

Properties of Shapes

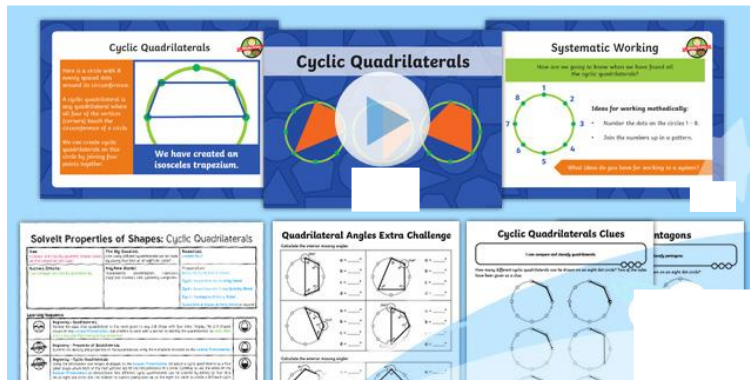
Maths | Year 6 | Area Overview

Introduction

In this unit, the children will draw 2D shapes to exact measurements, continue to find missing angles by measuring and calculating, and also compare and classify 2D shapes based on their properties. They revisit recognising, describing, comparing and classifying a range of 3D shapes and related shape nets and then further develop their skills by drawing and constructing their own shape nets including tabs. In addition, they consolidate being able to recognise and calculate angles around a point and on a straight line and are introduced to recognising vertically opposite angles. It also includes a brand new objective that has been introduced to KS2 relating to illustrating and naming the parts of a circle and knowing the relationship between radius and diameter.

Resources

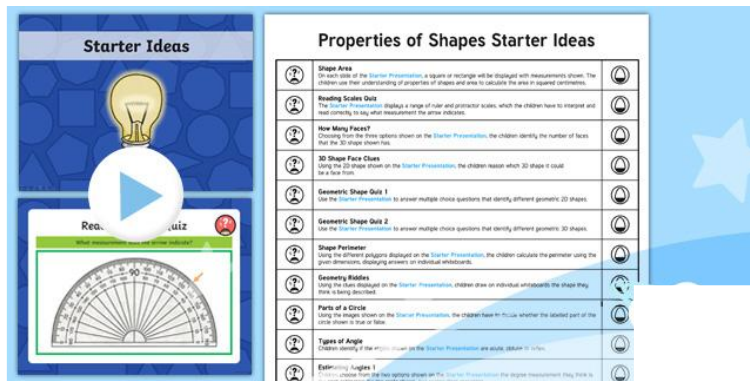
In addition to your standard maths resources, you will need protractors, pairs of compasses, scissors, and glue.



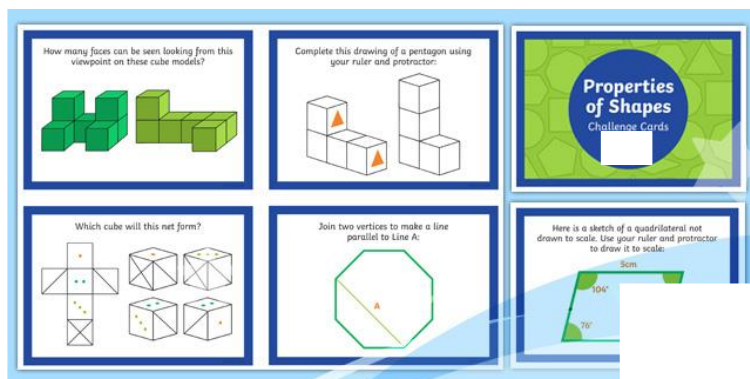
Solved Lesson Pack: Cyclic Quadrilaterals

How many different quadrilaterals can be drawn on an eight dot circle?

In this problem-solving lesson, children explore drawing cyclic quadrilaterals (quadrilaterals where each vertex lies on the circumference of a circle), working systematically to find how many different cyclic quadrilaterals are possible (not allowing rotations and reflections.) Supporting and extending differentiated activity sheets are included.



Starter Ideas



Challenge Cards

Assessment Statements

By the end of this unit...

...all children should be able to:

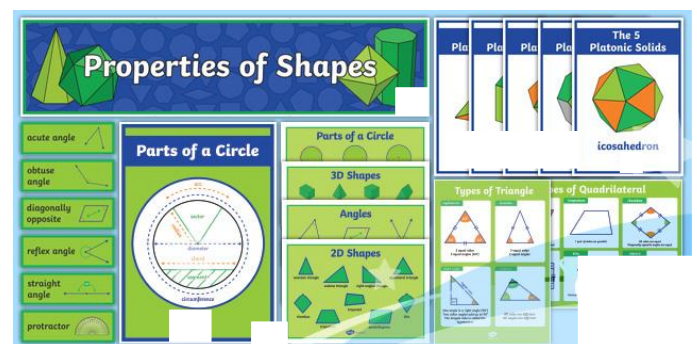
- use a ruler to draw a 2D shape to a given measurement;
- construct a 3D shape from a given shape net;
- compare and classify geometric shapes;
- recognise different types of angle;
- draw circle using a pair of compasses.

...most children will be able to:

- draw 2D shapes to given dimensions of length and angle;
- draw their own net of a simple 3D shape including construction tabs;
- measure and calculate unknown angles in 2D shapes and around a point or on a straight line;
- label the parts of a circle including radius and diameter.

...some children will be able to:

- confidently use a protractor to accurately draw 2D shapes to within 1° of the given dimension;
- draw their own net of more complex 3D shapes including construction tabs;
- use more complex reasoning to work out missing angles in 2D shapes and around a point or on a straight line;
- understand the relationship between radius and diameter using algebraic representation.



Display Pack

Lesson Breakdown

Draw 2D shapes using given dimensions and angles.

2D Shape Drawing (1): Expert 2D Shape Drawing

I can accurately draw a range of 2D shapes using the measurements given.

2D Shape Drawing (2): Champion 2D Shape Drawing

I can accurately draw a range of 2D shapes using the measurements given.

2D Shape Drawing (3): 2D Shape Reasoning

I can solve reasoning questions about drawing 2D shapes using the measurements given.

Home Learning: 2D Shape Challenge

A set of differentiated activity sheets that consolidate the skills of drawing 2D shapes to given dimensions.

Recognise, describe and build simple 3D shapes, including making nets.

3D Shapes (1): All Things 3D Shape

I can identify and describe the properties of 3D shapes and their nets.

3D Shapes (2): Drawing Shape Nets

I can draw shape nets and use them to build 3D shapes.

3D Shapes (3): 3D Shape Reasoning

I can solve reasoning questions about recognising, describing and building 3D shapes.

Home Learning: 3D Shape Challenge

A set of differentiated activity sheets that consolidate the skills of describing the properties of 3D shapes and drawing shape nets.

Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals and regular polygons.

Geometric Shapes (1): Triangles

I can compare, classify and find unknown angles in triangles.

Geometric Shapes (2): Quadrilaterals

I can compare, classify and find unknown angles in quadrilaterals.

Geometric Shapes (3): Polygons

I can compare, classify and find unknown angles in polygons.

Geometric Shapes (4): Polygon Reasoning

I can solve reasoning questions about comparing, classifying and finding unknown angles in polygons.

Home Learning: Polygons

A set of differentiated activity sheets that consolidate the skills of comparing and classifying geometric shapes based on their properties.

Lesson Breakdown

Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius.

