DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES

Geometry – Shape and Space

Level 3 (Year 5/6)

Teacher Booklet

Level 3 Year 5/6: Geometry – Space and Shape

Task 1	1. Can you sort these shapes into different groups? As you sort them, talk with your group about what you notice about them. What properties do they have that are the same? Different? 2. Randomly place a shape in the middle. Take turns to find other shapes which have properties the same as the first shape. The rule is that you have to name the properties of each new shape as it is added, and the properties that match the first shape. Do this again, starting with a different shape.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-3:** Sort objects by their spatial features, with justification. **GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Identify and sort shapes in a range of different ways using geometrical language to explain and justify grouping. • Sort and classify plane shapes using geometrical language. • Describe number of sides and angles, angle size, equal or unequal side length.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid.
Sharing back/Connect	Select students to share who have used different properties to group the shapes. **Connect:** We can put all these shapes together and call them rectangles. What properties do they all have in common?

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	What properties do all rectangles have?
Teacher Notes	• Have sets of shapes cut and available for students to use for grouping and regrouping. (See Copy Masters booklet). • Have students complete the first activity and discuss before moving to the second activity. • Facilitate the students to notice that shapes fall into classes of shapes. This is a marker for Level 1 for Van Hiele. By placing focus on a class of shapes, for example rectangles, they should be able to describe what makes a rectangle a rectangle. (four sides, opposite sides parallel, opposite sides same length, four right angles, congruent diagonals). • Monitor for students who use sophisticated descriptions of shapes and revoice using geometric terms. (For example, if a student says square corners revoice as right angle) • Notice students who use terms to describe classes of shapes. For example, the term rectangles to mean not just the shape in hand but all shapes which have the same properties which make them rectangles. • For the independent task, have available paper copies of shapes or classroom shapes available.
Independent Tasks	Use the shapes to do a 'secret sort'. Create a collection of about five shapes using a 'secret' rule (that only you know). Now challenge others to find more shapes with the same properties to add to the set and guess what your 'secret' rule was.
Anticipations	

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Task 2	Junior is playing a game with his sister. He says "I drew a shape with 4 sides. You draw what my shape might look like." Each person in your group draw the shape you think his sister drew, and compare it with other children in your group. What properties do you notice are the same in all the shapes you drew and what are different? As a group draw other shapes with 4 sides which she might have also drawn. Your challenge is to make sure that as a group you have drawn 7 different 4-sided shapes and can explain and justify the properties that are the same and the properties that are different.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-3:** Sort objects by their spatial features, with justification. **GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Draw objects that can take the form of plane views. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid.
Sharing back/Connect	Select students to share who have drawn almost all the 7 different types of quadrilaterals and can identify the properties which are the same and different. **Connect:**

