# 2D Space (including angles) 1

<table>
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<th>Outcome</th>
<th>Notes/Future Directions/Evaluation</th>
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<td><strong>A student:</strong></td>
<td><strong>Manipulation</strong> of a variety of real objects and shapes is crucial to the development of appropriate levels of visualisation, language and representation.</td>
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<td>› describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols MA1-1WM</td>
<td>The skills of discussing, representing and visualising three-dimensional objects and two-dimensional shapes are developing in Stage 1 and must be fostered through practical activities and communication. It is important that students have experience involving a broad range and variety of objects and shapes in order to develop flexible mental images and language.</td>
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<td>› supports conclusions by explaining or demonstrating how answers were obtained MA1-3WM</td>
<td>Students need to be able to recognise shapes presented in different orientations. They need to develop an understanding that changing the orientation of a shape does not change its features or its name. In addition, students should have experiences identifying both regular and irregular shapes, although it is not expected that students understand or distinguish between regular and irregular shapes in Stage 1. Regular shapes have all sides and all angles equal.</td>
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<td>› manipulates, sorts, represents, describes and explores two-dimensional shapes, including quadrilaterals, pentagons, hexagons and octagons MA1-15MG</td>
<td>Many shapes used in Aboriginal art are used with specific meanings. Local Aboriginal communities and many education consultants can provide examples. Further exploration of such meanings could be incorporated in students' studies within the Creative Arts Key Learning Area.</td>
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**Syllabus reference:**
Hardcopy: 112
Digital: 117

shape, two-dimensional shape (2D shape), circle, triangle, quadrilateral, parallelogram, rectangle, rhombus, square, trapezium, kite, pentagon, hexagon, octagon, regular shape, irregular shape, orientation, features, properties, side, parallel, pair of parallel sides, opposite, length, vertex (vertices), angle, right angle, symmetry, line (axis) of symmetry, rigid.
Explicit Mathematical Teaching

Describe the features of three-dimensional objects (ACMMG043)

- use the terms 'flat surface', 'curved surface', 'face', 'edge' and 'vertex' appropriately when describing three-dimensional objects
  - describe the number of flat surfaces, curved surfaces, faces, edges and vertices of three-dimensional objects using materials, pictures and actions, eg 'A cylinder has two flat surfaces, one curved surface, no faces, no edges and no vertices', 'This prism has 5 faces, 9 edges and 6 vertices' (Communicating)
- distinguish between objects, which are 'three-dimensional' (3D), and shapes, which are 'two-dimensional' (2D), and describe the differences informally, eg 'This is a two dimensional shape because it is flat'
  - date the terms 'two-dimensional' and 'three-dimensional' to their use in everyday situations, eg a photograph is two-dimensional and a sculpture is three-dimensional (Communicating, Reasoning)
- recognise that flat surfaces of three-dimensional objects are two-dimensional shapes and name the shapes of these surfaces
- sort three-dimensional objects according to particular attributes, eg the shape of the surfaces
  - explain the attribute or multiple attributes used when sorting three-dimensional objects (Communicating, Reasoning)
- represent three-dimensional objects, including landmarks, by making simple models or by drawing or painting
  - choose a variety of materials to represent three-dimensional objects, including digital technologies (Communicating)
  - explain or demonstrate how a simple model was made (Communicating, Reasoning)

recognise that the name of a shape does not change when the shape changes
its orientation in space, eg a square turned on its vertex is still a square  
(Communicating, Reasoning)
  • Select a shape from a description of its features (Reasoning)
  • Recognise that shapes with the same name may have sides of equal or  
    different lengths (Reasoning)
recognise that rectangles and squares are quadrilaterals
• identify and name shapes embedded in pictures, designs and the  
environment, eg in Aboriginal art
• Use computer drawing tools to outline shapes embedded in a digital picture  
or design (Communicating)

**Introduction resource – note taken from HCC stage 2**

What is a shape? A polygon (Greek term meaning many angles) is a closed shape with  
three or more angles and sides. The angles are the focus for the general naming  
system used for shapes.
What is a regular shape? Shapes which have equal angles and sides of equal length.  
This means that a rectangle is an irregular shape. If you turn (rotate) regular shapes  
they look the same. There are many more lines of symmetry in regular shapes. There  
has to be a certain length to sides of shapes to make it a closed shape eg a triangle  
cannot be constructed from three straws if the sum of the lengths of the two shortest  
straws is less than the longest straw
Shape Word Beginnings-Discuss the fact that many shape words have a beginning  
element (sometimes a prefix) that has a specific meaning, eg poly (many), octa  
(eight), tri (three) etc
Discuss metalanguage in lessons eg Why is a pentagon called that? What does it have  
to do with the Pentagon in the US? (five sided building) What does the prefix ‘pent-’  
mean? What other ‘pent-’ words can you think of? (Pentathlon, pentominoes).Are the  
following shapes pentagons? (Yes)

Why or why not?
What makes a regular pentagon?
Extension: Can a regular pentagon have a right angle?
Repeat for octagon.

