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| Strand: Space | Topic: Shape and line |
| Foundation Level: Level statementStudents are developing notions of shape, location, direction and movement. |
| Example learning outcomes:Students recognise familiar objects from different viewpoints.Students recognise common objects in a range of settings.Students identify common signs in familiar contexts. |
| Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically |
| Students know: everyday language that relates to various shapes and objectsfamiliar objects from different viewpointsfamiliar signs in their environments. | Students may:participate in games, activities and routines that explore, match or sort familiar shapes and objects (e.g. wooden puzzles, setting and clearing a table, posting shapes into boxes)participate in games and songs that use language related to shapes and objectsmatch, sort or identify familiar items or objects by their shapesexplore, match or sort 2D shapes and 3D objects (e.g. some foods are associated with particular shaped containers; setting the table with a placemat that displays the dinner settings) identify or select requested familiar 2D shapesrecognise or identify various commercial and other signs by their shape, size and orientation (e.g. stop sign, familiar brand logos, television station logos)recognise familiar objects from different viewpoints (e.g. the family car from side, back or front; their school bag from the bottom or top). |

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| Level 1: Level statementStudents identify some obvious properties that distinguish 3D shapes and objects and 2D shapes, and understand that these properties are constant. They describe properties using simple geometric terms and construct representations of shapes, paying attention to the number of sides or corners and the shapes of faces.Students identify and describe locations and the positions of objects relative to known landmarks within familiar environments. They give directions that guide others through those environments, follow directions to move between one location and another and identify alternative pathways between locations. |
| Core learning outcome: S 1.1Students identify everyday shapes and objects using geometric names and make and describe simple representations of them. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:geometric names of shapes and objectsthe language to describe properties of shapes and objectshow to make simple representations of shapes and objects how to describe representations of everyday shapes and objects. | Students may:describe geometric properties of 3D shapes and objects and 2D shapes using geometric termscompare shapes, identifying similar and different properties, such as lines and angles (corners)visualise, identify and describe the obvious properties of everyday shapes and objectsidentify geometric properties that could be used to determine categories, such as shapes with straight lines or shapes with curves classify shapes and objects according to obvious propertiesexplain reasons for the classifications using geometric terms and propertiesrecord or represent the obvious properties of shapes in pictures or wordscompare shapes within shapes and shapes that fold to make other shapes, and identify geometric properties and functionsvisualise, identify and describe shapes within shapesuse representations to visualise, make and describe reconstructions of simple shapesrepresent shapes from different viewpoints represent ‘mind pictures’ to assist recall and identification of geometric propertiesvisualise (create ‘mind pictures’ of) 2D and 3D shapes to develop descriptions for posing questions or giving clues about shapesdescribe how obvious properties (e.g. straight sides, curved sides) are used to construct particular shapes ask questions using descriptions of obvious properties to provide clues for the construction or identification of shapesmake simple representations of 3D shapes and objects and 2D shapes using descriptions of properties describe what could happen to a shape if geometric properties are modifiedmake simple representations of shapes with modified propertiesprovide simple representations of shapes and objects with descriptions for peers to construct similar shapes and objects (e.g. ‘Make a cube like this. It has six square faces’)identify and describe 2D shapes when viewing different orientations of 3D shapescompare 2D shapes with the faces of 3D shapes and objectsconstruct 3D shapes using identified properties visualise the rotation and movement of shapes when completing puzzles. | 3D shapes and objects and 2D shapes cubes, rectangular prisms, spheres, cylinders, cones, pyramidseveryday examples of 3D shapes (e.g. ice-cream cones, balls, dice)circles, triangles, rectangles including squaresGeometric terms and propertiesopen and closed figuresflat, straight, curved, round3D shapes (shapes of faces, function — ‘will roll’ ...)2D shapes (straight and curved lines, number of sides, number of corners)Visualisations and representations‘mind pictures’ of 3D and 2D shapes3D objects from different viewpoints2D shapes in different orientations shapes within shapes* folding, cutting
* joining halves

shapes within pictures, illustrations, puzzlesLines and anglesstraight and curved linescorners (angles) |
| Investigations should occur in a range of contexts. For example, students could investigate:paper models of objects, such as hats and planes, that involve folding, cutting or matching two halvesgames, such as ‘What shape am I?’the deconstruction of packaging in order to design packaging for objects with different propertieshow 3D shapes can be used in activities, such as using faces of 3D shapes for printinghow shapes fit into puzzleshow properties of 3D shapes can be changed or manipulated using concrete materials. |