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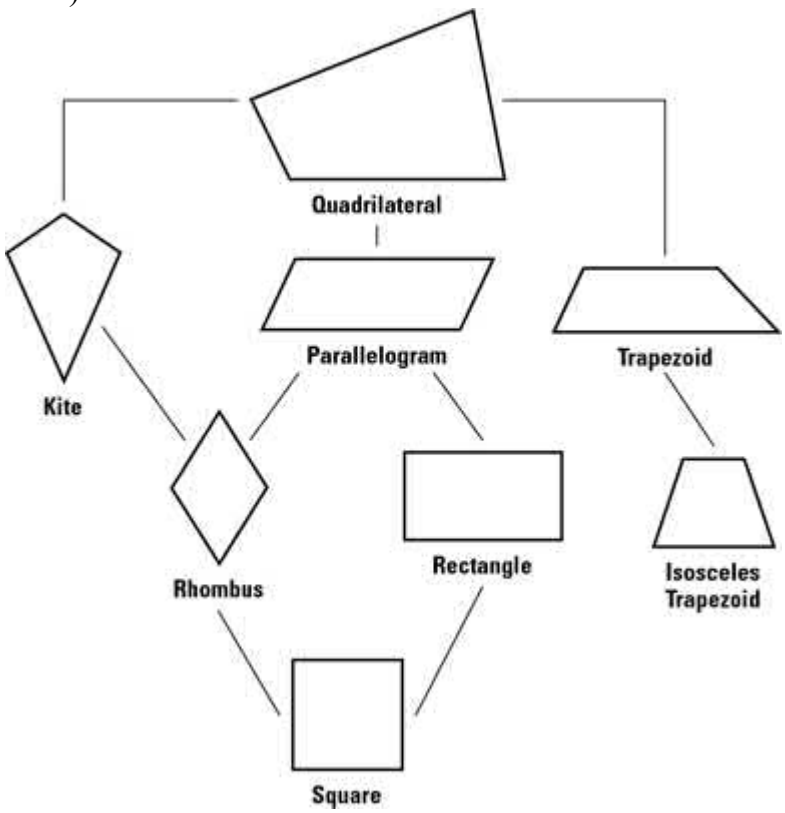
	If your sister asked you to explain what squares are, what would you say? What about if she asked you what the difference was between squares and rectangles. What would you say?
Teacher Notes	• During the launch, use 2D shapes and 2 hoops. With the students develop a Venn diagram of shapes which share common properties. For example, in one hoop have shapes which have parallel sides. In the other hoop have shapes which have right angles. • Have 2D shapes for students to work with (See Copy Masters booklet, Task 1). • Facilitate the students to notice that all quadrilaterals have 4 sides, and 4 angles but these are different according to their special case of quadrilateral. Here are the 8 types of quadrilaterals (See Copy Masters booklet for printable chart).  • Notice students who use more generalised terms, i.e. rather than referring to one triangle talking about triangles. • For the independent task, have available short sticks of the same length.
Independent Tasks	1. Make 2 squares with your sticks. How many sticks did you need? 2. Make a rectangle with the sticks which is made up of 2 squares joined together.

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	3. Make 4 squares with your sticks. How many sticks did you need? 4. Make a 2 by 2 large square with the sticks which is made of 4 squares joined together to make one large square. How many sticks did you need this time? Why do you need less? 5. On your paper draw without looking at the picture a rectangle made of 2 squares. 6. On your paper draw without looking at the picture a 2 by 2 large square made up of the 4 smaller squares.
Anticipations	

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Task 3	Ready to be a shape sorter? You will need to be because the word polygon is from Greek and poly means many! Here you have a set of polygons all mixed up. With your group can you sort these polygons into different groups by their properties. What do you notice about their properties? Can you come up with a list of attributes you have decided are shared by **all** the polygons each set? As a shape sorter be ready to explain and justify your list of attributes shared by the polygons in each set. What about across the whole set of polygons?
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-3:** Sort objects by their spatial features, with justification. **GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Draw objects that can take the form of plane views. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon.
Sharing back/Connect	Select students to share who are able to sort and classify according to the properties of polygons.

Connect:

We know that polygons are 2D shapes but what would you say if someone told you that **all** 2D shapes are polygons?

As part of your argument be ready to explain and justify a description of polygons.

Teacher Notes

- During the launch, have a long piece of elastic. Begin by standing 3 students up inside the elastic at an equivalent distance from each other. Have students draw the shape and discuss the properties of the shape. Continue adding children and repeating the drawing and discussion.
- Have an elastic band and sets of the polygons ready for sorting and grouping. These can be either as 2D wooden blocks or card representations (See Copy Masters booklet, Task 1).
- Facilitate the students to notice that all polygons are 2D closed plane figures with three or more sides that are all straight. Poly means many and that there are infinite number of polygons, some as listed below

Polygon	No. of Sides	No. of Diagonal	No. of vertices	Interior Angle
Triangle	3	0	3	60
Quadrilateral	4	2	4	90
Pentagon	5	5	5	108
Hexagon	6	9	6	120
Heptagon	7	14	7	128.571
Octagon	8	20	8	135
Nonagon	9	27	9	140
Decagon	10	35	10	144
Hendecagon	11	44	11	147.273
Dodecagon	12	54	12	150
Triskaidecagon	13	65	13	158.308
Tetrakaidecagon	14	77	14	154.286

