### Overview

#### Small Steps

- Recognise 2-D and 3-D shapes
- Count sides on 2-D shapes
- Count vertices on 2-D shapes
- Draw 2-D shapes
- Lines of symmetry
- Sort 2-D shapes
- Make patterns with 2-D shapes
- Count faces on 3-D shapes
- Count edges on 3-D shapes
- Count vertices on 3-D shapes
- Sort 3-D shapes
- Make patterns with 3-D shapes

### NC Objectives

- Identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line.
- Identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces.
- Identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid.]
- Compare and sort common 2-D and 3-D shapes and everyday objects.
Before learning about their properties, children need to recognise and name both 2-D and 3-D shapes and to be able to differentiate between them. They begin to understand that 2-D shapes are actually flat and the manipulatives they handle in class are representations of the shapes. Children also need to be able to recognise 2-D shapes in different orientations and proportions.

What is the difference between a 2-D and 3-D shapes?
What shape is this? If I turn it around, what shape is it now?
Can you draw around any of the faces on your 3-D shapes?
Which 2-D shapes can you make?

Put a combination of 3-D shapes in a feely bag. Can you find the cube, the cone, the cylinder? What do you notice about each shape?
How did you know that was the right shape?
What were you feeling for?

Go on a shape hunt around school.
Create a tally of the shapes you see.
Can you see any pentagons?
Can you see any octagons?
Can you see any hexagons?
What was the most common shape?
Which shape is the odd one out? Explain why.

The square is the odd one because it is the only 2-D shape or flat shape.

I'm thinking of a 2-D shape with more than 3 sides.

What shape could Whitney be thinking of?

Are there any other shapes it could be?

What shape is Whitney definitely not thinking about? How do you know?

Use true or false to say which shapes are triangles.

True, false, true, true, true, false, false, false.

Possible examples: square, rectangle, pentagon, hexagon, octagon. Whitney is not thinking of a triangle because it only has 3 sides.
Children should be encouraged to develop strategies for accurate counting of sides, such as marking each side as it has been counted.

Children also need to understand that not all same-sided shapes look the same, such as irregular 2-D shapes.

**Mathematical Talk**

What is a side?

How can you check that you have counted all the sides?

Do all four-sided shapes look the same?

Why do you think the shapes have the names that they do?

**Variety Fluency**

- Match the shapes to the number of sides.
  - Six
  - Four
  - Three

- Colour the four-sided shapes.

- Complete the table.

<table>
<thead>
<tr>
<th>Name</th>
<th>Shape</th>
<th>Number of sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentagon</td>
<td><img src="image1" alt="Pentagon" /></td>
<td>5</td>
</tr>
<tr>
<td>Rectangle</td>
<td><img src="image2" alt="Rectangle" /></td>
<td>4</td>
</tr>
<tr>
<td>Square</td>
<td><img src="image3" alt="Square" /></td>
<td>4</td>
</tr>
<tr>
<td>Triangle</td>
<td><img src="image4" alt="Triangle" /></td>
<td>3</td>
</tr>
<tr>
<td>Hexagon</td>
<td><img src="image5" alt="Hexagon" /></td>
<td>6</td>
</tr>
</tbody>
</table>
### Count Sides on 2-D Shapes

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Here are 18 lollipop sticks. How many hexagons can you make?</th>
<th>Using one stick per side: 3 hexagons, 2 octagons with 2 lollipop sticks spare, 6 triangles, 4 squares or 3 pentagons. May also create shapes with more than one stick on each side.</th>
<th>If I put these shapes into order from the smallest number of sides to the largest, which shape would come third?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many octagons can you make?</td>
<td>Mo makes a rectangle using the sticks.</td>
<td>Where would a hexagon come in the list? Why?</td>
</tr>
<tr>
<td>What other shapes can you make with 18 lollipop sticks?</td>
<td>Mo could make 3 rectangles using 6 sticks. Talk about how rectangles can look differently.</td>
<td>triangle, quadrilateral, pentagon, octagon</td>
</tr>
<tr>
<td>Mo makes a rectangle using the sticks. How many identical rectangles could he make with 18 sticks? Make your own rectangle. How many sticks did you use? Is your rectangle the same as your friend's?</td>
<td></td>
<td>The pentagon would be third.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A hexagon would come after the pentagon and before the octagon because it has 6 sides which is more than 5 and less than 8.</td>
</tr>
</tbody>
</table>
Children are introduced to the terms vertex and vertices. They understand that a vertex is where two lines meet at a point. They recognise that corners are vertices and will be able to identify and count them on shapes.