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| Level 2: Level statementStudents sort 3D shapes and objects by identifying common properties, including those that distinguish them from 2D shapes. They identify and match drawings, pictures and other representations of 3D shapes and objects from different viewpoints and orientations. They investigate nets of some shapes by unfolding and refolding packages.Students recognise that maps and plans are representations of environments and use these to follow or give directions related to pathways and the location of objects. They interpret and use alphanumeric grids to describe locations. They create simple sketches that represent parts of familiar environments and recognise the relative size and proximity of objects and locations. |
| Core learning outcome: S 2.1Students describe and sort 3D shapes and objects and 2D shapes according to geometric properties and identify shapes and objects from different viewpoints or orientations. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:geometric properties of 3D shapes and objects and 2D shapeslanguage to describe properties of 3D shapes and objects and 2D shapeshow to sort 3D shapes and objects and 2D shapes using geometric properties shapes and objects maintain their geometric properties when seen from different viewpoints or orientationshow to identify shapes and objects from different viewpoints or orientations. | Students may:identify and describe properties of 3D shapes and objects and 2D shapessort shapes according to properties label categories and shapes within categories using geometric termsidentify given categories of 3D and 2D shapesdescribe properties (e.g. angles)compare and identify a range of anglessort and identify categories of 3D shapes of familiar objects and justify choicesidentify relationships between 2D representations and 3D shapesidentify symmetry where shapes are partitioned and for shapes within shapesvisualise and describe the geometric properties of known objects and shapesrepresent shapes from different viewpoints or orientationsidentify and describe what is, and is not, visible from different viewpointsvisualise the rotation and movement of shapes, and identify and describe properties from different viewpoints compare and describe how the properties of actual shapes and representations of shapes are similar and differentmake representations of shapes using nets describe the properties of shapes or nets of shapessort representations into categories using common characteristics and propertiescompare the geometric properties of a net with its 3D shapeuse nets and properties to identify the shapes to be constructedvisualise and describe alternative ways to construct particular shapesidentify and describe different nets for the same 3D shape. | 3D shapes and objects and 2D shapescommon characteristics of cubes and prismsspheres, cylinders, cones, pyramidscommon characteristics of rectangles including squares Geometric terms and propertiesface, corner, side, edge3D shapes (shape and number of faces, function ...)2D shapes (number of sides, number of angles …)nets of 3D shapes with flat surfacesVisualisations and representations ‘mind pictures’ of 3D and 2D shapes 3D objects from different viewpoints 2D shapes in different orientationspartition of 2D shapes (e.g. triangles within a square)depth in 3D shapesLines and anglesright angle (square corner)angles (‘greater than’, ‘less than’, ‘same as’ a right angle) |
| **Investigations should occur in a range of contexts. For example, students could investigate:*** how packages can be sorted to make the best use of storage space
* what 3D shapes look like when seen from different viewpoints
* how objects can be illustrated in advertisements using different views, such as front, back, top and side
* how objects can be replicated using manipulative equipment.