Parts of Circles (1): Clever Circles

I can draw circles accurately using a pair of compasses and I can identify and label the parts of a circle.

Parts of Circles (2): Circle Algebra

I know that the diameter of a circle is twice the radius and can express this as algebra.

Parts of Circles (3): Circle Reasoning

I can solve reasoning questions about knowing that the diameter of a circle is twice the radius.

Home Learning: Circles

A set of differentiated activity sheets that consolidate the skills of labelling and calculating the radius and diameter of circles.

Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.

Angles (1): Angles at a Point

I can recognise angles where they meet at a point and find missing angles.

Angles (2): Angles on a Straight Line

I can recognise angles on a straight line and find missing angles.

Angles (3): Opposite Angles

I can recognise angles that are vertically opposite and find missing angles.

Angles (4): Angle Reasoning

I can solve reasoning questions about recognising and finding missing angles where they meet at a point, are on a straight line, or are vertically opposite.

Home Learning: Amazing Angles

A set of differentiated activity sheets that consolidate the skills of recognising and describing angles.

Properties of Shapes: All Things 3D Shape

Aim: Recognise, describe and build 3D shapes, including making nets. I can identify and describe the properties of 3D shapes and their nets.	Success Criteria: I can identify and describe a wide range of 3D shapes. I can compare and classify 3D shapes. I can reason about 3D shapes	Resources: Lesson Pack
	Key/New Words: Prism, polyhedron, face, edge, vertex, vertices.	Preparation: Shape Net Dominoes Resource Sheet - 1 per group Differentiated All Things 3D Shape Activity Sheets - 1 per child Extra Challenge Activity Sheet - as required

Prior Learning: It will be helpful if children have compared and classified a range of 3D shapes.

Learning Sequence

	How Many Faces?: Choosing from the three options shown on the Lesson Presentation , the children say the number of faces that the 3D shape shown has.	
	Identifying 3D Shapes 1: Using the images displayed on the Lesson Presentation , the children discuss in pairs which of the 3D shapes they can name and describe the properties of. Rehearse the names and properties of a range of 3D shapes.	
	Identifying 3D Shapes 2: Using the images displayed on the Lesson Presentation , rehearse the names and properties of a range of 3D shapes.	
	Shape Net Dominoes: Using the Shape Net Dominoes Resource Sheet , the children work in their pairs to match the 2D shape net to the correct 3D shape. Solutions are shown on the Lesson Presentation .	
	The Platonic Solids: Use the information displayed on the Lesson Presentation to explain that a regular polyhedron is a polyhedron whose faces are identical regular polygons and that there are five convex regular polyhedra, known as the Platonic Solids (cube, tetrahedron, octahedron, dodecahedron and icosahedron).	
	All Things 3D Shape: Children complete the differentiated All Things 3D Shape Activity Sheets to demonstrate that they can identify and describe the properties of 3D shapes and their nets. <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Match the correct 3D shape and 2D shape net to the correct shape name.</p> </div> <div style="text-align: center;"> <p>Complete the table describing the properties of 3D shapes.</p> </div> <div style="text-align: center;"> <p>Complete the table describing the properties of 3D shapes and drawing the correct shape net. An Extra Challenge Activity Sheet is provided as an extension activity if required.</p> </div> </div>	
	Euler's Rule: Use the Lesson Presentation to introduce Euler's rule: The number of faces of a 3D shape added to the number of vertices, subtract the number of edges will always equal 2. (Faces + Vertices - Edges = 2). The children prove or disprove this rule using a range of 3D shapes.	

Masterit

Puzzleit: Explore how many cubes are needed to create different 3D structures (links to work on volume). There are interactive versions available on the Internet to help with modelling.

Riddleit: Write riddles to describe different 3D shapes.

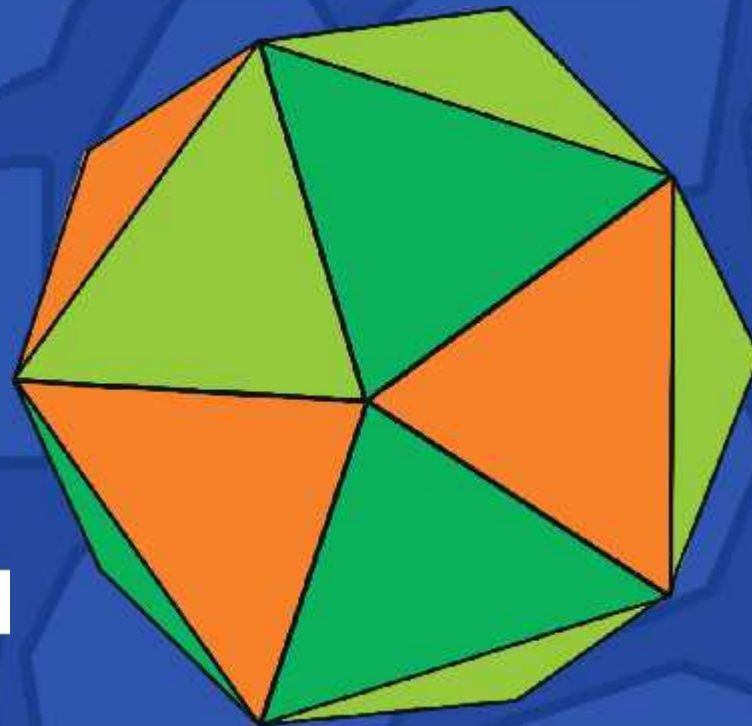
Sculptit: Make 3D constructions based on the work of Andy Goldsworthy.



Maths

Properties of Shapes

All Things 3D Shape



Aim

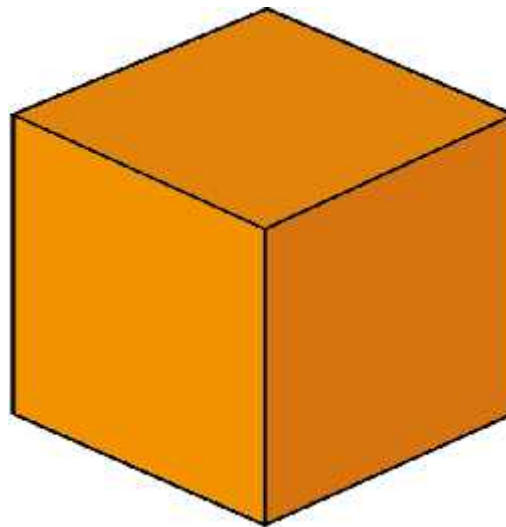
- I can recognise, describe and build 3D shapes, including making nets.

Success Criteria

- I can identify and describe the properties of 3D shapes and their nets.
- I can identify and describe a wide range of 3D shapes.
- I can compare and classify 3D shapes.
- I can reason about 3D shapes.

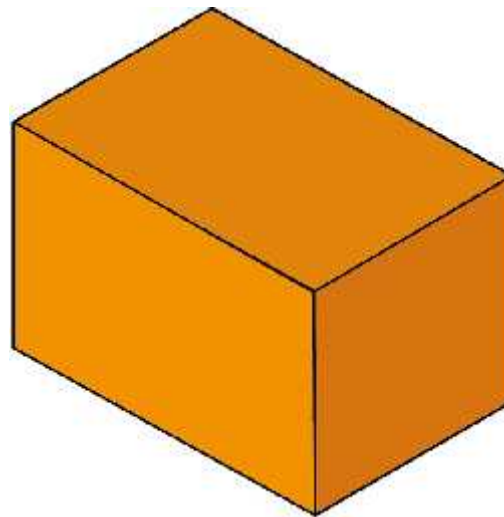
How Many Faces?