**Activities**

**Celebrity Quadrilateral.**

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Use hints about parallel sides, right angles and equal sides to identify the quadrilateral.

New Shapes from Old Shapes
Students are given a variety of regular and irregular shapes. Students are asked to:
- arrange two or more shapes to create a new shape eg combine 6 triangles to form a hexagon
- cut a square into four triangles and put the triangles together to make other shapes eg a rectangle
- cut a rectangle into two triangles and create new shapes.
Students describe and record what they have done. Some students might use fraction language in their description.

Make a new shape
In pairs students make a six sided shape using 2 pattern blocks. Demonstrate how sometimes 2 trapezia together make a hexagon and sometimes they don't. What features make them able to form hexagons?

Geoboard Shapes
Identify the attributes of hexagons, rhombuses and trapezia. What is similar? What is different?
Make the shapes on geoboards - draw and label on dot paper.
Year 2 - show these shapes in different orientations.
Make these shapes using toothpicks / popsticks / straws / computer

Sorting Shapes
Students are given a collection of regular and irregular shapes with three sides, four sides, five sides and six sides. Students are asked to sort the shapes into groups according to the number of sides. Students select one of the groups and arrange the shapes to form a picture. Students write a description of their picture, commenting on the shapes they have used.
Possible questions include:
- can you show me how to draw and name each shape?
- what can you tell me about each shape?
- how are these shapes different/the same?

Shape Symmetry - Sample Units of Work pg 77
Students find shapes that have a line of symmetry by folding the shapes in half. In pairs, they are given a collection of regular and irregular shapes that could include squares, rectangles, triangles, trapeziums, rhombuses, hexagons and circles. Possible questions include:

- which shapes can be folded in half?
- which shapes can be folded in half in a different way?
- which shapes do not have a line of symmetry?

Students glue their shapes onto paper and record their findings.

### Flags
The teacher provides a number of flags for students to investigate symmetry. In pairs, students choose flags from those displayed, determine which are symmetrical, and give reasons for their choice. In pairs, students design their own symmetrical flags and display these for others to determine the lines of symmetry.

### Alphabet Symmetry
In pairs, students cut out and fold capital letters in different ways to investigate their symmetry. They are then asked to glue the symmetrical letters onto one sheet of paper and the non-symmetrical letters onto another sheet. Some letters have more than one line of symmetry. Students compare and discuss their responses. Possible questions include:

- does any student in the class have a name with letters that are all symmetrical? eg TOM

### Lines and Shapes in the Environment
Students identify lines and shapes in the classroom and playground eg the flag pole, a telegraph pole, the edge of the roof, the edge of the floorboards. Students discuss and record their observations. They are encouraged to identify the most commonly occurring shapes, and horizontal and vertical lines.

### Weaving Lines Sample Units of Work pg 78
The teacher provides students with several strips of paper in two colours to weave together. Students identify and comment on the types of lines they have created eg straight lines, crossed lines, horizontal lines, vertical lines, parallel lines.

Variation: Students could make the loom with wavy lines.
Possible questions include:
- Can you identify and name parallel, vertical and horizontal lines?

Corners as Angles Sample Units of Work pg78
Part A
Students use one corner of a large cardboard square or rectangle to find other corners of the same size eg the corner of the classroom, the corner of a book. They then find angles that are smaller or larger than the corner of the square.

Part B
In pairs, students are given a selection of regular shapes including squares, rectangles, and triangles to compare the angles at the corners by superimposing one over the other. They could sort the shapes according to the size of the angles eg the same as a square, larger than a square, smaller than a square. Students then discuss and record results.

Geoboard Shapes and Angles
In pairs, students use geoboards and elastic bands to create shapes and discuss which shapes have the most sides and the most corners. Students investigate angles on the geoboard and compare the number of sides and corners of the shapes they have created. Students transfer shapes to dot paper and record the name of the shape, the number of sides and the number of corners.
Possible questions include:
- How can you describe the angles at the corners of each shape?
- Are the angles at the corners of each shape the same or different?
- What happens when you place an angle from a square on top of an angle at the corner of a hexagon?
- Can you describe the difference?

Angle Hunt
In pairs, students find angles around the room that are larger, smaller or the same size as an angle tester made from cardboard or geostrips. Results could be recorded in a table.

Creating Angles - Sample Units of Work pg79
Students construct a variety of angles using cardboard strips or geostrips. Students are asked to make:
- an angle and then make one that is smaller and one that is larger
- an angle that looks like the corner of a square
- angles of the same size but with arms of various lengths
- an angle that looks like one made by another student.

Results can then be recorded in a table.