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<tr><td></td><td>
<table>
<tr><td>Pentadecagon</td><td>15</td><td>90</td><td>15</td><td>156</td></tr>
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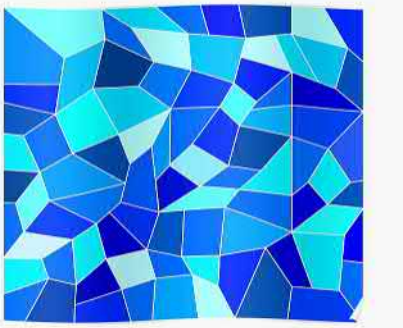
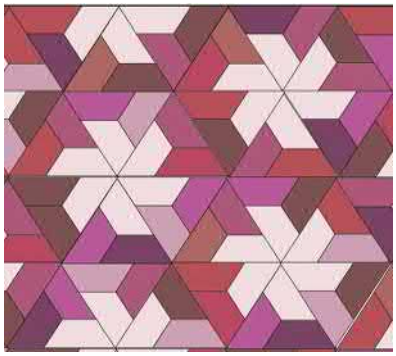
Notice students who identify the number of sides of the polygon, the angles between the sides of the polygon and the length of the sides of the polygon. Use their observations to name them as regular or irregular.
For the independent task, have the following sheet prepared.

</td></tr>
<tr><td>Independent Tasks</td><td>Look at the geometric patterns on some wrapping paper.
  
What do you notice about all the shapes on the wrapping paper that are the same? That are different?

Mason says that he can see lots of different shapes and they all have different names, but they are also all called quadrilaterals. Can you explain why Mason said that?

Can you find the different sorts of quadrilaterals in the design? How are they the same? How are they different from other quadrilaterals?</td></tr>
<tr><td>Anticipations</td><td></td></tr>
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Task 4	Today as a shape sorter you are going to sort a special sort of polygons. Your challenge is to sort the whole set into three groups. But wait! There is an important rule you need to follow as you do this. **No triangle is allowed to belong to two groups.** When you have sorted them into three groups record the properties of each group. Now start again. Re-sort the set into another three groups which are different from your first set. Record the properties of this new group.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Draw objects that can take the form of plane views. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who can explain and justify their groupings of triangles according to their properties.

	Connect (See Copy Masters booklet for printable ngatu**):** Are all the three-sided shapes on this piece of ngatu triangles? Why or why not? Be ready to explain and justify your answer using all the three sided figures on this piece of ngatu.  How could you give a description that covers all the properties of triangles?
Teacher Notes	• During the launch, challenge the students with a "Can you make it?" activity in which they draw what is described. A shape with only one square corner and four sides. A shape with two square corners A shape with two lines of symmetry A shape with two pairs of parallel lines A shape with two pairs of parallel lines and no right angles • Have the sets of the different triangles cut out and available for the students to sort (See Copy Masters booklet). • Facilitate the students to notice that triangles are classified by their sides and/or their angles.

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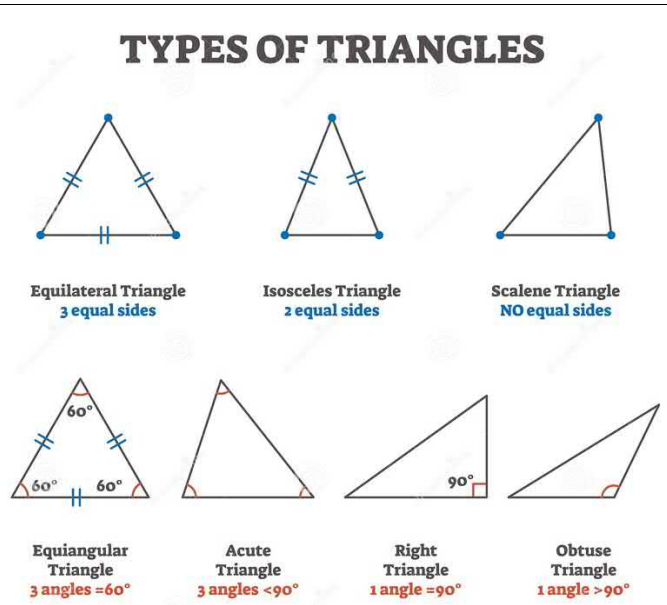

- Notice students who use the term triangles rather than the singular triangle. The use of the plural denotes that they are able to generalise what makes all triangles, triangles.
- For the independent task, have the following sheet prepared (See Copy Masters booklet).

Independent Tasks

Regular polyhedrons are shapes that have all sides equal in length and all inside angles are equal.