How many faces does this 3D shape have?
Click on your answer to see if you are correct.



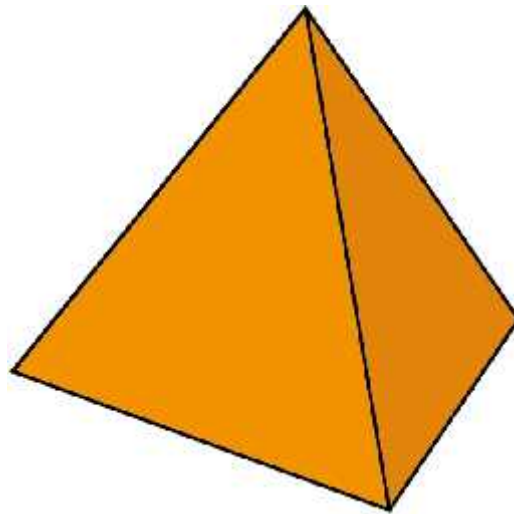
How Many Faces?

How many faces does this 3D shape have?
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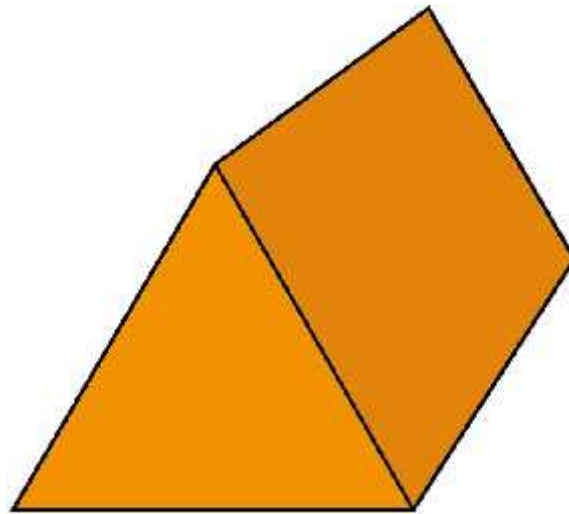
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How many faces does this 3D shape have?
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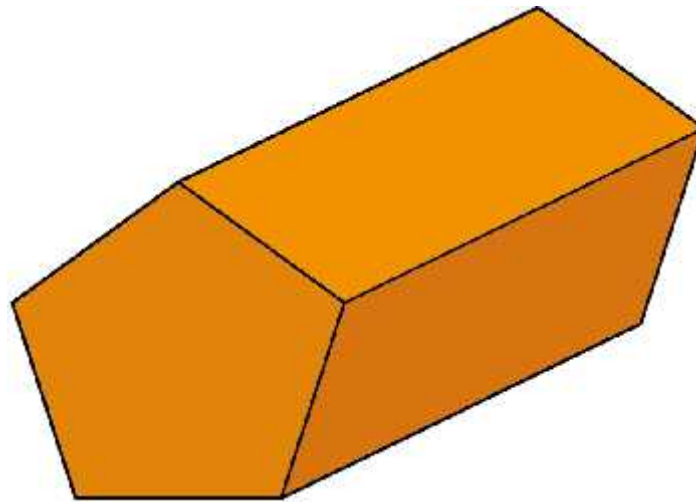
How Many Faces?

How many faces does this 3D shape have?
Click on your answer to see if you are correct.



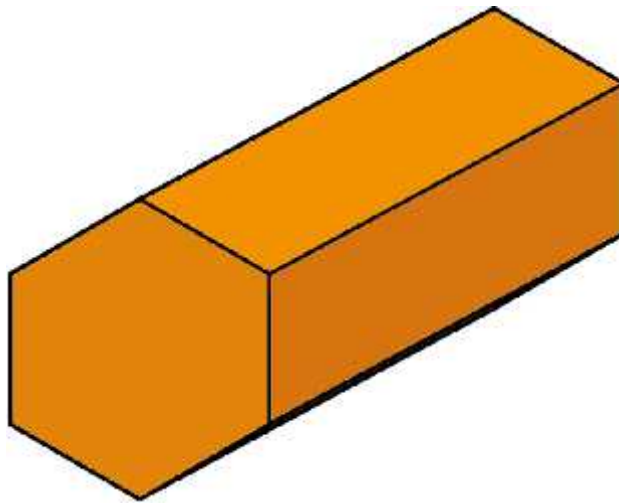
How Many Faces?

How many faces does this 3D shape have?
Click on your answer to see if you are correct.

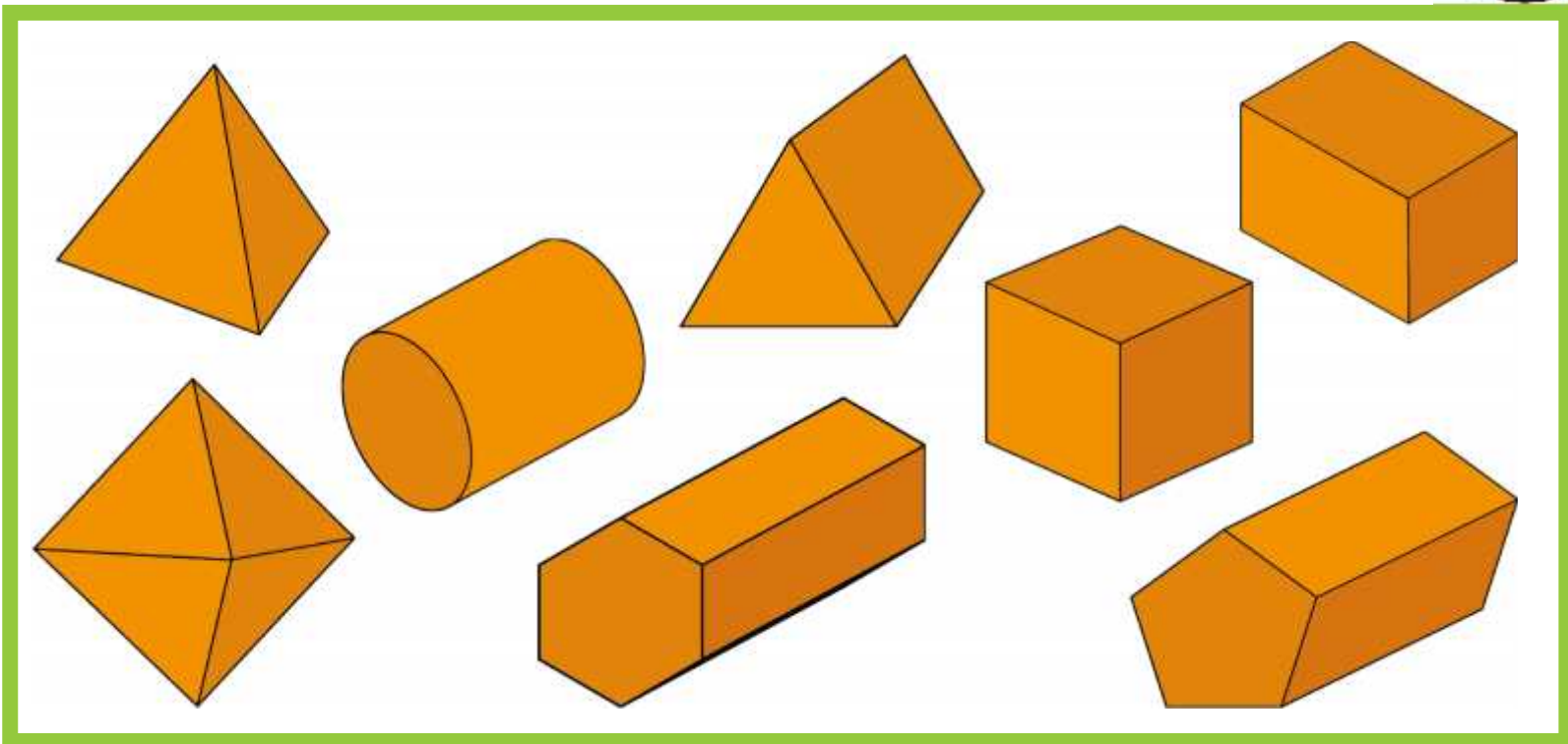


How Many Faces?

