Year 6 properties of shapes

Prior Knowledge

- Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes (Y4)
- Identify acute and obtuse angles and compare and order angles up to 2 right angles by size (Y4)
- Identify lines of symmetry in 2-D shapes presented in different orientations (Y4)
- Complete a simple symmetric figure with respect to a specific line of symmetry (Y4)
- Identify 3-D shapes, including cubes and other cuboids, from 2-D representations (Y5)
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles (Y5)
- Draw given angles, and measure them in degrees (°) Identify:

- angles at a point and 1 whole turn (total 360°)
- angles at a point on a straight line and half a turn (total 180°)
- other multiples of 90° (Y5)

- Use the properties of rectangles to deduce related facts and find missing lengths and angles (Y5)
- Distinguish between regular and irregular polygons based on reasoning about equal sides and angles (Y5)

	Properties of shapes	Working Towards	Within	Expected	Above
	Draw 2-D shapes using given dimensions and angles				
	Recognise, describe and build simple 3-D shapes, including making nets				
	Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons				
	Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius				
	Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles				

Highlights: ____

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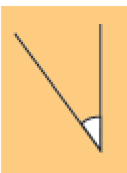
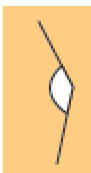
Glossary



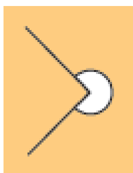
Acute Angles

Any angle that measures less than 90° is called an **acute** angle.



Obtuse Angles

Any angle that measures greater than 90° and less than 180° is called an **obtuse** angle.



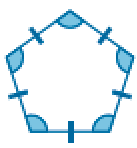
Reflex Angles

Any angle that measures greater than 180° is called a **reflex** angle.

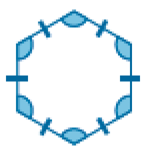
Angles in Regular Polygons

As the number of sides of a polygon increases by one, the total of the interior angles increases by 180°. When n = number of sides, this formula can be used to find the size of each angle in a **regular polygon**:

Sum of Interior Angles $= (n - 2) \times 180°$ **Each Angle** $= \dfrac{(n - 2) \times 180°}{n}$



Pentagon
$n = 5$
$(5 - 2) \times 180° = 540°$
$540° \div 5 = 108°$



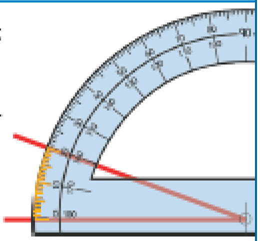
Hexagon
$n = 6$
$(6 - 2) \times 180° = 720°$
$720° \div 6 = 120°$

Using a Protractor

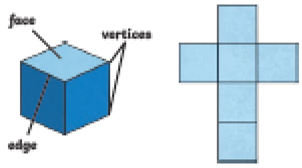
Place the cross or circle at the point of the angle you are measuring.

Read from the zero on the outer scale of your protractor.

Count the degree lines carefully.



Nets of 3D Shapes



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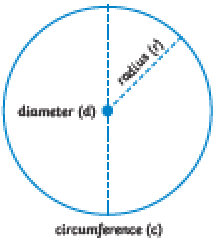
A shape net shows which 2D shapes can be folded and joined to make a 3D shape. When you are drawing a net, or solving a problem involving a shape net, think carefully about where the edges of the faces meet.

Parts of Circles

A circle is a 2D shape. The perimeter of a circle is called the **circumference** (c). The distance across the circle, passing through the centre, is called the **diameter** (d).

The distance from the centre of the circle to the circumference is called the **radius** (r).

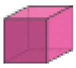
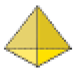
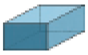
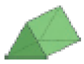
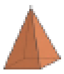
$r \times 2 = d$ $\frac{d}{2} = r$



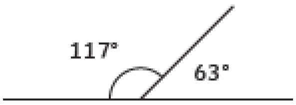
Properties of 3D Shapes

3D shapes have three dimensions – **length**, **width** and **depth**.

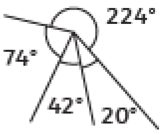
A **polyhedron** is a 3D shape with flat faces. Spheres, cylinders and cones are not polyhedrons as they have curved surfaces.

Cube  6 square faces, 12 edges, 8 vertices	**Tetrahedron**  4 triangular faces, 6 edges, 4 vertices	**Sphere**  1 curved surface, 0 edges, 0 vertices
Cuboid  6 faces, 12 edges, 8 vertices	**Octahedron**  8 faces, 12 edges, 6 vertices	**Triangular prism**  5 faces, 9 edges, 6 vertices
Square-based pyramid  5 faces, 8 edges, 5 vertices	**Cone**  1 circular face, 1 curved surface, 1 curved edge, 1 apex	**Cylinder**  2 circular faces, 1 curved surface, 2 curved edges, 0 vertices

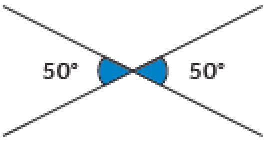
Calculating Angles

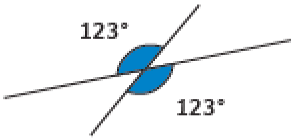


Angles on a straight line always total 180°.



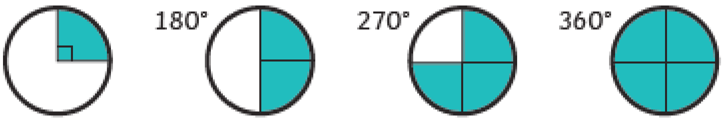
Angles around a point always total 360°.





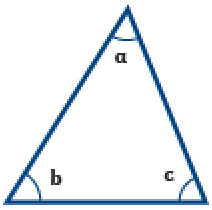
Opposite angles that share a vertex are equal.

$\frac{1}{4}$ turn 90° $\frac{1}{2}$ turn 180° $\frac{3}{4}$ turn 270° 1 turn 360°



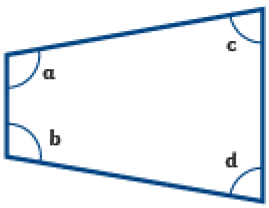
Multiples of 90° can be used as descriptions of a turn.

Angles in a Triangle



$a + b + c = 180°$

Angles in a Quadrilateral



$a + b + c + d = 360°$

Resources

protractor, ruler, nets

Future Learning

Key Stage 3
• draw and measure line segments and angles in geometric figures, including interpreting scale drawings • derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line • describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric • use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles • derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies • identify properties of, and describe the results of, translations, rotations and reflections • applied to given figures • identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids • apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles • understand and use the relationship between parallel lines and alternate and corresponding angles • derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons • apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs • use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles • use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D • interpret mathematical relationships both algebraically and geometrically

Key Stage 4
In addition to consolidating subject content from key stage 3, pupils should be taught to: • interpret and use fractional {**and negative**} scale factors for enlargements • identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment • construct and interpret plans and elevations of 3D shapes • interpret and use bearings • calculate arc lengths, angles and areas of sectors of circles • calculate surface areas and volumes of spheres, pyramids, cones and composite solids • apply the concepts of congruence and similarity, including the relationships between lengths, {**areas and volumes**} in similar figures • apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {**and, where possible, general triangles**} in two {**and three**} dimensional figures • know the exact values of sin and cos • describe translations as 2D vectors • apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; {**use vectors to construct geometric arguments and proofs**}.