

Mathematics in the New Zealand Curriculum Second Tier

Strand: Geometry and Measurement Strand

Thread: Shape

Level: Two

Achievement Objectives:

- Sort objects by their spatial features, with justification.
- Identify and describe the plane shapes found in objects.

Exemplars of student performance:

Exemplar One: Given a set of attribute blocks the student is asked to collect all the triangles, squares and rectangles. They are able to separate these shapes into sets and describe the similarities and differences between triangles, squares and rectangles. They will focus on attributes such as sides, angles, right-angled corners, for example, "Squares and rectangles all have 4 sides and 4 right angled corners but the squares are different as all the four sides are equal length."

Exemplar Two: By walking around the school, or by looking at photographs taken of objects and buildings around the school, the student is able to identify the plane shapes within them. For example, he/she will be able to comment that the roof consists of 2 triangular shapes and 2 rectangular shapes or that the brick wall is made up of many rectangular bricks.

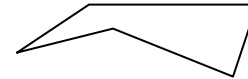
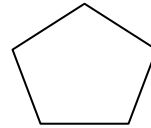
This response shows achievement at Level Two because the student is able to attend to spatial characteristics of objects, rather than just general characteristics such as colour, and is able to offer explanations for their sorting based on these attributes.

Important teaching ideas (working at):

The focus of this level is classifying collections of shapes according to their similarities and differences. Specifically students need to do this by referring to the spatial features of the shapes, rather than colour, using mathematical language such as angles, right-angled (square) corners, number of sides, shape of faces, and quadrilateral. The students should be able to sort with justification and identify common shapes including; triangle, square, circle, rectangle, pentagon, hexagon, octagon, oval, diamond, rhombus, trapezium, cube, cylinder, sphere, prism, cone and pyramid.

The students should be exposed to regular and irregular shapes. For example, the following shapes are both polygons with five sides, hence they are both pentagons.

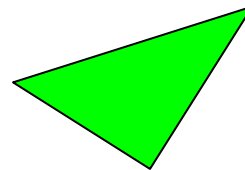
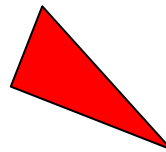
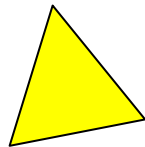
A regular pentagon



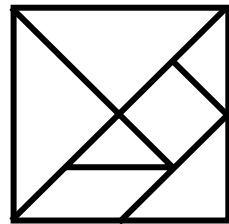
An irregular pentagon

Recognising that similar shapes all have the same features in common despite differences in other attributes like size, position and colour, involves thinking about how features of the different shapes “map onto” each other.

For example, students may not recognize the shapes below as all being triangles because they are in different positions to the normal standardized (prototypical) image but as all these shapes have 3 sides and corners, they are therefore all triangles.

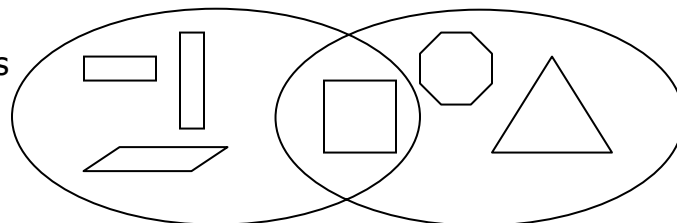


Tangram pieces can be rearranged to form specific shapes (e.g. rabbit as shown) by paying particular attention to the properties of the pieces, for example a square needs four right angled corners and sides to be equal lengths.



Students could be challenged to sort objects by isolating specific attributes i.e. number of sides, faces, or edges, thickness, size (large, small) and use sets or Venn diagrams to sort objects accordingly.