How many faces does this 3D shape have?
Click on your answer to see if you are correct.

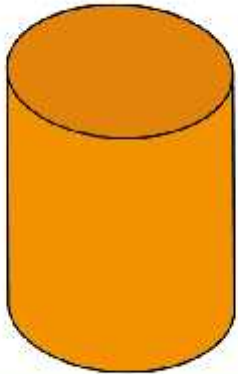


Identifying 3D Shapes 1



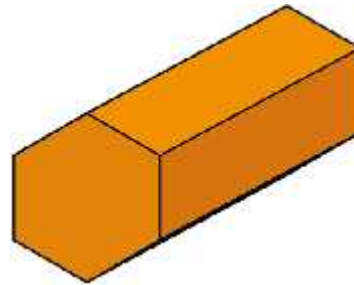
Which of these 3D shapes can you name and describe?

Identifying 3D Shapes 2



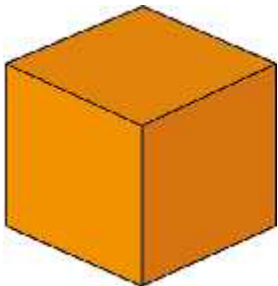
Cylinder

- 3 faces
- 2 edges
- 0 vertices



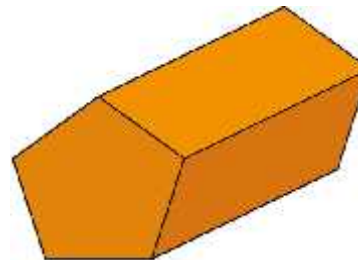
Hexagonal Prism

- 8 faces
- 18 edges
- 12 vertices



Cube

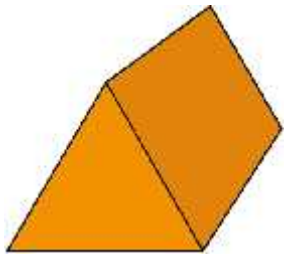
- 6 faces
- 12 edges
- 8 vertices



Pentagonal Prism

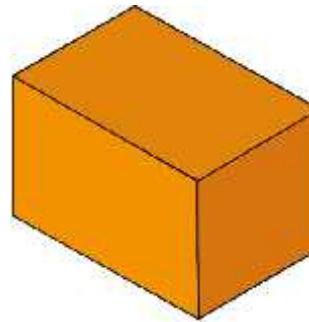
- 7 faces
- 15 edges
- 10 vertices

Identifying 3D Shapes 2



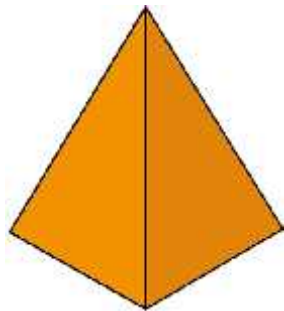
Triangular Prism

- 5 faces
- 9 edges
- 6 vertices



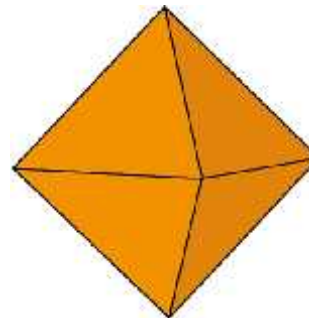
Cuboid

- 6 faces
- 12 edges
- 8 vertices



Square-based pyramid

- 5 faces
- 8 edges
- 5 vertices



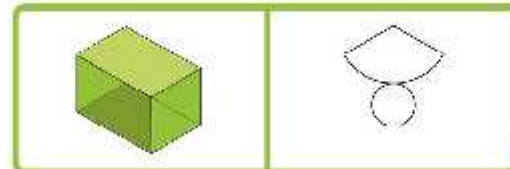
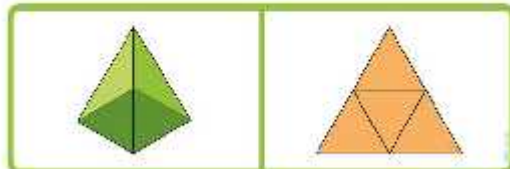
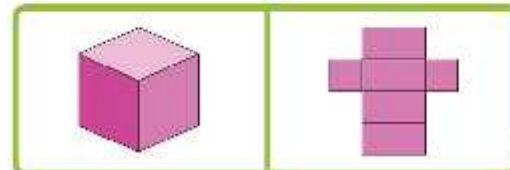
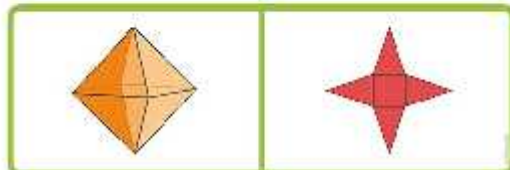
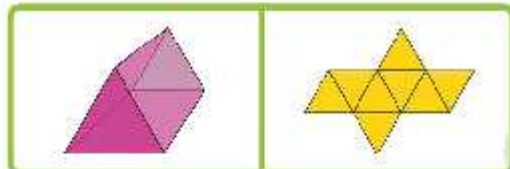
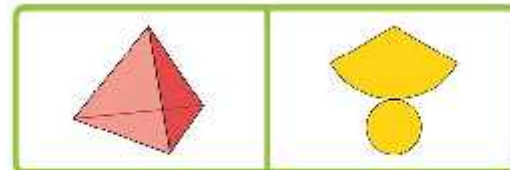
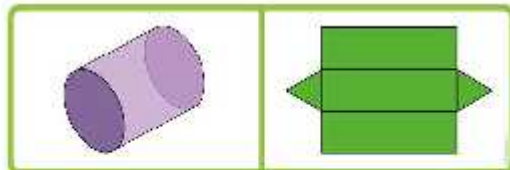
Octahedron

- 8 faces
- 12 edges
- 6 vertices

Shape Net Dominoes



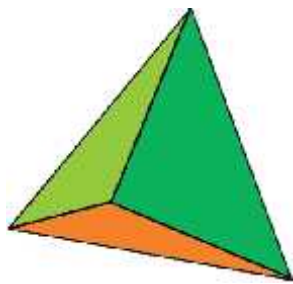
Match the 2D shape net to the correct 3D shape.