Irregular polyhedrons are 2-D shapes that have straight sides that are not equal to each other and angles that are not equal to each other.

Fill in the missing details. Draw examples of what the following might look like.

Number of sides & angles	**Name**	**Draw an example of regular polygon**	**Draw an example of irregular polygon**
3	Triangle		
3	Triangle		
	Kite		
4	Quadrilateral		
5	Pentagon		
	Hexagon		
	Square		

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	7			
		Octagon		
		Nonagon		
	10			
Anticipations				

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Task 5	Talk with your buddy about what you notice about the shape of these different things. Can you sort them into groups which you think are the same? Can you sort them into groups which you think are different? Be ready to explain and justify why you sorted them into the different groups.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Explain how solid shapes have fixed-cross sections and can be classified by their cross-section. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who can explain and justify using everyday language and the language of geometry how the different objects are the same and/or different.

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	Connect: Someone said that all 3D shapes are made from 2D shapes. How would you respond to that? Think about the attributes of a square and the attributes of a cube. How are these related? Could any other 2D shape be used to construct a cube? Why or why not?
Teacher Notes	• Provide students in groups with a collection of structured 3D shapes and a collection of common objects from their environment and have them talk with each other about what they notice about them (See Copy Masters booklet). Then have the students sort the objects into groups that are the same and have them justify why they are the same. Repeat with how they are different. • Have available a large collection of common objects including some that are similar to cubes, cuboids, cylinders and spheres (e.g., boxes, dice, cans, balls, glad wrap roll, building blocks, Lego) • Facilitate the students to notice 3D aspects of the shapes including flat faces, curved faces, faces form an edge, corner, vertices when they come together, horizontal and vertical lines etc. Also notice that objects which are shaped like balls have a single curved surface. They are called a sphere; objects shaped like a can or glass jar have two circular ends and a curved surface between them and are called cylinders; objects shaped like bricks and dice have 6 rectangular faces and are called cuboids.- • Monitor for students who recognise that 3D shapes are solid shapes or figures that have three dimensions. Generally, length, width, and height are the dimensions of 3D shapes. Have students recognise the relationships between these aspects • For the independent task, have available the task below.
Independent Tasks	 What do you notice about the three-sided shapes on the ngatu? Are all the three-sided shapes on this piece of ngatu triangles?

	Why or why not? Explain and justify your reasoning for all the three-sided figures on this piece of ngatu. Represent a description that covers all the properties of triangles.
Anticipations	

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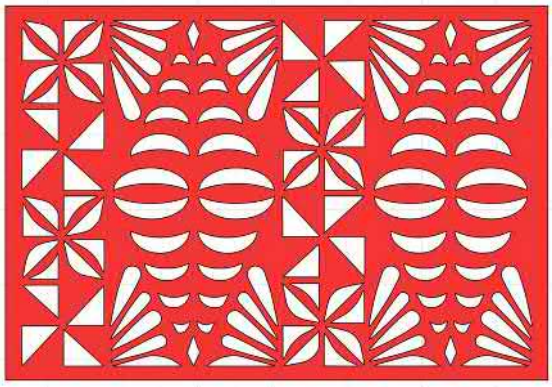
Task 6	When the box makers were designing these cuboids, they drew a 2D representation of their net. What 2D shapes did they draw? Look carefully at one of the cuboids and imagine what it would look like flattened out as a net. Talk to your buddy about how many faces it will have and how many will be congruent. Draw what you think it will look like as a net. Remember that when you fold the net up it needs to make a 3D cuboid and so you need to draw all the faces.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Create 2-dimensional drawings of 3-dimensional models. • Draw objects which can take the form of plane views of nets. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who are able to explain and justify the attributes of a cuboids and can approximate these as a net. **Connect** (See Copy Masters booklet for nets resource):

