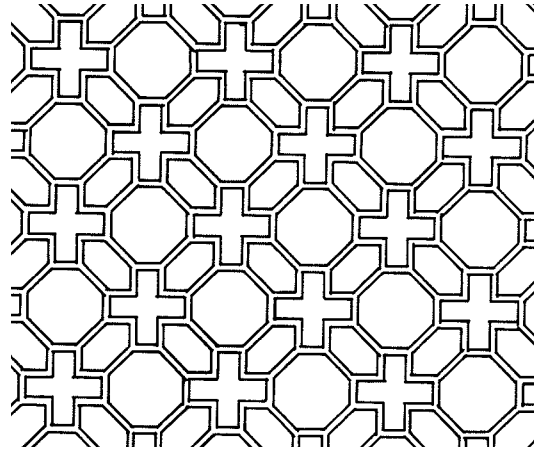
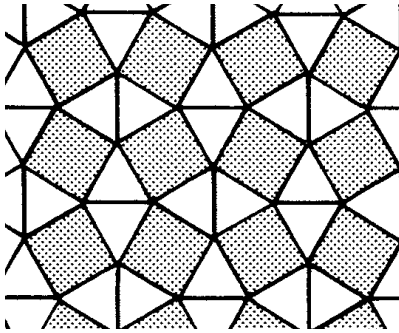


from Stevens' *Handbook of Regular Patterns*

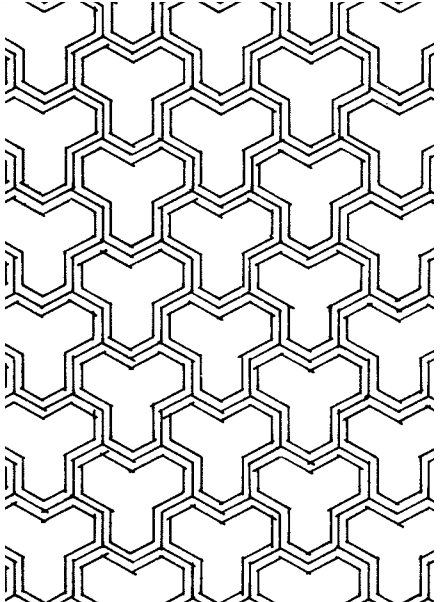
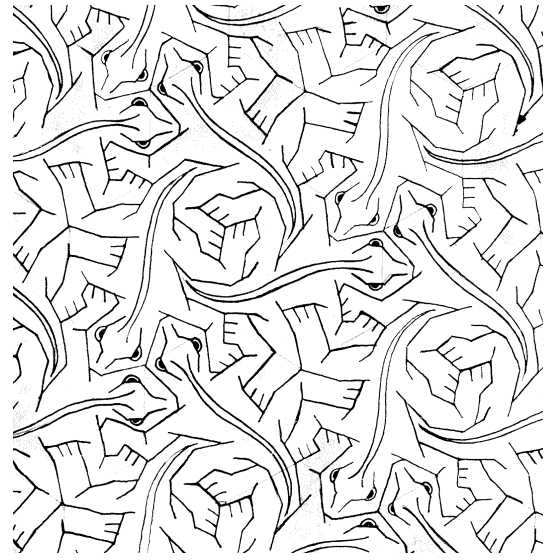
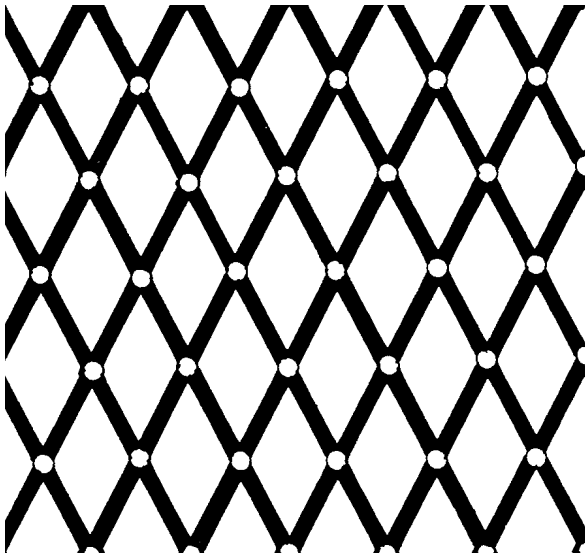
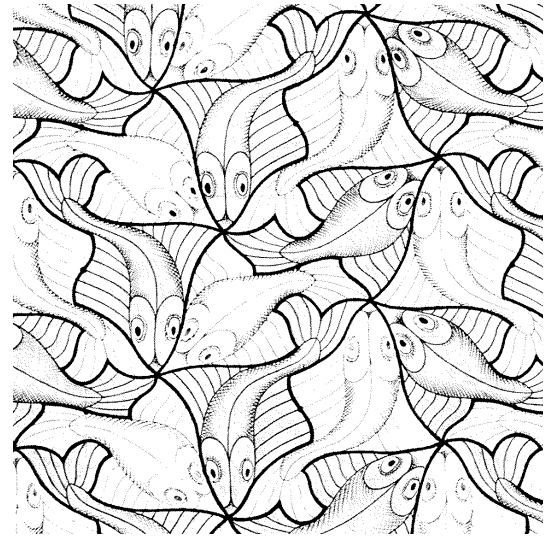
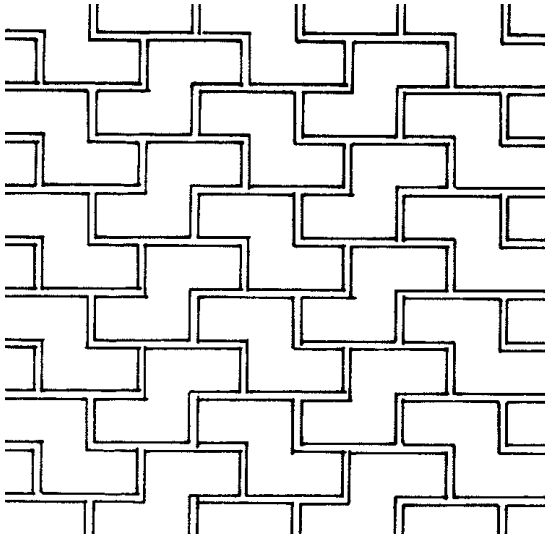
# Wallpapers



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