Ensure from this point forwards the word vertex is used in place of corner throughout all content.

**Mathematical Talk**

Show me a vertex.
Can you identify the vertices in this shape?
Would this be a vertex? Explain why.
If my shape has ___ vertices, what could my shape be?
What couldn’t it be?

### Count Vertices on 2-D Shapes

<table>
<thead>
<tr>
<th>Name</th>
<th>Shape</th>
<th>Number of vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentagon</td>
<td><img src="image" alt="Pentagon" /></td>
<td>5</td>
</tr>
<tr>
<td>Rectangle</td>
<td><img src="image" alt="Rectangle" /></td>
<td>4</td>
</tr>
<tr>
<td>Square</td>
<td><img src="image" alt="Square" /></td>
<td>4</td>
</tr>
<tr>
<td>Triangle</td>
<td><img src="image" alt="Triangle" /></td>
<td>3</td>
</tr>
<tr>
<td>Hexagon</td>
<td><img src="image" alt="Hexagon" /></td>
<td>6</td>
</tr>
</tbody>
</table>

**Varied Fluency**

- Match the shapes to the number of vertices.
  - Six
  - Four
  - Three

- Colour the shapes with 4 vertices.
- Complete the table.
Amir says:
My shape has half the number of vertices as an octagon.

What shape could he have?

Put these shapes in order based upon the number of vertices they have.

<table>
<thead>
<tr>
<th>Square</th>
<th>Rectangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle, rectangle, pentagon, hexagon</td>
<td></td>
</tr>
</tbody>
</table>

Jack has created a pattern using shapes.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How many vertices does each step in the pattern have?

What do you notice?

Can you predict how many vertices the next step in the pattern will have?

Is there more than one way to continue the pattern?

Can you create your own pattern and explore how the vertices change?

Possible answer: 4, 7, 11

The next step could have another square (15 vertices) or another triangle (14 vertices).
Children use their knowledge of properties of shape to accurately create 2-D shapes. Children could use geo-boards to make shapes with elastic bands and look carefully at the number of sides and vertices.

Using geo-boards is a practical step to take before children draw their own shapes on dotted or squared paper.

**Year 2 | Spring Term | Week 5 to 7 – Geometry: Properties of Shape**

**Draw 2-D Shapes**

**Notes and Guidance**

**Varied Fluency**

- Use a geoboard to make different 2-D shapes. Can you make a rectangle? Can you make a square? Can you make a triangle?

- Can you draw a rectangle on dotted paper? Start at a vertex and use a ruler to draw your first straight side. How many straight sides will you need? Rotate the paper to help you draw the shape more accurately. Try drawing other shapes in the same way.

- Choose a 2-D shape. Build it on a geo-board. Can you copy the shape onto dotted paper and squared paper?

**Mathematical Talk**

Compare your shape with a friend's shape. Is it in the same position? Is it the same size?

Where are you going to start drawing the shape? In the middle of a side? At a vertex? Which is the most efficient way?

Why is it important to use a ruler?

Is your shape an exact copy? How do you know?
Using geoboards, how many different rectangles can you make?
What's the same about the rectangles?  What's different?
Has your friend made any different rectangles?

What shape could be hiding under the spilt paint?

Prove your answer by drawing it.

Possible answer:

Draw a large rectangle on squared paper or dotted paper.
Draw a square inside the rectangle.
Draw a triangle below the rectangle.
Draw a pentagon that is bigger than the square.

Could be any 2-D shape.
Encourage children to think about irregular pentagons, hexagon, etc.