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| Level 3: Level statement Students identify and visualise the geometric properties that define and distinguish families of prisms, cylinders, spheres, cones and pyramids. They recognise and describe the properties that distinguish trapeziums and rhombuses from other quadrilaterals, as well as the properties that distinguish different groups of triangles. They describe the properties of shapes using terms such as parallel, congruent, symmetrical and other terms related to angles. They draw shapes using various conventions to indicate particular geometric properties. Students describe locations and directions with reference to the four compass points and grid references displayed on simple, authentic maps and plans. They interpret the symbols used on maps by referring to the keys and legends and know that most maps are orientated to the north. |
| Core learning outcome: S 3.1Students describe the defining geometric properties of families of 3D shapes, model 3D shapes using nets and other representations, and identify and describe the properties of specific families and subgroups of 2D shapes. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:families of 3D shapesgeometric properties that categorise families of 3D shapeshow to describe the defining geometric properties of 3D shapesnets are 2D representations of the surfaces of 3D shapeshow to model 3D shapes using netsdifferent ways to represent and model 3D shapesfamilies of 2D shapesgeometric properties that categorise families of 2D shapeshow to identify and describe the properties of specific families of 2D shapes. | Students may:visualise shapes and list geometric properties identify properties that characterise families of shapesdescribe and classify the geometric properties of shapes, including lines and anglesuse a range of properties to classify and define families of shapes and objectsdescribe the similar and different properties of families of shapescompare shapes within familiesuse geometric terms for particular 2D and 3D shapes (e.g. parallelogram, rectangular prism)make ‘mind pictures’ of a single flip, slide or turn of 2D shapes and record the various representationsexperiment using a range of shapes in play constructions and artwork classify shapes that do and do not tessellate and describe using geometric properties and termsrepresent tessellations in different ways (e.g. concrete materials and drawings)identify and describe other everyday situations that use tessellations of triangles and quadrilaterals describe tessellations in terms of geometric propertiescreate enlargements or reductions of 2D shapes (e.g. using spirographs or OHTs)compare, identify and describe similarities and differences in geometric properties of shapes after enlargements and/or reductionsrepresent enlargements and reductions of shapes on grid paperuse conventions to label shapes and anglesidentify and describe geometric properties of similar shapes from a variety of orientations or viewpoints after enlargements and/or reductionsidentify and describe changes in 2D shapes that result from enlargement or reduction of the length of the sidesidentify and describe the defining geometric properties of a family of 3D shapesidentify and describe 2D shapes in nets used to create 3D shapesrepresent the 3D shape to be created from a net using isometric papervisualise and construct different shapes using a range of materials including netsdeconstruct shapes to identify the range of possible netsdescribe how geometric properties and nets can be used for the classification of 3D shapes visualise and describe the construction of 3D shapes from 2D netspredict the 3D shape that will be constructed from a given net and justify the choice using properties that characterise shape familiesuse conventions when representing shapes from a variety of orientations or viewpoints. | 3D shapes and objects and 2D shapes definition of:* prisms
* spheres
* cylinders
* cones
* pyramids

