

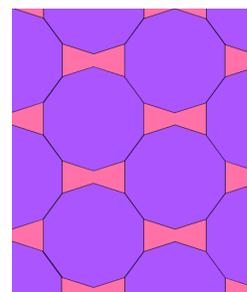
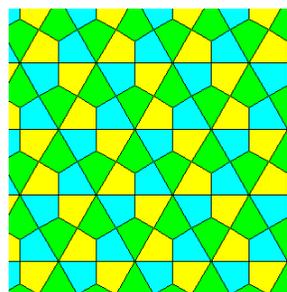
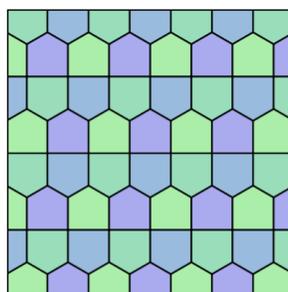
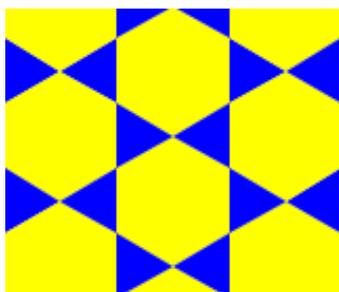


## Grade 6 Math Circles

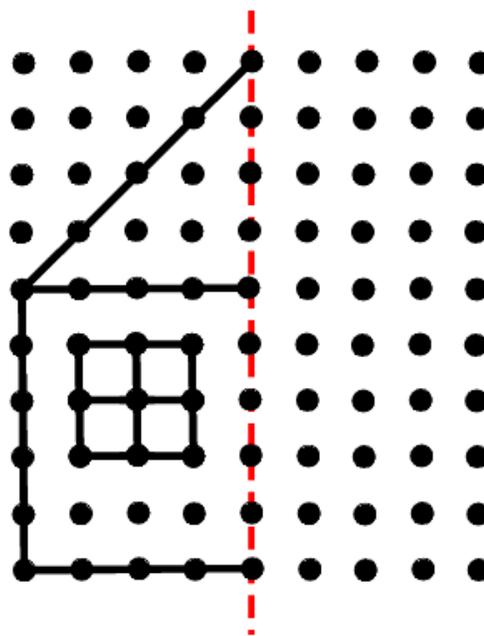
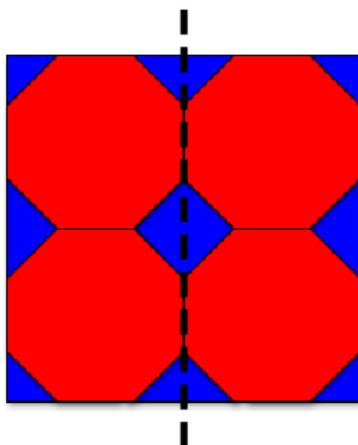
### Fall 2012

### *Tessellations*

A **tessellation** is a collection of shapes that fit together with no gaps or overlaps.

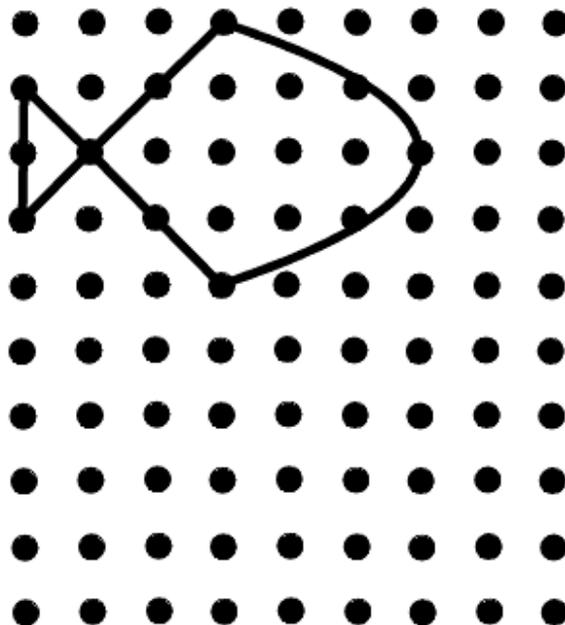
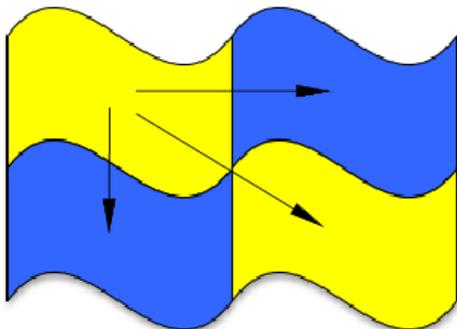


**Reflectional symmetry:** the shape is reflected over a line of symmetry so that each side is a mirror image of the other.