Can you give instructions to your partner to help them draw different shapes?
Children are introduced to the concept of vertical lines of symmetry. They should be exposed to examples that are symmetrical and also examples that are not.

Children use a range of practical resources (mirrors, geoboards, paper folding) to explore shapes being halved along their vertical line of symmetry.

**Mathematical Talk**

Where is the vertical line of symmetry?
What does vertical mean?
Which is the odd shape out? How do you know?
What resources could you use to check if a shape has a vertical line of symmetry?

**Notes and Guidance**

**Varied Fluency**

Can you fold these shapes to find a vertical line of symmetry?

Draw the vertical lines of symmetry on these shapes.

Circle the shape with an incorrect line of symmetry. Can folding help you prove your answers.
## Lines of Symmetry

### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Question</th>
<th>Possible answers:</th>
<th>Question</th>
<th>Possible answer(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you draw more than one four-sided shape that has a vertical line of</td>
<td>square, rectangle, kite.</td>
<td>Which 2-D shapes can be made when a vertical line of symmetry is drawn on</td>
<td>Rectangle and triangle.</td>
</tr>
<tr>
<td>symmetry?</td>
<td></td>
<td>a square?</td>
<td></td>
</tr>
<tr>
<td>Tommy has placed a mirror on the vertical line of symmetry. This is what</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>he sees:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you complete the other half of the shape?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Children recognise and sort 2-D shapes including circle, square, triangle, rectangle, pentagon, hexagon and octagon using a range of different orientations. Children should be encouraged to sort the shapes in more than one way. They can then describe how they have sorted them using key language including side, vertex and symmetrical.

How have you sorted your shapes?
How do you know you have sorted your shapes correctly?
Can you sort the shapes in a different way?
Can you find a shape which is in the wrong place?
Can you see how these shapes have been sorted?

Sort the 2-D shapes into the correct group:
- Rectangle
- Triangle
- Pentagon

How have the shapes been sorted?

Whitney sorted her shapes by the number of sides. What shapes could belong to each group?

<table>
<thead>
<tr>
<th>4 sides</th>
<th>Not 4 sides</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ron sorted the shapes in order of the number of sides. Has he ordered them correctly? Explain why.

<table>
<thead>
<tr>
<th>Vertical line of symmetry</th>
<th>No vertical line of symmetry</th>
</tr>
</thead>
<tbody>
<tr>
<td>△ □  ⬤</td>
<td>△ □  ⬤ □</td>
</tr>
</tbody>
</table>

No because the square should be before the pentagon.

Which shape is in the wrong set? Explain why.

The circle is in the wrong set because it does have a vertical line of symmetry.

Where should these shapes go in the Venn diagram?

4 sides  Orange

Create your own labels and sort the shapes in a different way.

Possible labels:
Blue
Less than 4 vertices.
Children use their knowledge of the properties of 2-D shapes to create patterns. They are encouraged to place the shapes in different orientations when making patterns and recognise that it is still the same shape. In particular, squares do not become diamonds when turned sideways.

Can you explain the pattern? How does circling the set of shapes that repeat help you see the pattern?

Continue the pattern. Which shape will be next?

How are these patterns similar? How are these patterns different?

How can you work out which shape will come __th?

Can you make your own repeating patterns using only one shape?
Make Patterns with 2-D Shapes

Reasoning and Problem Solving

Dora says that the 12th shape in this pattern will be a triangle.

Is she correct? How do you know?

The 12th shape will be a triangle. Children may physically continue the pattern to find the answer or recognise that the triangle is the 3rd and count in 3s.

How many different ways can you arrange these shapes to make a repeating pattern?

Can you translate this pattern using shapes?

Clap, clap, snap, clap, clap, snap, clap, clap …...

Possible answer:

Square, square, triangle or pentagon, pentagon, circle.
Children use their knowledge of 2-D shapes to identify the shapes of faces on 3-D shapes. To avoid miscounting the faces children need to mark each face in some way. Children identify and visualise 3-D shapes from 2-D representations. Cones should be described as having 1 face and 1 curved surface; cylinders as having 2 faces and 1 curved surface and spheres having 1 curved surface.