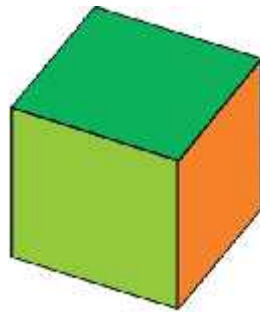
The Platonic Solids



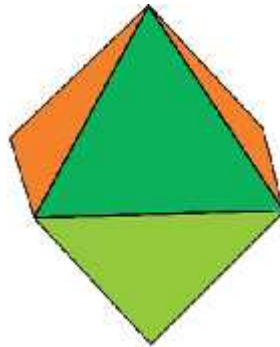
Why do you think these five 3D shapes are called the **Platonic Solids**?



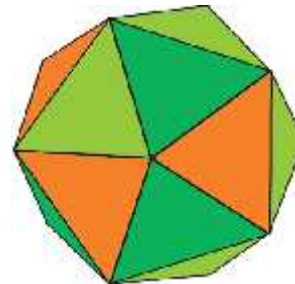
Tetrahedron



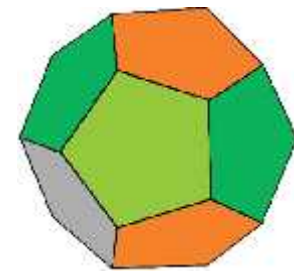
Cube



Octahedron



Icosahedron



Dodecahedron

- Each one is a polyhedron (a solid with flat faces).
- They are special because every face is a regular polygon of the same size and shape.
- They are named after Plato, a famous Greek philosopher and mathematician.

All Things 3D Shape



All Things 3D Shape

I can recognise and describe 3D shapes and their nets.

★

Cut out and match the correct 3D shape.

Name	3D Shape
Cone	
Triangular Prism	
Cube	
Octahedron	
Pentagonal Prism	

★★

Complete the table describing the properties of 3D shapes.

Name	No. of faces	No. of edges	No. of vertices	2D shape face	Name	No. of faces	No. of edges	No. of vertices	2D shape face
Cone 					Cuboid 				
Triangular Prism 					Tetrahedron 				
Cube 					Cylinder 				
Octahedron 					Hexagonal Prism 				
Pentagonal Prism 					Square based Pyramid 				

No. of edges	No. of vertices	2D shape net

Euler's Rule



Swiss mathematician Leonhard Euler (1707 - 1783) discovered a mathematical equation relating to the properties of 3D shapes:

$$\text{Number of faces} + \text{Number of Vertices} - \text{Number of Edges} = 2$$

Choose a 3D shape and prove that the equation is correct!



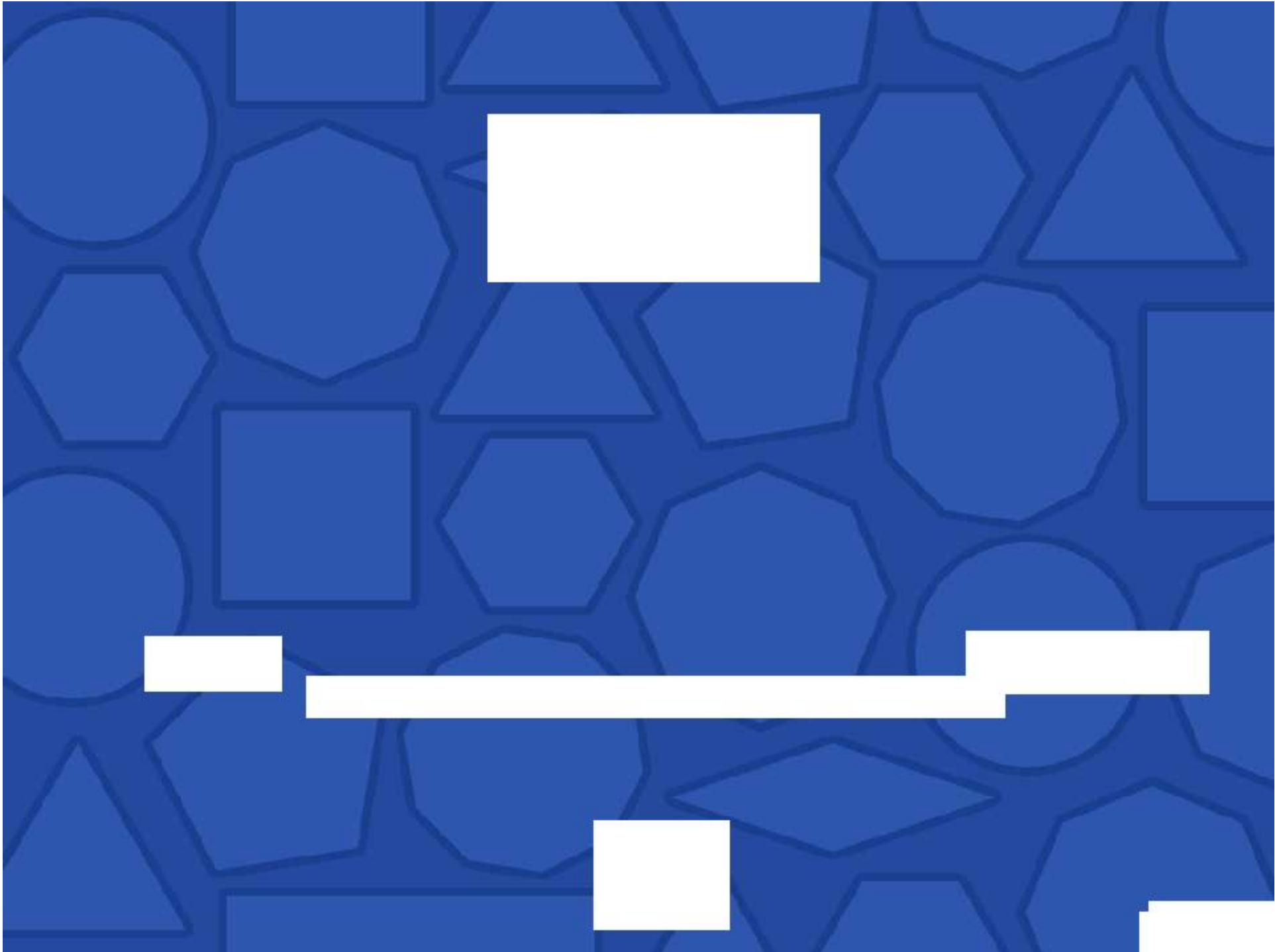
Aim



- I can accurately draw a range of 2D shapes using the measurements given.

Success Criteria

- I can follow instructions to accurately draw shapes.
- I can draw lines accurately using a ruler.
- I can draw angles accurately using a protractor.
- I can reason about shapes.





All Things 3D Shape

I can recognise and describe 3D shapes and their nets.



Cut out and match the correct 3D shape and 2D shape net to the correct shape name.