	Predict which of these nets will fold and make a cuboid. What attributes are important to make a net for a box shaped like a cuboid?
Teacher Notes	• During the launch, use the geometric quick images (See quick images PDF for ideas). • Have available a wide range of cuboid shaped boxes collected from home. • Tell the students not to draw the flaps just the faces. This activity will need to be repeated so that they have the opportunity to get closer and closer to drawing the net. As they complete an iteration have them open the box and compare their net with the net of the box. • Facilitate the students to notice that despite the different dimensions of the boxes they all have six rectangular faces, and the opposite faces are congruent (the same). Note also that all corners are square (right angles). • Notice the students who are able to draw six faces and approximate a net for a cuboid. These students will often be different from those who are able to compute. Also notice the students who use gesturing for the number of faces needed. • For the independent task, have the following available (See Copy Masters booklet).
Independent Tasks	What do you notice about the pattern on this Polynesian material? Are all the three-sided shapes triangle? Why or why not? What are the attributes or properties of a triangle? What attributes are the same? What attributes are different? Have some triangles only got one attribute the same? Have some triangles only more than one attribute the same? 
Anticipations	

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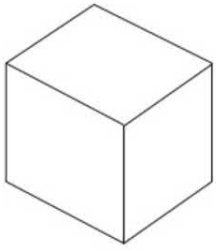
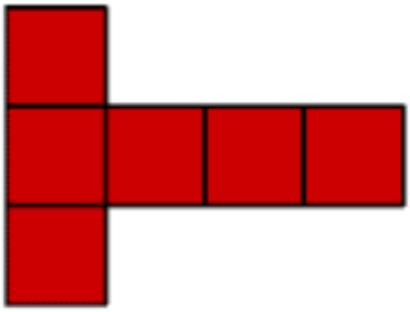
Task 7	Your class has an opportunity to sell lucky dip prizes at the local Night Market for a fundraiser. The prizes will be put in a box that looks like this and children will lift the flap and choose a parcel:  In your group discuss and justify whether the net drawing below would make the box.  Can you draw at least 3 different nets which will also make the box. Be ready to prove that they all work.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Create 2-dimensional drawings of 3-dimensional models. • Draw objects which can take the form of plane views of nets. • Use commonly shared rules to communicate ideas about defining shapes.

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	• Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who are able to explain and justify the attributes of a cuboids and can approximate these as a net. **Connect:** Predict which of these nets will fold and make a cuboid. What attributes are important to make a net for a box shaped like a cuboid?
Teacher Notes	• Have cardboard, scissors, and Sellotape available and encourage the students to use the inside of these to test out their different nets. Have different templates for cubes, some which will work and some which will not work (See Copy Masters booklet, Task 6 best printed on A3). • Notice students who use gesturing to represent the six faces and their attention to ensuring that they have congruent faces. • Facilitate students to notice the need to attend to width, length and height as the attributes. • For the independent task, have available cardboard boxes for the students to use to draw nets from.
Independent Tasks	Look closely at the box you have chosen. Draw what you think it will look like as a net. Do not draw the flaps just the faces. Remember that when you fold the net up it needs to make a 3D cuboid and so you need to draw all the faces. When you have finished drawing the net undo your box and compare its net with the net you drew. Keep redrawing the net until you have got it correct.
Anticipations	

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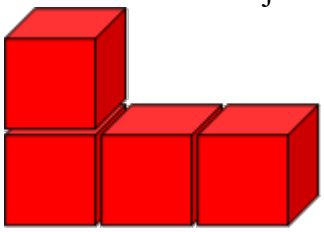
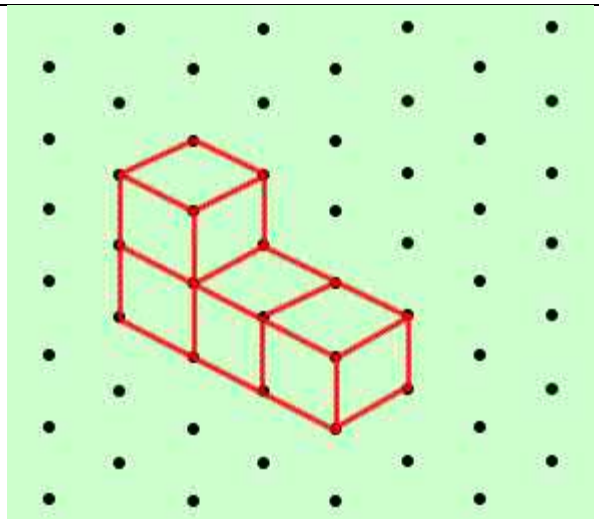
Task 8	Whittaker's chocolate company have a competition currently running for schools around New Zealand. Schools are competing to see who can design the best packaging for a new series of chocolate that they have created. Work in your group to design at least two different nets for each chocolate bar below.  Make sure that you can all explain and justify why the nets you designed would be suitable for each different chocolate bar.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Create 2-dimensional drawings of 3-dimensional models. • Draw objects which can take the form of plane views of nets. • Use commonly shared rules to communicate ideas about defining shapes. • Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right

