LESSON

5

This Looks Like That!

Years 4 to 8

Investigating Symmetry

This lesson involves students in investigating the symmetry of MATHOMAT and other shapes and using MATHOMAT shapes to create two-dimensional symmetrical shapes and patterns.

In this lesson students will:

- investigate lines of symmetry in two-dimensional shapes; and
- classify shapes according to the number of lines of symmetry.

Materials Required

For each student:

- a MATHOMAT;
- unlined paper (scrap paper will do);
- a copy of the Worksheet 5.1, Lines of Symmetry in Complex Shapes (a photocopy master is provided at the end of this lesson); and
- fine-point pens or pencils.

Additional materials:

- one overhead projector version or photocopies for each group of students of Transparency 5.1, Lines of Symmetry (a photocopy master is provided at the end of this lesson).

Lesson Summary

- Identifying lines of symmetry on MATHOMAT shapes;
- classifying shapes according to the number of lines of symmetry they have;
- completing and constructing symmetrical two-dimensional shapes and patterns; and
- identifying lines of symmetry in more complex shapes.

For the Teacher

A line (or axis) of symmetry in a figure is a line that divides the figure into two identical parts, which are mirror images of one another. Any point of the figure will have a corresponding (or image) point at an equal distance on the opposite side of the line of symmetry.

Some examples of figures which have one or more lines of symmetry are included in the Transparency 5.1, Lines of Symmetry at the end of this lesson. These can be either reproduced on an overhead projector transparency for class discussion or photo-copied for groups of students to look at and discuss.

This lesson provides opportunities for students to explore the lines of symmetry in the two-dimensional shapes on the MATHOMAT template and classify the shapes according to the number of lines of symmetry. For some shapes, the markings provided on their perimeter can be used to construct lines of symmetry. If desired, the sin/cos curve (number 31), the parabola (number 34) and the half dodecagon (number 39) can also be included here.

The 40 MATHOMAT shapes and curves include those which have no lines of symmetry (the scalene triangles), those which have one line of symmetry (the non-equilateral isosceles triangles, the trapezium, the sin/cos curve, the parabola and the half dodecagon), those which have two lines of symmetry (the ellipses, the rhombus and the non-square rectangles), those which have three, four, five, six or eight lines of symmetry (the regular polygons with the corresponding number of sides) and the circles which have infinitely many lines of symmetry. Depending on the year level, students should be encouraged to attempt to describe their results from the classification activity in general terms like that given above. This can form the basis of a valuable class discussion.

Following the classification activity, students can use their MATHOMAT to construct and create attractive symmetrical shapes and patterns, as well as identify lines of symmetry in more complex patterns.

Lesson Outline

1. Introducing lines of symmetry

Use an overhead projector transparency or photocopy of Transparency 5.1, Lines of Symmetry to introduce a class discussion about symmetry. This can also include: a discussion of everyday objects which have lines of symmetry (e.g. flowers, T-shirts when ironed flat, forks and spoons but not knives—this is stretching two-dimensions a bit); a brief investigation of the lines of symmetry of upper case letters of the alphabet; and a discussion of the fact that people's faces are NOT symmetrical. (In fact, pictures produced by using one side of a person's face and its mirror image look decidedly odd!)

Students should be aware that some shapes might have no lines of symmetry while others might have infinitely many.

2. Identifying lines of symmetry in MATHOMAT shapes

Ask students to work individually or in groups to construct lines of symmetry for each of the MATHOMAT shapes.

Students can trace MATHOMAT shapes onto paper and draw lines of symmetry onto the shapes in order to find and record how many lines of symmetry each shape has. For some shapes, the markings provided on the perimeter of the shapes on the MATHOMAT can be used to construct lines of symmetry.