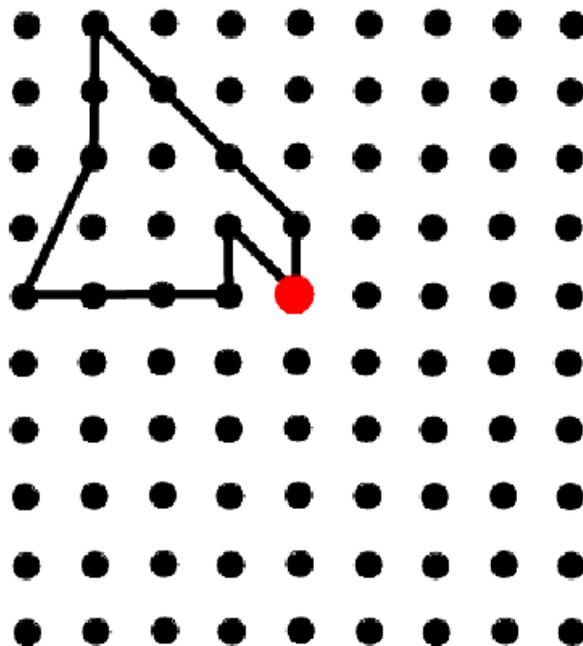
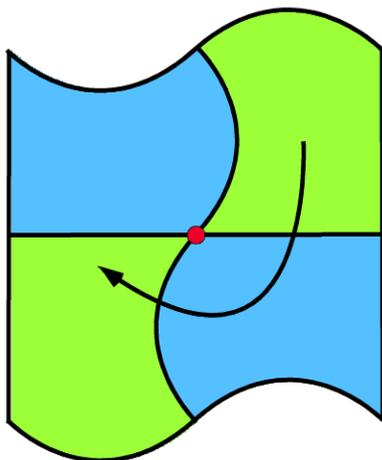
Draw the reflection of the image using the dashed line as the line of symmetry.

**Translational symmetry:** the shape is shifted in one or multiple direction(s), but otherwise remains unchanged.



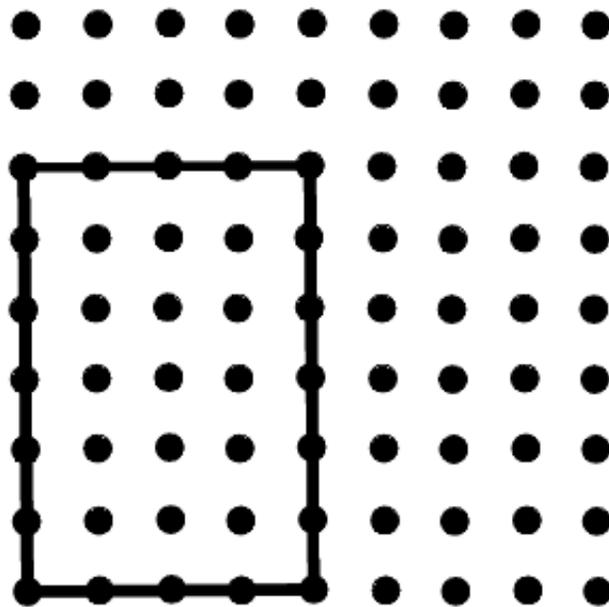
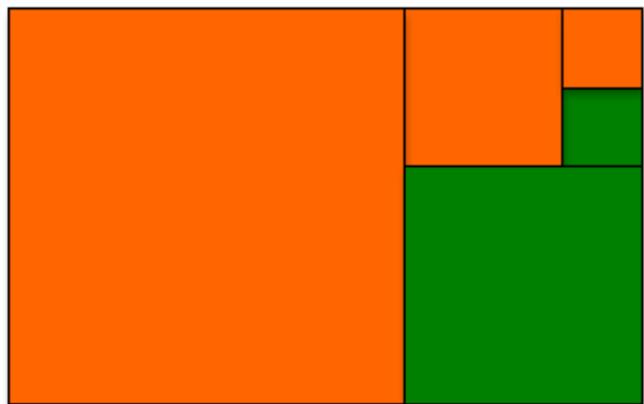
Translate the image 1 unit right and 4 units down.