	angle, rhombus, parallelogram, kite, trapezoid, isosceles trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who are able to explain and justify the attributes of the different nets for the different shapes they have constructed. **Connect (See Copy Masters booklet):** Here are some soccer balls.  Imagine you had to draw the net of a soccer ball. What 2D shapes would you use? How many of each would there be?
Teacher Notes	• During the launch use the geometry quick images. • Facilitate the students to notice that you need to consider the height, length and width of 2D shapes to make 3D shapes. Have students consider how the angles change according to the shapes. • For the connect have students discuss what they notice. A ball is spherical, it's shaped like a sphere-a 3D version of a 2D circle. Traditional soccer balls are made from two 2D shapes, pentagons and hexagons as part of their 32 panel design. • For the independent task, have dotty paper available and interlinking cubes or similar (See Copy Masters booklet).
Independent Tasks	Here are four cubes joined together.  Here is what they look like drawn on dotty paper

	 How many other ways can you arrange the cubes? When you complete the arrangement draw what they look like on dotty paper.
Anticipations	

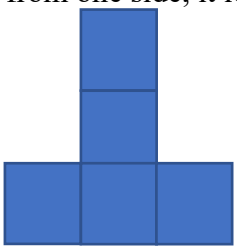
Level 3 Year 5/6: Geometry – Space and Shape

Task 9	Ready to be a constructor? Your challenge is to build a shape with nine cubes. It has to be at least two cubes wide and at least two cubes tall. It also has to be symmetrical. Can you build another one with the same requirements which is a different shape? Are there anymore you could build with the same requirements? If you have run out of ideas, you can develop another challenge for other constructors. You can change the number of cubes and the other requirements, but the shape must still be symmetrical. Explore and build first and then write the instructions.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
Learning Outcomes: Students will be able to:	• Use geometrical language to explain and justify classification and properties of shapes. • Describe number of sides and angles, angle size, equal or unequal side length. • Create 2-dimensional drawings of 3-dimensional models. • Draw objects which can take the form of plane views of nets. • Use commonly shared rules to communicate ideas about defining shapes. Identify and explain relationships between shapes, including similarities and differences.
Mathematical language	Properties, square, rectangle, attribute, 2-dimensional, 3-dimensional, shape, side, equal, size, smaller than, straight, parallel, congruent, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, sphere, cylinder, cube, cuboid, rectangular prism, triangle, quadrilateral, hexagon, equilateral triangle, square corner, right angle, rhombus, parallelogram, kite, trapezoid, isosceles

Level 3 Year 5/6: Geometry – Space and Shape

	trapezoid, polygon, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle
Sharing back/Connect	Select students to share who have constructed the structures and developed an alternative set of instructions. **Connect (See Copy Masters booklet for photos of buildings):** Can you describe some buildings around you using geometric language? Could you argue that most buildings have symmetry?
Teacher Notes	• Have linking cubes or other cubes available. • Facilitate the students to notice that symmetry extends into three dimensions. This is important because this is relevant to the world that they live in and positions Geometry as part of their lived lives. • For the independent task, have the following available (See Copy Masters booklet).
Independent Tasks	Look at this siapo. Make a table and describe all the attributes of the different geometric shapes you see. 
Anticipations	