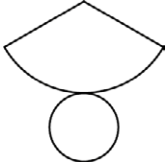
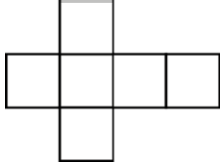
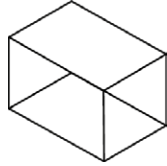
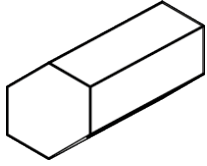
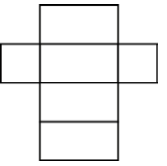
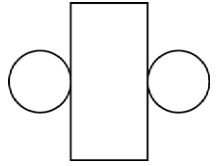
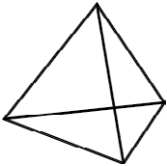
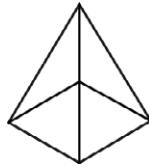
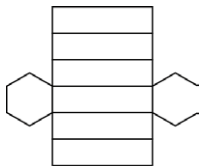
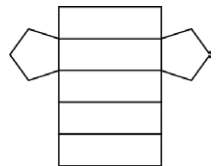
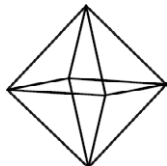
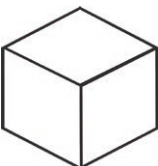
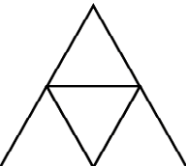
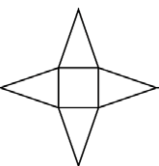

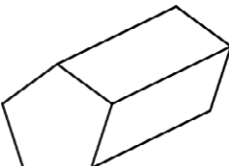
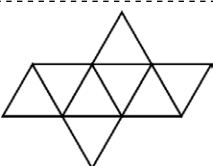
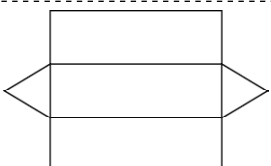

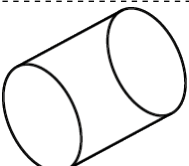
Name	3D Shape	2D Shape Nets
Cone		
Triangular Prism		
Cube		
Octahedron		
Pentagonal Prism		

Name	3D Shape	2D Shape Nets
Cuboid		
Tetrahedron		
Cylinder		
Hexagonal Prism		
Square-based Pyramid		



All Things 3D Shape

Cut out and match the correct 3D shape and 2D shape net to the correct shape name.



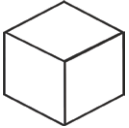

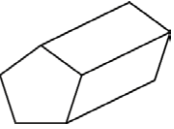


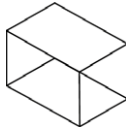

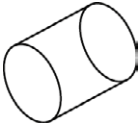
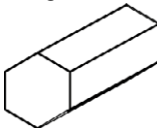
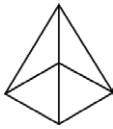
All Things 3D Shape

I can recognise and describe 3D shapes and their nets.



Complete the table describing the properties of 3D shapes.

Name	No. of faces	No. of edges	No. of vertices	2D shape faces
Cone 				
Triangular Prism 				
Cube 				
Octahedron 				
Pentagonal Prism 				

Name	No. of faces	No. of edges	No. of vertices	2D shape faces
Cuboid 				
Tetrahedron 				
Cylinder 				
Hexagonal Prism 				
Square-based Pyramid 				


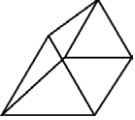
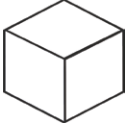




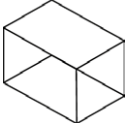

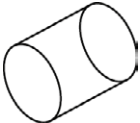

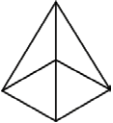
All Things 3D Shape

I can recognise and describe 3D shapes and their nets.



Complete the table describing the properties of 3D shapes and drawing their nets.

Name	No. of faces	No. of edges	No. of vertices	2D shape net
Cone 				
Triangular Prism 				
Cube 				
Octahedron 				
Pentagonal Prism 				

Name	No. of faces	No. of edges	No. of vertices	2D shape net
Cuboid 				
Tetrahedron 				
Cylinder 				
Octagonal Prism 				
Square-based Pyramid 				

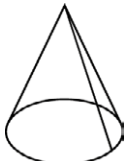
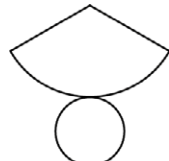


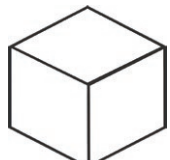
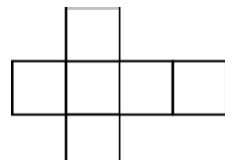
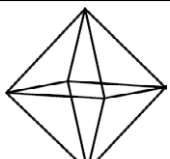
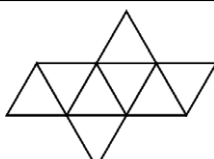
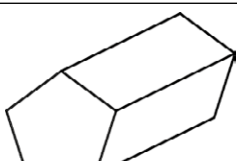
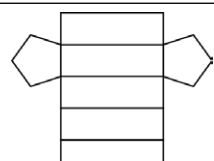


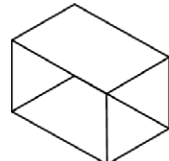
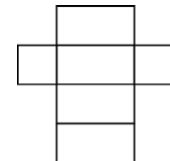
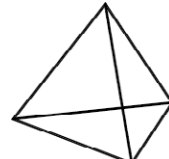
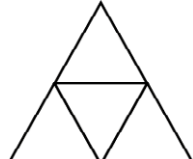
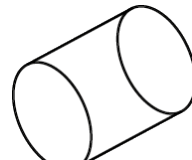
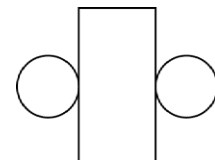
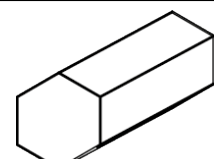
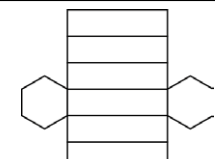
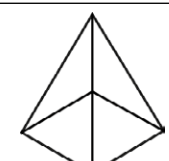
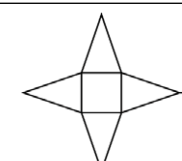
All Things 3D Shape - Answers

I can recognise and describe 3D shapes and their nets.



Cut out and match the correct 3D shape and 2D shape net to the correct shape name.



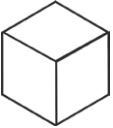


Name	3D Shape	2D Shape Nets
Cone		
Triangular Prism		
Cube		
Octahedron		
Pentagonal Prism		

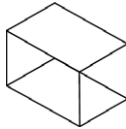

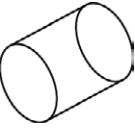
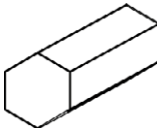
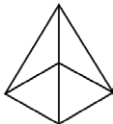
Name	3D Shape	2D Shape Nets
Cuboid		
Tetrahedron		
Cylinder		
Hexagonal Prism		
Square-based Pyramid		

All Things 3D Shape - Answers

I can recognise and describe 3D shapes and their nets.

Complete the table describing the properties of 3D shapes.