quadrilaterals (parallelograms, rectangles, trapeziums, rhombuses including diamonds)triangles (right-angled triangles, isosceles triangles, scalene triangles, equilateral triangles)Geometric terms and propertiesvertex, base, apexcongruence (same shape and size)parallel sides, faces, linesequal sides and anglesconventions for labelling shapes and angles* letters for naming shapes (ABC …)
* arrows to identify parallel lines
* marks to identify equal sides of shapes
* symbols for angles
	+ surfaces of 3D shapes

nets (excluding spheres)line symmetry of 2D shapessymmetrical/asymmetrical shapestransformations of 2D shapes* enlargements and reductions of shapes

tessellating properties of triangles and quadrilateralsVisualisations and representations‘mind pictures’ of a single flip, slide or turn of 2D shapes‘mind pictures’ of 3D shapesdifferent viewpoints and orientationsnets of shapesshapes within shapes, angles within anglesconventions for representing 3D shapes (dotted lines, shading, connecting overlays)Lines and anglesvertical, horizontal and oblique linesparallel linesdegreesright angle (90 degrees)acute, obtuse, straight and reflex angles |
| **Investigations should occur in a range of contexts. For example, students could investigate:*** the construction of building blocks for manipulative play
* the design of packaging for grocery items or toys
* shapes represented in works of art
* how shapes can be enlarged or reduced for various purposes, such as set designs or works of art
* designs for mosaics or paving patterns.
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| Level 4: Level statementStudents analyse the geometric properties that define and distinguish families of polygons and their subgroups. They analyse and describe groups of 3D shapes, such as the Platonic solids. They use the properties of prisms and pyramids to identify other shapes belonging to those groups. They analyse and classify shapes according to criteria including rotational symmetry and perpendicular lines or faces, and measure angles in degrees using protractors.Students interpret maps of the world, describing the location of the equator and other key lines of reference. They describe how the lines of latitude and longitude relate to the equator and the poles. They refer to the eight compass points or angle of turn when giving directions. They use simple linear scales to estimate distance on maps and plans. |
| Core learning outcome: S 4.1Students analyse the geometric properties of a range of 3D and 2D shapes to classify shapes into families and their subgroups and justify reasoning. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:geometric properties of subgroups of families of 3D shapes geometric properties of subgroups of families of 2D shapes subgroups of families of 3D shapessubgroups of families of 2D shapes how to analyse 3D and 2D shapes to identify geometric propertieshow to classify subgroups using different combinations of geometric propertieshow to justify reasoning for the classification of shapes. | Students may:construct and/or deconstruct shapes within families of shapes to analyse, identify and describe the defining geometric properties identify subgroups of families of shapes (e.g. quadrilaterals, triangles, pentagons...)identify the family to which the subgroup belongs (e.g. regular polygons)identify geometric properties used to classify families of shapes and subgroups of familiesuse geometric tools to create shapes using subgroups of a particular family analyse and compare subgroups of families of shapes based on the defining geometric propertiesreclassify subgroups as required and give reasons visualise and represent families and their subgroups in a variety of ways, such as concept maps or family treesdescribe representations of subgroups of families of shapes using defining geometric propertiesidentify shapes embedded within other shapesdescribe the defining geometric properties, such as rotational symmetry and the sum of internal anglesuse geometric properties of subgroups to visualise and construct a variety of modelsrepresent models in a variety of waysdescribe constructions using the defining geometric properties of the subgroups and/or familycreate specifications for the construction of models by others.  | 3D shapes and objects and 2D shapes triangular prisms and hexagonal prismssquare-based pyramids, tetrahedronscircle, semicircle, quadrant, concentric circles regular and irregular polygons (quadrilaterals, triangles, pentagons, hexagons, octagons, dodecagons)non-polygons (e.g. ellipse)Platonic solids (cube tetrahedron, octahedron, dodecahedron, icosahedron)Geometric terms and propertiesperpendicular faces, perpendicular linescongruence symmetry rotational symmetrysum of internal angles of shapesVisualisations and representations3D shapes from different viewpoints2D shapes in different orientationsshapes embedded within other shapesLines and anglesintersecting linesdiagonal linesperpendicular linesdegreesgeometric tools* 360 degrees protractor

pair of compasses  |
| Investigations should occur in a range of contexts. For example, students could investigate:design specifications for fantasy or real-life constructions, such as cityscapes or toysshapes used in historical architectureshapes used in furniture, such as shelves or desksshapes and designs of sets of stationeryshapes used for storage in confined areas such as on a yacht or caravandesigns for storage such as lunchboxes or CD holders  |