Level 3 Year 5/6: Geometry – Space and Shape

Task 10	Constructors ready for another challenge? Here is a shape made with linking cubes. When you look at it from one side, it looks like this.  What do you think the whole structure looks like? Before you explore and experiment with your cubes can you visualise what you think it looks like. Make a drawing of what you think it might look like and then build it with the cubes.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
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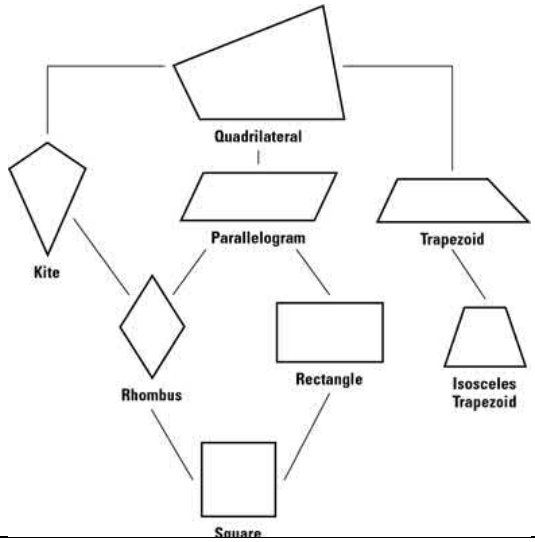
Sharing back/Connect	Select students to share who have realised that there can be more than five cubes and have drawn and built structures to match. **Connect (See Copy Masters):** Draw two pictures of this box that look different  Be ready to describe each view using the language of geometry.
Teacher Notes	• Have linking cubes or other cubes available. • Facilitate the students to notice the multiple perspectives of structures. Some students will assume that the structure has only the five obvious cubes in it whereas others will realise that there are more possibilities with additional cubes which cannot be seen from this view. • Monitor for students using vocabulary which identifies relationships between the different perspectives • For the independent task, have the following sheet ready (See Copy Masters booklet).
Independent Tasks	What do you notice about the shapes below? Write down everything you notice about their sides and angles. List all of the places you could find these shapes. Describe how they are used. 

Level 3 Year 5/6: Geometry – Space and Shape

Anticipations	

Level 3 Year 5/6: Geometry – Space and Shape

Task 11 (optional)	Young children love unwrapping presents, don't they? But with global warming we need to save paper. So, your challenge is to draw the net of the wrapping paper you need to wrap the box. But you are not allowed to have one piece of paper overlapping any other piece of paper. First build the box you want to wrap. Use 27 multilink cubes to make a 3 by 3 by 3 cube and use this as your box to wrap. How many different designs could you use? Ready for the next level of challenge? Use more multilink cubes to extend one end of the cube so that you now have a cuboid. How many different designs could you use? Too easy? Okay, what about extending the cube in two different directions? How many different designs could you use? As a group be ready to explain using the language of geometry what changed in your nets as you changed the shape of the boxes.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
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Sharing back/Connect	Select students to share who can explain and describe using the language of geometry how the nets changed as the boxes changed shape **Connect:** Develop an explanation you would give of how to find the net of a cuboid.
Teacher Notes	• Have multilink cubes available and paper and card if needed. • Facilitate the students to notice the similarities and differences between what changes as they change the shapes from cubes to cuboids. • For the independent task, you will need the picture of the box below (See Copy Masters booklet).
Independent Tasks	Draw two pictures of this box that look different Label everything you can. Describe each view using the language of geometry. 
Anticipations	

Level 3 Year 5/6: Geometry – Space and Shape

Task 12 (optional)	You have all shown yourselves as fantastic geometry puzzle solvers. So, first you have some puzzles to solve and then it is your turn to write puzzles for others. 1. None of the pattern blocks in the row touch each other, and none of the shapes are congruent to any other in the row. Make the row of pattern blocks. 2. The pieces at the end of the row are not quadrilaterals, but there are two rhombuses (rhombi) in the middle of the row. Make the row of pattern blocks. 3. The piece of the left has the largest number of acute angles of any piece. The piece on the right has more obtuse angles than any other. Make the row of six pattern blocks. 4. The two pieces on the left end of the row are both regular- they have equal angles in every corner. Make the row of six pattern blocks. 5. The trapezoid is next to the piece that has the smallest angles. Make the row of pattern blocks. Your turn now to make different pattern rows and then write them as a puzzle for others to solve.
Big ideas	Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes. Shapes have sides that are parallel, perpendicular, or neither. Shapes have line symmetry, rotational symmetry, or neither. Shapes are similar, congruent, or neither.
Curriculum links	**GM2-4:** Identify and describe the plane shapes found in objects. **GM3-3:** Classify plane shapes and prisms by their spatial features. **GM3-4:** Represent objects with drawings and models. **GM4-5:** Identify classes of two-and-three-dimensional shapes by their geometric properties. **GM4-6:** Relate three-dimensional models to two dimensional representations, and vice versa.
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Level 3 Year 5/6: Geometry – Space and Shape