**What do we mean by the ‘face’ of a shape?**
What is the difference between a face and a curved surface?

**What real life objects have 6 faces like a cube?**
Does a cuboid always have 2 square faces and 4 rectangular faces?

**Which 2-D shapes can you see on different 3-D shapes?**
How can you make sure that you don’t count the faces more than once?

**Look at these 3-D shapes:**
Which 2-D shapes can you see on the surface of each one?

**Complete the table:**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name of shape</th>
<th>Number of flat faces</th>
<th>Draw the faces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Count Faces on 3-D Shapes

Reasoning and Problem Solving

Teddy says my 3-D shape has 6 faces. Mo says he must have a cube. Is Mo correct? Explain your answer.

No because Teddy could have a cube or a cuboid.

Annie has sorted these 3-D shapes. Can you spot her mistake? Can you add another shape to each set?

The can should be in the ‘both’ set because it has flat faces and a curved surface.

Whitney says, I have a 3-D shape with 2 square faces and 4 rectangular faces.

What shape does Whitney have? Play this game with a friend. Describe the faces of a 3-D shape and they need to guess what it is.

Whitney has a cuboid.
Children use their knowledge of faces and curved surfaces to help them to identify edges on 3-D shapes. They learn that an edge is where 2 faces meet or where a face and a curved surface meet. To avoid over counting the edges children need to mark each edge in some way. Children identify and visualise the 3-D shape from a 2-D representation.

What do we mean by the ‘edge’ of a shape?
How can you make sure that you don’t count the edges more than once?
What do you notice about the shapes with ____ edges?

Look at these 3-D shapes:

How many edges does each shape have?

Complete the table:

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Edges</th>
<th>Faces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Count Edges on 3-D Shapes

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Ron has sorted these shapes according to the number of edges. Which shape is in the wrong place? Explain why.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sphere (football) is in the wrong place because it doesn't have any edges, it has one curved surface.</td>
</tr>
<tr>
<td>Eva says her 3-D shape has 12 edges. Dora says she could have a cube, cuboid or square-based pyramid. Is Dora correct? Explain your answer.</td>
</tr>
<tr>
<td>Dora is not correct, because a square-based pyramid has 8 edges.</td>
</tr>
</tbody>
</table>

#### Compare these 3-D shapes.

- **Same** – both have square faces, 6 faces, 12 edges, don’t roll, can stack, no curved edges.
- **Different** – name, colour, size, one only has square faces the other has squares and rectangles...

---

<table>
<thead>
<tr>
<th>1 edge</th>
<th>More than 1 edge</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="triangle" /></td>
<td><img src="image2.png" alt="football" /> <img src="image3.png" alt="cube" /> <img src="image4.png" alt="cylinder" /></td>
</tr>
</tbody>
</table>
Children use their knowledge of edges to help them to identify vertices on 3-D shapes. They understand that a vertex is where 2 or more edges meet. To avoid over-counting the vertices children need to mark each vertex in some way.

The point at the top of a cone can be referred to as an apex or a vertex.

**Mathematical Talk**

What is the difference between vertex and vertices?

How can you make sure that you don’t count the vertices more than once?

How many edges meet to make a vertex on a 3-D shape?

How many sides meet to make a vertex on a 2-D shape?

**Varied Fluency**

Look at these 3-D shapes:

- Pyramid
- Cube
- Cone
- Cylinder

How many vertices does each shape have?

Complete the table:

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Faces</th>
<th>Edges</th>
<th>Vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Pyramid" /></td>
<td>Pyramid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Cube" /></td>
<td>Cube</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Cone" /></td>
<td>Cone</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Place 3-D shapes in order starting with the shape with the fewest vertices.
### Count Vertices on 3-D Shapes

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>What is the same about these 2 shapes?</th>
<th>Example answer:</th>
<th>Jack says:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Same – both have a triangular face, both have 5 faces.</td>
<td>All 3-D shapes have at least one vertex.</td>
</tr>
<tr>
<td></td>
<td>Different – name, colour, size, one has 6 vertices the other has 5 vertices, one has a rectangular face, one has a square face.…</td>
<td></td>
</tr>
</tbody>
</table>

What is different about them?
Talk about faces, edges and vertices in your answer.