**Rotational symmetry:** the shape is rotated by some angle around some point, but otherwise remains unchanged.



Rotate the image  $90^\circ$  about the large dot and then rotate your new image another  $180^\circ$ .

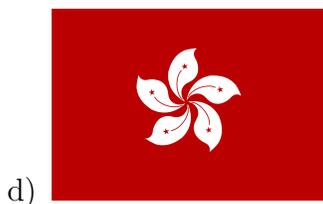
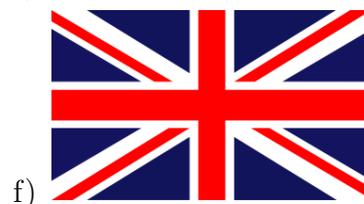
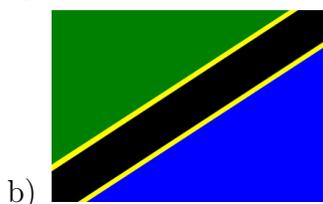
**Scale symmetry:** the shape is scaled to a different size.



Scale the image down by a factor of 2 by halving the lengths of each side.

### Problem Set

1. What types of symmetry can you find in the following items?



2. We can find tessellations in many places outside of the classroom. Can you figure out of what the following pictures are of? Can you think of any other tessellations?



3. Write your name in all capital letters, then find all of the lines of symmetry in the letters.

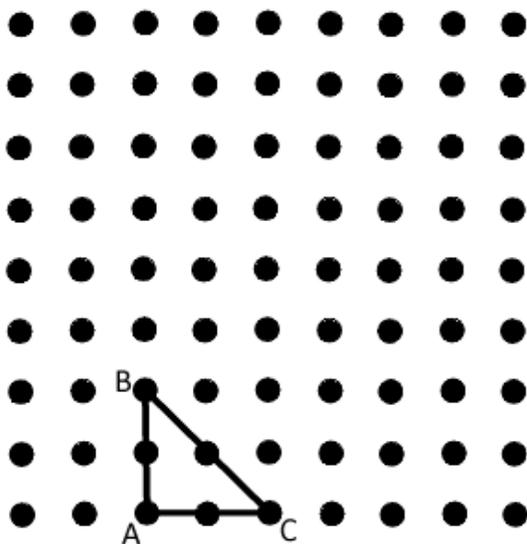
For example:



4. As you have just seen, some of the letters of the alphabet contain symmetry. Use the following chart to indicate which letters have which types of symmetry.

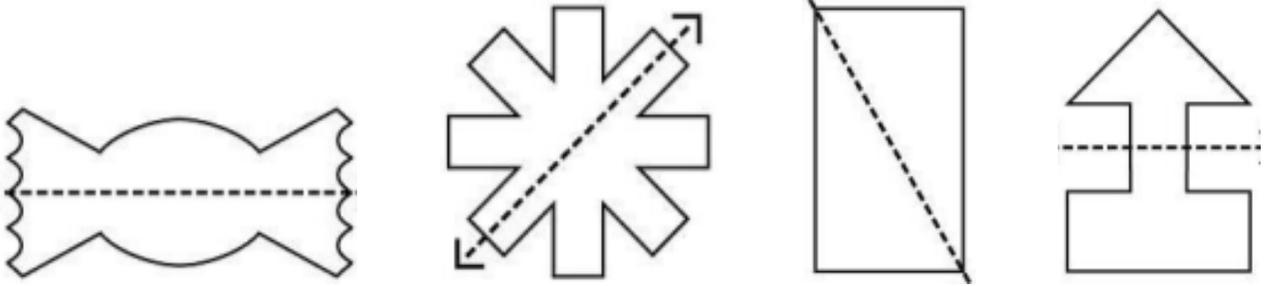
	A	B	C	D	E	F	G	H	I	J	K	L	M
Reflectional													
Translational													
Rotational													
	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Reflectional													
Translational													
Rotational													