	• Identify and explain relationships between shapes, including similarities and differences.
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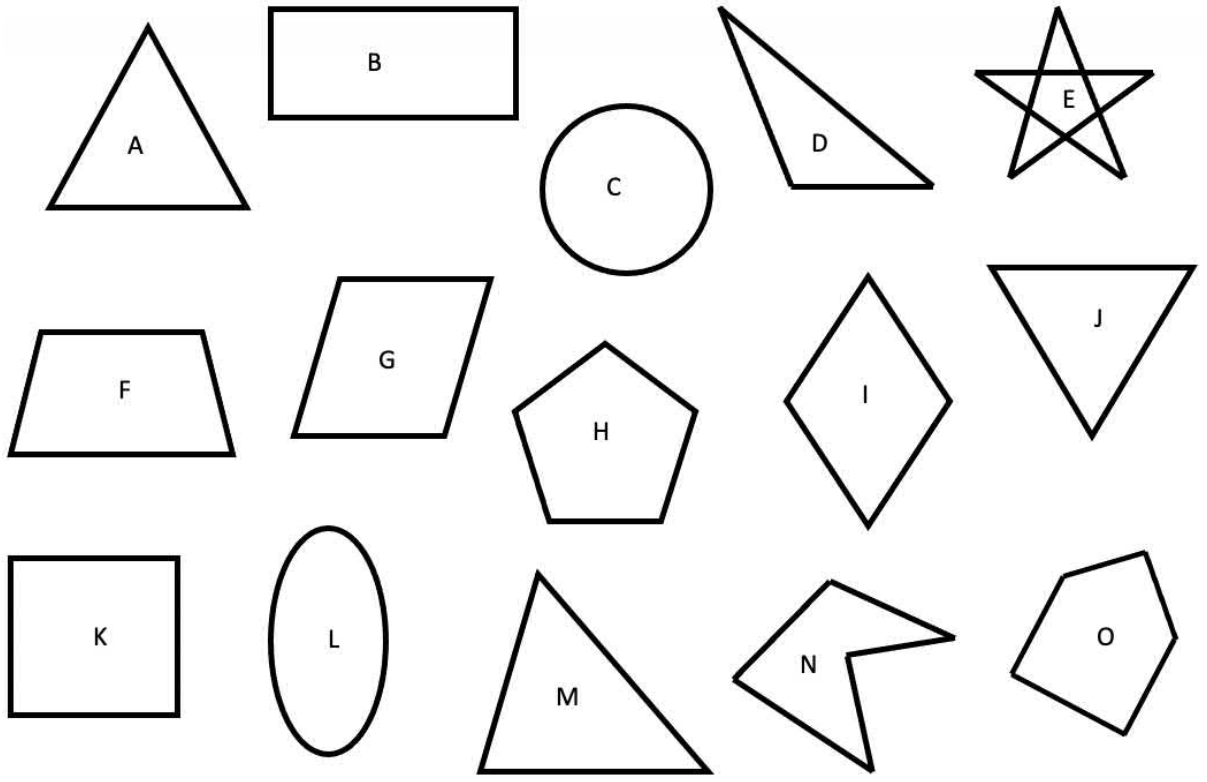
Sharing back/Connect	Select students to share who can explain and justify the relationships between the 2D shapes. **Connect:** Describe the relationships between sets of shapes (for example, triangles and quadrilaterals).
Teacher Notes	• Have sets of 2D shapes available (See Copy Master booklet, Task 1). • Facilitate the students to notice the relationships they can describe between the different shapes. • For the independent task, students complete the assessment task.
Independent Tasks	Complete the one of the following assessment tasks (attached at the end of the document) as the independent activity: • GS5A : Geometry – Shape • GS8 : Geometry - Shape
Anticipations	

DMIC

DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

GEOMETRY: SHAPE: LEVEL 3-4 Task GS5A

Here is a set of shapes. Sort them into groups and provide a description of the properties of the groups using geometrical language. This could include types of lines, angles, and sides.



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DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

GEOMETRY: SHAPE: LEVEL 3-4 Task GS8

At school prize-giving all the students will receive a gift presented in a square or rectangle box. Draw as many different nets as you can for the boxes.