**Example answer:**

- **Same:** both have a triangular face, both have 5 faces.
- **Different:** name, colour, size, one has 6 vertices the other has 5 vertices, one has a rectangular face, one has a square face.…

**Jack says:**

- All 3-D shapes have at least one vertex.

**Is this true or false?**

**False.**

A sphere has no vertices.

Could also be an opportunity to talk about the words apex and vertex.

**Alex has a shape with 8 vertices.**

**What 3-D shape could it be?**

**Cube or cuboid.**
Sort 3-D Shapes

Children use their knowledge of shape properties to sort 3-D shapes in different ways e.g. faces, shapes of faces, edges, vertices, if they roll, if they stack...

They should have access to a range of real life objects to sort and compare. Before sorting it may be useful to give children the opportunity to match the object e.g. a can of pop to a cylinder etc.

Mathematical Talk

How have you sorted your shapes?
How do you know you have sorted your shapes correctly?
Which method have you used to sort your shapes?
Can you sort your shapes in a different way?
Can your friend guess how you have sorted them?
Can you group your solids by shape, type of faces and size?

Notes and Guidance

Varied Fluency

How could you sort these objects?
Can you find some other classroom objects to add to each set?

How are these shapes grouped?

Could you group them in a different way?
Sort the 3-D shapes on your table.
Label the groups.
Can you find more than one way?
Remove the labels. Can someone guess how you sorted?
Annie is sorting 3-D shapes.
She puts a cube in the cuboid pile.

**A cube is a type of cuboid.**

Do you agree? Why?

Annie is right.
They both have 6 faces.
They both have 12 edges.
A cube is a special kind of cuboid where all faces are squares.

Jack is investigating which shapes stack and which shapes roll.
He says:

*Some shapes will stack and roll.*

Is he correct?

Sort your shapes using the Venn diagram.
Explain what you notice about each set.
Do all shapes with flat surfaces stack?

Some shapes with flat faces will stack – they will need to have flat faces on opposite sides. (cubes, cylinders, cuboids)

Shapes with a curved surface will roll. (cone, sphere, cylinder)

Some shapes with a flat face cannot be stacked (square based pyramid, cone)
Children use their knowledge of the properties of 3-D shapes to create patterns. They are encouraged to place the shapes in different orientations.

A wide range of examples of shapes should be used, including, construction shapes, cereal boxes, different sized balls etc.

Where can you see real life patterns with 3-D shapes?
Can you explain your pattern to a partner?
Does the shape always have to be a certain way up?
Can you work out what shape would be the ___th?

Make Patterns with 3-D Shapes

Notes and Guidance

Varied Fluency

Use some different coloured cubes to make a repeating pattern. Can you describe the pattern to your partner?
Using colours? Using letters? Using sounds?

Make a sequence of 3-D shapes.
Can you build a similar pattern with real life objects?
You could use food cans, boxes, balls, or other things in your classroom. Describe the pattern.

How many times does the pattern repeat?
What will the 10th cylinder look like?

Can you make your own repeating patterns using only one 3-D shape?
### Make Patterns with 3-D Shapes

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>What is the same about these patterns? What is different about these patterns?</th>
<th>The first and second patterns use two shapes. Colour is a difference to note. In the 3rd pattern, one shape is used in different orientations. In the 2nd pattern, the shape is used twice each time.</th>
<th>Choose two 3-D shapes. What different repeating patterns could be made?</th>
<th>Possible answer: Cube, cylinder, cube.... Cube, cube, cylinder...</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Pattern 1" /></td>
<td><img src="image2" alt="Pattern 2" /></td>
<td><img src="image3" alt="Pattern 3" /></td>
<td>Answer will depend on the shapes used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Make a repeating pattern where there are more cones than cuboids.
- Make a repeating pattern where the third shape is always a cylinder.