5. Perform the following transformations to the triangle ABC:

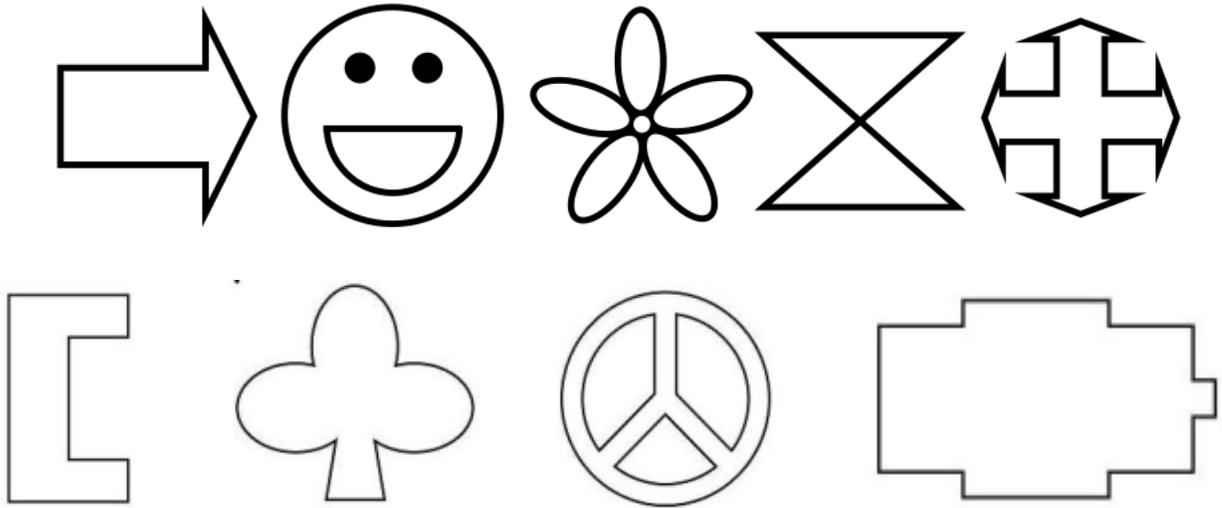


- Translation 5 units up.
- Rotate  $90^\circ$  about the point C.
- Reflection over the line BC.
- Translation 2 units right and 3 units down.

6. Determine whether the dotted line on each shape represents a line of symmetry.



7. Find all of the lines of symmetry in the following images.



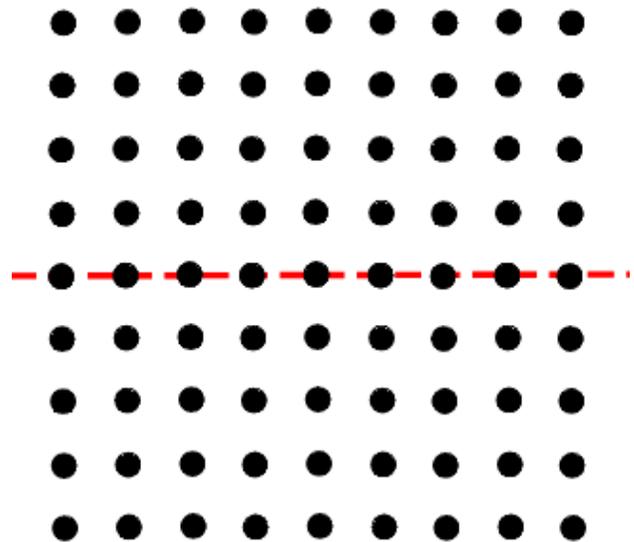
8. Draw a shape on the following grid. Then perform the following transformations:

(a) Translation 2 units left.

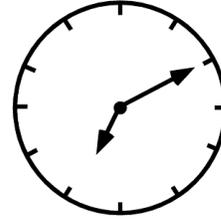
(b) Rotation  $180^\circ$ .

(c) Translation 1 unit up.

(d) Reflect using the given axis of symmetry.



9. Janet is sitting in her classroom where behind her she has a clock and in front of her is a mirror. The clock on the right, is what Janet sees when she looks in the mirror. What is the actual time?



10. Which of the following regular shapes can you make a tessellation with?
- (a) equilateral triangle
  - (b) square
  - (c) pentagon (5 sides)
  - (d) hexagon (6 sides)
  - (e) octagon (8 sides)
  - (f) decagon (10 sides)

Why can you make tessellations out of some shapes and not others?

11. Tessellate the following pattern. Once finished, try colouring it in, or creating a design.