Name	No. of faces	No. of edges	No. of vertices	2D shape faces
Cone 	2	1	1	circle
Triangular Prism 	5	9	6	triangle rectangle
Cube 	6	12	8	square
Octahedron 	8	12	6	triangle
Pentagonal Prism 	7	15	10	pentagon rectangle

Name	No. of faces	No. of edges	No. of vertices	2D shape faces
Cuboid 	6	12	8	rectangle
Tetrahedron 	4	6	4	triangle
Cylinder 	3	2	0	circle rectangle
Hexagonal Prism 	8	18	12	hexagon rectangle
Square-based Pyramid 	5	8	5	triangle square


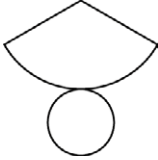
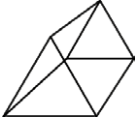


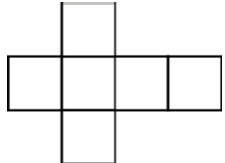

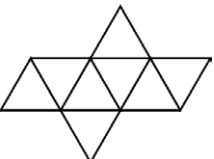
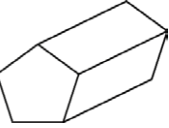
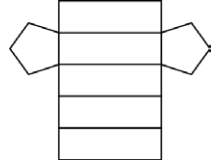


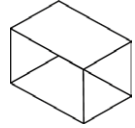
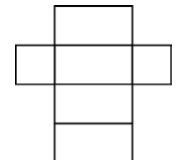

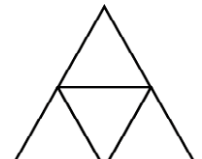
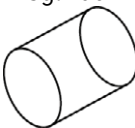
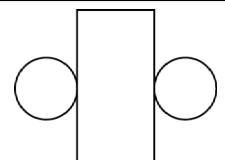
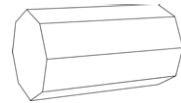
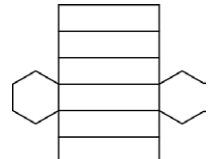
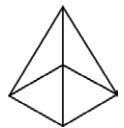
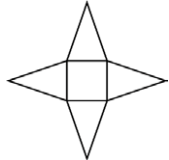
All Things 3D Shape - Answers

I can recognise and describe 3D shapes and their nets.



Complete the table describing the properties of 3D shapes and drawing their nets.

Name	No. of faces	No. of edges	No. of vertices	2D shape net
Cone 	2	1	1	
Triangular Prism 	5	9	6	
Cube 	6	12	8	
Octahedron 	8	12	6	
Pentagonal Prism 	7	15	10	

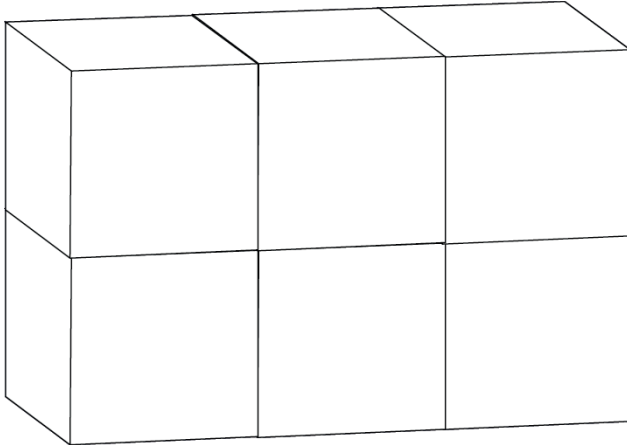
Name	No. of faces	No. of edges	No. of vertices	2D shape net
Cuboid 	6	12	8	
Tetrahedron 	4	6	4	
Cylinder 	3	2	0	
Octagonal Prism 	10	24	16	
Square-based Pyramid 	5	8	5	

All Things 3D Shape Extra Challenge

I can identify and describe the properties of 3D Shapes.

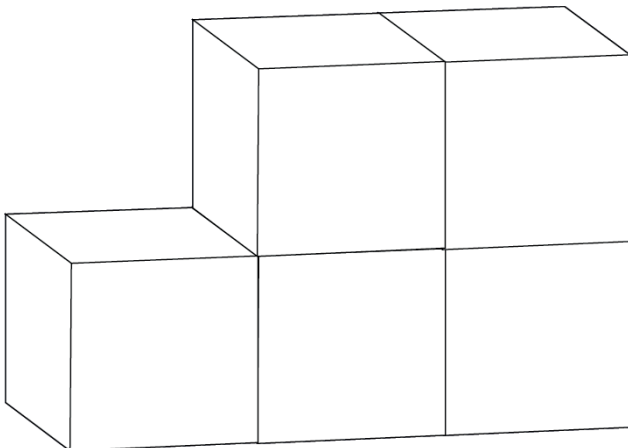


I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:



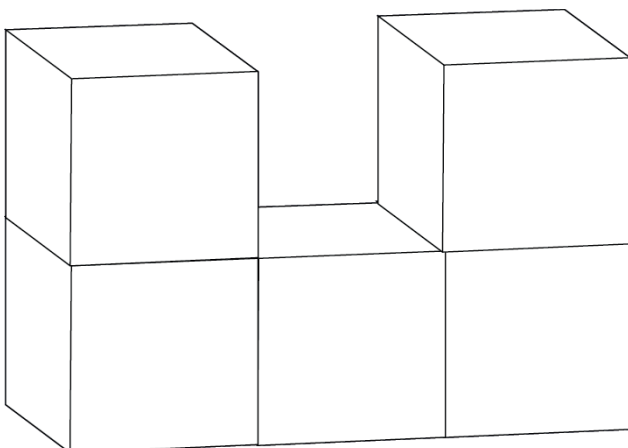
Total length of edges:	Draw a sketch of the cube model's shape net:
Total surface area:	

I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:



The total length of the edges will be more/less because...
The total surface area will be more/less because...

I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:



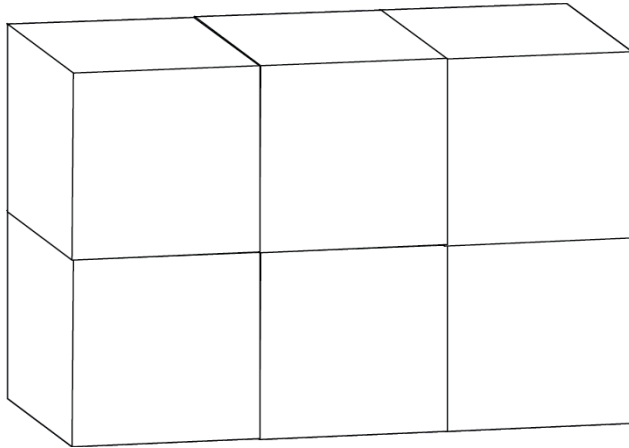
front view			side view			top view		

All Things 3D Shape Extra Challenge - Answer

I can identify and describe the properties of 3D Shapes.

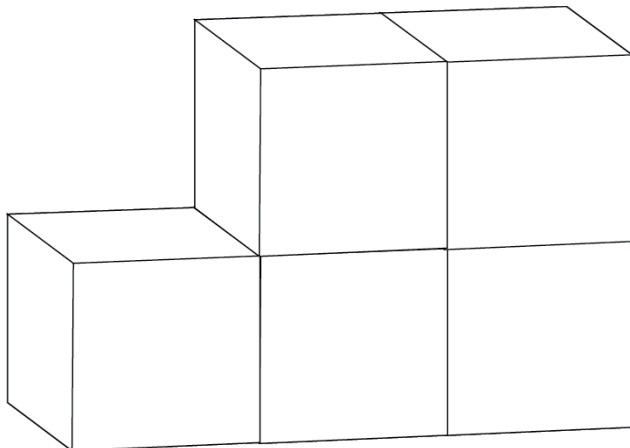


I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:



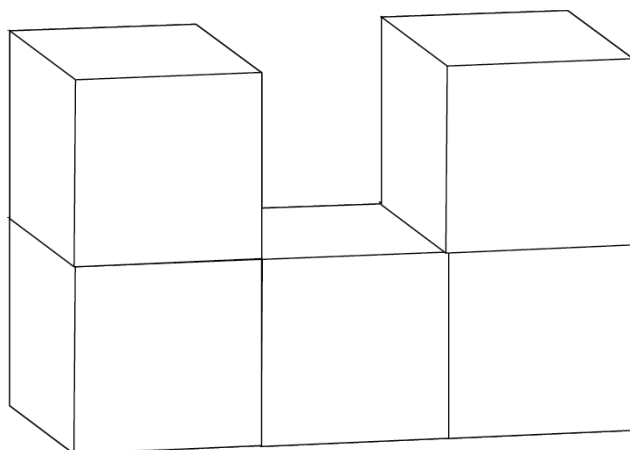
Total length of edges:	Draw a sketch of the cube model's shape net:
24cm	
Total surface area:	
22cm ²	