4 sides



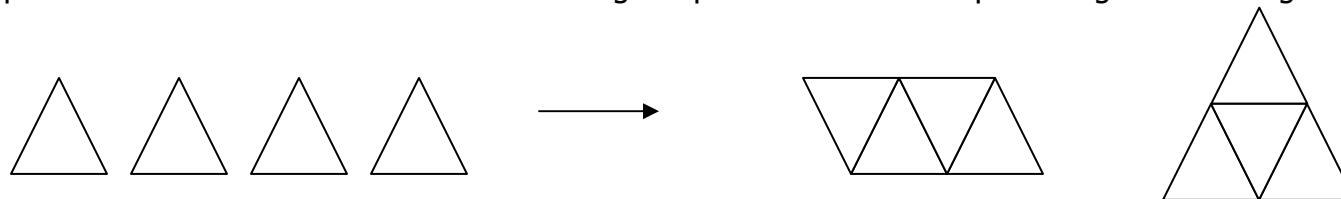
Thick shapes

Students should be able to draw pictures of simple geometric shapes as well as create two dimensional and three dimensional shapes using concrete materials such as playdough, peg boards, cubes, card and geoboards.

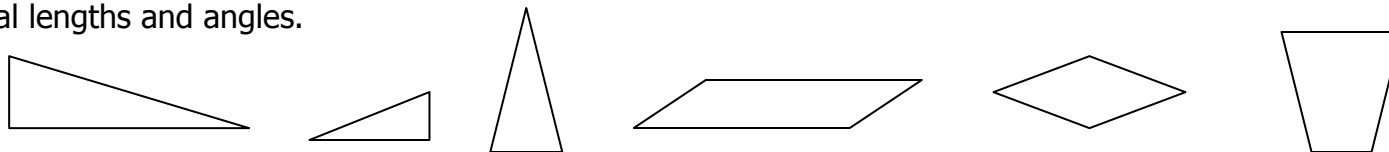
At this level students are introduced to nets. Students could imagine and draw their net (flat pattern) of a box or cylinder and then compare their drawing to when it is opened out flat. An important idea is to relate the properties of shapes to their purpose, e.g. why are wheels circular? Why are boxes rectangular prisms? (They are easier to pack and stack). Although creation of nets is an idea of Level 3, students could begin to create the nets for cuboids by wrapping and unwrapping or rolling solids, e.g. grocery packets.

As well as identifying, describing and creating shapes, students also need to capture mental images of shapes with given attributes. These can then be described and represented through drawing or constructing with concrete material. For example "Draw any quadrilateral with two equal sides". In pairs, students could take turns to describe a given shape which is shielded from their partner whilst their partner listens to the description and draws it from the image created, for example, "I have a small, thin oblong". A feely bag could also be used to describe unseen shapes for someone else to correctly image and identify. "This mystery shape is a quadrilateral. It has two long sides and two short sides."

Connections can also be made to other strands. For example, explore what new shapes are made when you cut a square into quarters or thirds (going from whole to part). Conversely go from part to whole. Begin with one piece of a shape labeled "a quarter" and create the whole i.e. four triangular pieces can create a parallelogram or a large triangle.



Similarly explore the symmetry of shapes. For example, which of the following shapes will fold in half so that the two parts will be folded onto each other exactly. To do this students will need to focus on the matching sides and corners being of equal lengths and angles.



Useful resources

Figure It Out: Geometry Level 2-3, Pages 1-13, 24 (Learning Media, Wellington)

nzmaths Website:

<http://www.nzmaths.co.nz/geometry/shape/foilfun.aspx>

<http://www.nzmaths.co.nz/geometry/shape/nowyousee.aspx>

<http://www.nzmaths.co.nz/LearningObjects/G2.aspx> (Learning objects)

Virtual Library Website Manipulatives:

http://nlvm.usu.edu/en/nav/frames_asid_270_g_1_t_3.html (Attribute Blocks)

http://nlvm.usu.edu/en/nav/frames_asid_165_g_1_t_3.html (Congruent Triangles)

http://nlvm.usu.edu/en/nav/frames_asid_277_g_1_t_3.html (Geoboards)

http://nlvm.usu.edu/en/nav/frames_asid_169_g_1_t_3.html (Pattern Blocks)

http://nlvm.usu.edu/en/nav/frames_asid_195_g_1_t_3.html (Space Blocks)

http://nlvm.usu.edu/en/nav/frames_asid_268_g_1_t_3.html (Tangrams)

Illuminations Website Manipulatives:

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=70> (Geometric Solids)

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=72> (Shape Cutter)

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=27> (Patch Tool)

<http://www.tangram.i-p.com/> (Tangram puzzles)

Book 9 Teaching Number through Measurement, Geometry, Algebra & Statistics. Learning Media, Wellington 2006. p16-21