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| Level 5: Level statementStudents investigate the properties of shapes, including congruence and similarity, and identify shapes embedded within irregular shapes to assist with the calculation of areas. They interpret and draw plans and elevations with attention to suitable scales, depth and perspective, and use geometric tools to assist with the construction of shapes and angles.Students use the conventions of mapping, including latitude and longitude, to interpret and describe movements and locations on maps of the world. They calculate distance on maps and dimensions on plans by referring to scales expressed as simple ratios. They give or follow directions expressed as compass bearings and distance to move around a local environment. |
| Core learning outcome: S 5.1Students analyse the relationships between the properties of shapes, lines and angles to explain similarity and congruence and to create representations of geometric objects that satisfy design specifications. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:* relationships between the properties of shapes, lines and angles
* how to analyse the relationships between properties of shapes, lines and angles
* similar figures are the same shape
* congruent figures are the same shape and size
* how to create representations of geometric objects that satisfy design specifications.
 | Students may:* explain relationships between the properties of shapes, lines and angles
* compare and analyse properties of shapes, lines and angles to identify relationships between them
* explain similar shapes as being shapes that are the same shape but different size
* identify and explain the similarity between a plan and a real-life representation
* explain congruent shapes as shapes that have the same shape and size
* explain the difference between similarity and congruence
* measure dimensions in a plan and compare with real-life representations to determine congruence or similarity
* interpret design specifications involving compound and embedded shapes
* construct 90° and 60° angles using a variety of geometric tools
* bisect a line and check the size of the angle created
* create 3D representations from plan drawings that show different viewpoints, such as side, front, top and cross-sections
* analyse how the properties of some congruent shapes enable tessellation
* sketch realistic 3D shapes showing depth and perspective
* use a range of methods to draw similar and congruent shapes.
 | 3D shapes and objects and 2D shapes plans and elevations compound shapesembedded shapesGeometric terms and propertiessimilarity* similar shapes (reductions and enlargements)

congruence* symbol for labelling

scale plansVisualisations and representationsconventions for representing 3D shapes (perspective)sections and cross-sectionsLines and anglesexternal anglessimple constructions using geometric tools* perpendicular line (90 degrees)
* angle of 60 degrees
* bisect a line
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| **Investigations should occur in a range of contexts. For example, students could investigate:**computer-aided designs plans of road constructions, sports courts or airport runwaysproportions used in historical architecture such as phithe construction of buildings with a view to producing floor plans and elevationsdesigns of logos, decals or badgesdesign templates such as those used in Do It Yourself magazinesthe construction of household items and toysdesign processes for kitchens or bathrooms.  |

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| Level 6: Level statementStudents make generalisations about shapes, lines and angles and develop chains of reasoning connecting related properties that can be used to solve geometric problems. They communicate their solutions by using geometric terms and symbols supported by appropriate representations.Students analyse a range of authentic maps, globes and plans, identifying the information that guides interpretation. They understand why time varies across the world, and refer to international time zones, rotation of the Earth, and position on the Earth’s surface to explain or calculate dates and times in specific places. |
| Core learning outcome: S 6.1Students use deductive reasoning to generalise about the properties of shapes, lines and angles referring to relationships between these properties to justify arguments. |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | **Core content** |
| Students know:properties of shapes, lines and angleslines and angles can be represented using letter conventions relationships between shapes, lines and angleshow to use deductive reasoning to make generalisationshow to develop a mathematical argument that can be justified. | Students may:describe generalised relationships between the properties of shapes (2D and 3D), and lines and anglesrepresent lines and angles using letter conventions including pro-numeralsuse properties of shapes and angle relationships formed by parallel and intersecting lines to deduce the magnitude of angles (i.e. isosceles triangle rule, equilateral triangle rule, exterior angles of a triangle, sum of the angles of a triangle, opposite angles in a quadrilateral, sum of angles of a quadrilateral, opposite angles in a parallelogram, corresponding angles, alternate angles, co-interior angles, vertically opposite angles, supplementary angles, angles at a point)use logical chains of reasoning to make generalisations check thinking using alternative generalisations and strategies, including algebraic reasoning justify arguments by using, ordering and explaining generalisations.  | 3D shapes and objects and 2D shapes generalisations relating to 2D shapesrelationships between 2D and 3D shapesGeometric terms and propertiesgeneral patterns of triangles, quadrilaterals, parallel and intersecting linesscale factorVisualisations and representationsembedded shapes, lines and anglesLines and anglesletter conventionsangles produced when a transversal crosses parallel linesgeneralisations relating angles* vertically opposite
* at a point
* in a triangle

in a quadrilateral  |
| **Investigations should occur in a range of contexts. For example, students could investigate:**support structures for constructionsarchitectural designs for buildings or bridges. |