I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:

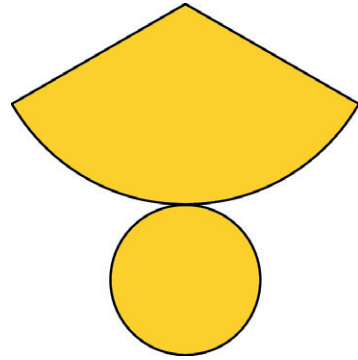
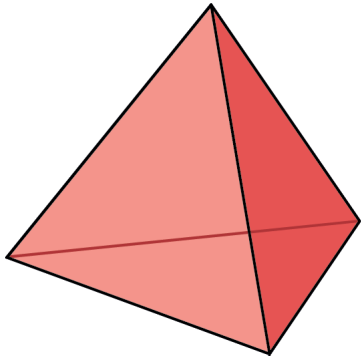


The total length of the edges will be more because...
the total length of edges is 26cm.
The total surface area will be less because...
the total surface area is 20cm ² .

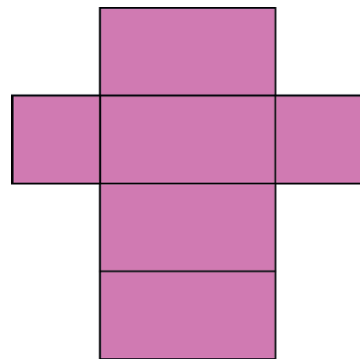
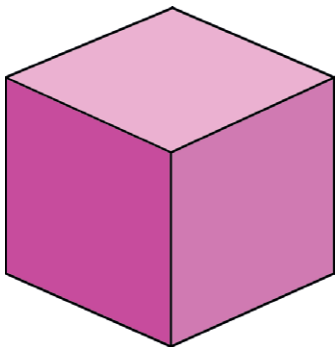
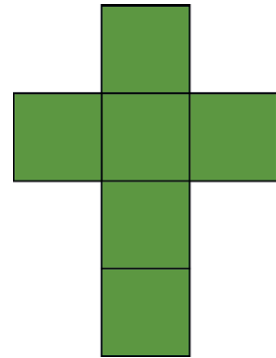
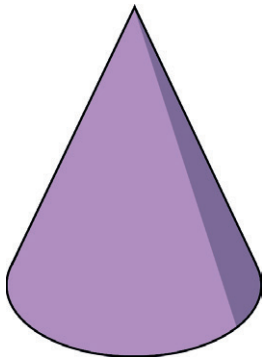
I make this cube model out of six 1cm cubes. Calculate the dimensions of the model:



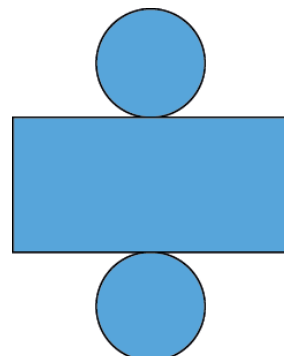
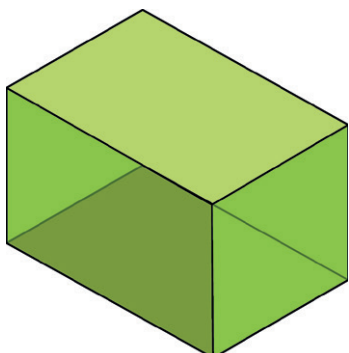
front view	side view	top view
■	■	■ ■
■ ■	■	

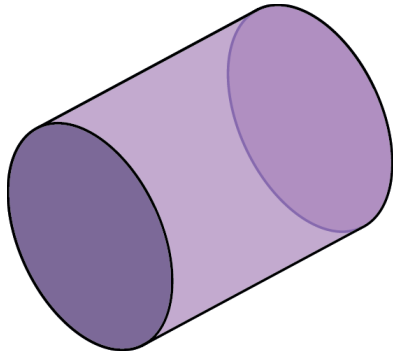


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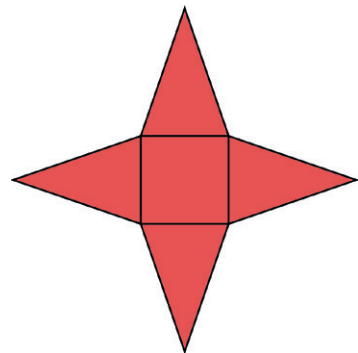
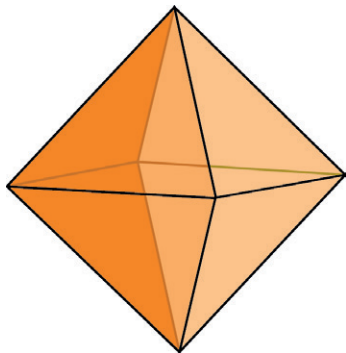
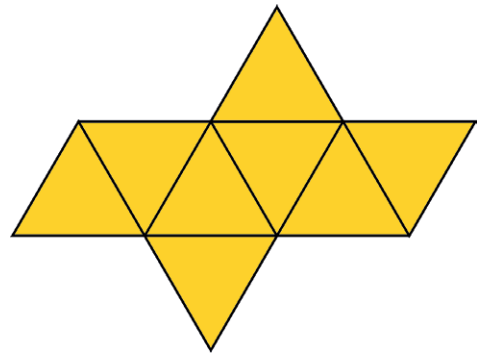
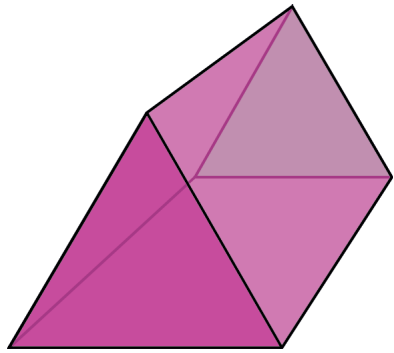


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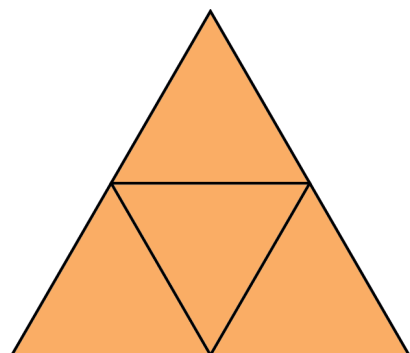
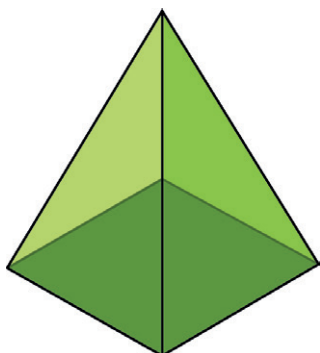




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Maths | All Things 3D Shape

I can identify and describe the properties of 3D shapes and their nets.		
I can identify and describe a wide range of 3D shapes.		
I can compare and classify 3D shapes.		
I can reason about 3D shapes.		

Maths | All Things 3D Shape

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