3. Classifying MATHOMAT shapes according to the number of lines of symmetry

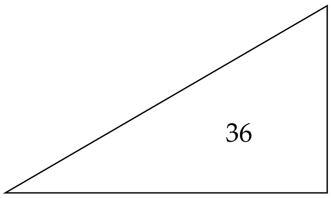
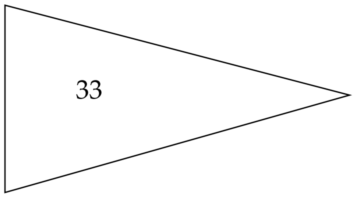
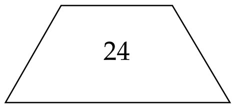
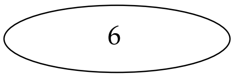
Ask students to work in groups to classify the MATHOMAT shapes according to the number of lines of symmetry.

Each group should be encouraged to record and display their results in preparation for a class discussion. Students may wish to complete a table like the one shown on the following page.

There are many different ways to produce such a table and students should be encouraged to plan how to display their results. Tracing or gluing copies of the shapes onto the table (as in the table shown)—rather than just recording the shape numbers—has the advantage that it will encourage students to recognise general properties of the shapes. However, the table required to do this will be quite large. Younger students can produce an attractive poster at this stage. Older students can classify the shapes directly from the previous part of the activity and replace the drawings in the table by their descriptions in words of the types of shapes which would be found in each cell of the table.

As soon as most groups have completed their recordings or displays, hold a class discussion to compare results and attempt to come to an agreement on the types of shapes which have different numbers of lines of symmetry. This discussion can be valuable at all year levels in developing students' ability to use conventional geometric language to describe classes of shapes.

Sample table classifying MATHOMAT shapes according to numbers of lines of symmetry

Number of lines of symmetry	Shapes
0	
1	 
2	
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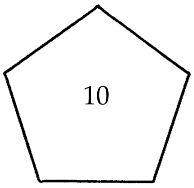
4	
5	
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7	
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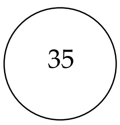
∞	

4. Identifying lines of symmetry in more complex shapes

Ask students to work individually or in groups to complete the Worksheet 5.1, Lines of Symmetry in Complex Shapes.

The first part asks students to complete diagrams showing half of a pattern which has been produced using MATHOMAT shapes and find the number of lines of symmetry for each complete pattern. The second part shows some diagrams which have been produced using a MATHOMAT and others which are photos of objects occurring in real life. Students are again asked to find the number of lines of symmetry for each diagram—of course the real life objects won't be perfect!

