Killara HIGH SCHOOL

**Mathematics Department**

# Year 9 Shapes and Tessellations Investigation

Date Distributed: . Date Due **Friday 7th June 2013 (electronically)**

## A Tessellations

1. Explain, **in your own words,** what a tessellation is. Follow the link below to find a definition of tessellation

http://www.math.nus.edu.sg/~mathelmr/gem-projects/maa/0203-2-03-Escher/main2.html

Explore the tessellations at:

http://www.mathcats.com/explore/tessellationtown.html

## B Regular Polygons

2. Complete the following table for regular polygons

| Number of sides, n | Name of figure | Interior angle size | Exterior angle size | Interior angle sum |
|---|---|---|---|---|
| 3 | Triangle | 60 | 120 | 180 |
| 4 | Square | 90 | 90 | 360 |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 20 | | | | |
| n | | | | |

3. Explain any patterns or trends you notice in the table.

4. Which of these regular polygons will tessellate? Why are there only three? These tessellations are called **regular**. (Hint consider the interior angle size of each polygon and a complete rotation $360^\circ$)

5. Using Google Sketchup, produce diagrams showing each of these tessellations.

   **Semi-regular tessellations** involve two or more regular polygons arranged in the same order (clockwise or anti-clockwise) about each vertex. There are 8 different semi-regular tessellations. They can be named or coded, by listing the number of sides in each of the regular polygons at each vertex.

E.g. Code: 3,4,3,3,4 represents a semi-regular tessellation with three triangles and two squares at each vertex.

Note: 4,3,3,4,3 represents the same tessellation, but 4,4,3,3,3 is different!

**There are 8 different semi-regular tessellations. How many can you find?**

6. Using Google SketchUp., produce diagrams showing at least four of the semi-regular tessellations you have discovered. You may enhance your diagrams with colour/texture .

7. Examine the symmetries in each of your diagrams. How many lines of symmetry are there? Show them. Comment on your findings.

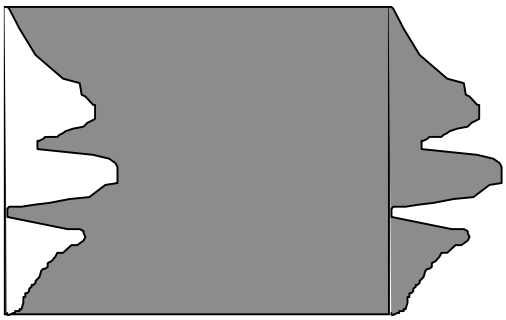
## C Non-regular Tessellations

The following activities should be done in Google SketchUp.

8. Show and justify how **any** triangle can tessellate the plane.

9. Show and justify how **any** quadrilateral can tessellate the plane.

10. In the diagram below, a section (the shape could be anything) has been cut out from one edge of a square and pasted onto the opposite edge. Show how the resultant shape can tessellate the plane.



11. Explore the above idea by producing several additional different tessellations in Google SketchUp. with all four sides distorted.

12. Find and present examples of tessellations in nature and art. The works of M.C. Escher would be a good starting point. Also, the tessellations of the Moors as found in the Alhambra Castle in Granada, Spain.

http://www.math.nus.edu.sg/~mathelmr/gem-projects/maa/0203-2-03-Escher/main.html#Introduction

## D Extensions

13. Show how non-regular pentagons with one pair of parallel sides can tessellate the plane.

14. Investigate other non-regular polygons. Under what conditions can they tessellate?