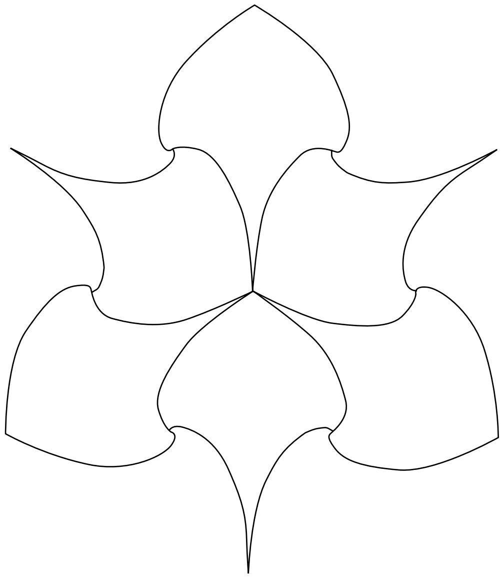
5. Creating symmetrical patterns

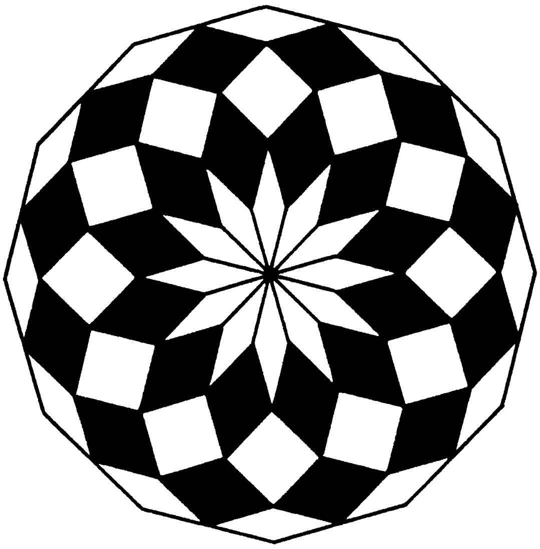
Ask students to create their own symmetrical patterns using their MATHOMAT. Older students can be asked to produce patterns with specified numbers of lines of symmetry.

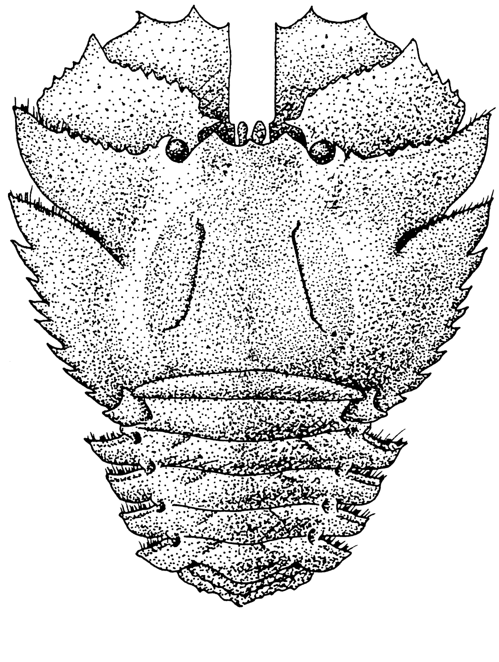
References

Williams, G. (1971). *African Designs from Traditional Sources.* Dover Pictorial Archive Series. New York: Dover Publications.

Lines of Symmetry

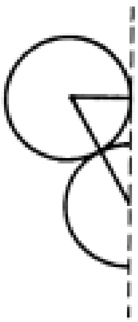
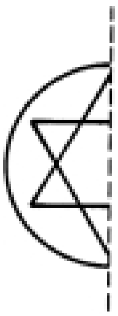
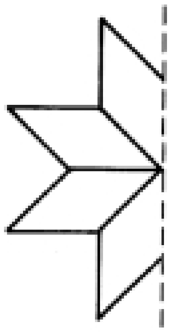




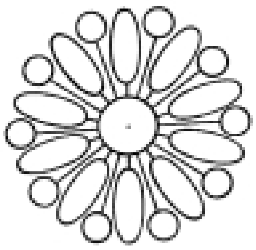
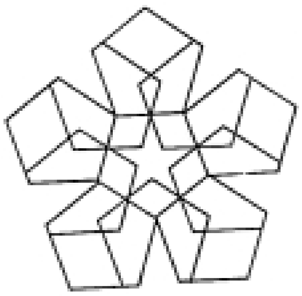
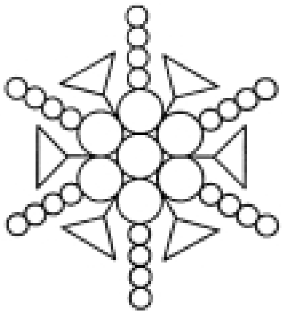


Lines of Symmetry in Complex Shapes

1. Each of the diagrams below is half of a pattern which has been produced using a MATHOMAT.
   a) Use your MATHOMAT to complete each of the diagrams below.
   b) For each of the completed patterns, find the number of lines of symmetry and record your answer in the space provided.

2. For each of the diagrams below, find the number of lines of symmetry and record your answer in the space provided.
   a) MATHOMAT DESIGN

b) REAL-LIFE OBJECTS—of course these will not be perfect!