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| Strand: Space | | Topic: Shape and line |
| Foundation Level: Level statement  Students 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 objects  familiar objects from different viewpoints  familiar 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 objects  match, sort or identify familiar items or objects by their shapes  explore, 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 shapes  recognise 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 statement  Students 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 1.1  Students 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 objects  the language to describe properties of shapes and objects  how 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 terms  compare shapes, identifying similar and different properties, such as lines and angles (corners)  visualise, identify and describe the obvious properties of everyday shapes and objects  identify 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 properties  explain reasons for the classifications using geometric terms and properties  record or represent the obvious properties of shapes in pictures or words  compare shapes within shapes and shapes that fold to make other shapes, and identify geometric properties and functions  visualise, identify and describe shapes within shapes  use representations to visualise, make and describe reconstructions of simple shapes  represent shapes from different viewpoints  represent ‘mind pictures’ to assist recall and identification of geometric properties  visualise (create ‘mind pictures’ of) 2D and 3D shapes to develop descriptions for posing questions or giving clues about shapes  describe 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 shapes  make 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 modified  make simple representations of shapes with modified properties  provide 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 shapes  compare 2D shapes with the faces of 3D shapes and objects  construct 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, pyramids  everyday examples of 3D shapes (e.g. ice-cream cones, balls, dice)  circles, triangles, rectangles including squares  Geometric terms and properties  open and closed figures  flat, straight, curved, round  3D 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 shapes  3D objects from different viewpoints  2D shapes in different orientations  shapes within shapes   * folding, cutting * joining halves   shapes within pictures, illustrations, puzzles  Lines and angles  straight and curved lines  corners (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 halves  games, such as ‘What shape am I?’  the deconstruction of packaging in order to design packaging for objects with different properties  how 3D shapes can be used in activities, such as using faces of 3D shapes for printing  how shapes fit into puzzles  how properties of 3D shapes can be changed or manipulated using concrete materials. | | |

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| Level 2: Level statement  Students 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 2.1  Students 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 shapes  language to describe properties of 3D shapes and objects and 2D shapes  how 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 orientations  how to identify shapes and objects from different viewpoints or orientations. | Students may:  identify and describe properties of 3D shapes and objects and 2D shapes  sort shapes according to properties  label categories and shapes within categories using geometric terms  identify given categories of 3D and 2D shapes  describe properties (e.g. angles)  compare and identify a range of angles  sort and identify categories of 3D shapes of familiar objects and justify choices  identify relationships between 2D representations and 3D shapes  identify symmetry where shapes are partitioned and for shapes within shapes  visualise and describe the geometric properties of known objects and shapes  represent shapes from different viewpoints or orientations  identify and describe what is, and is not, visible from different viewpoints  visualise 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 different  make representations of shapes using nets  describe the properties of shapes or nets of shapes  sort representations into categories using common characteristics and properties  compare the geometric properties of a net with its 3D shape  use nets and properties to identify the shapes to be constructed  visualise and describe alternative ways to construct particular shapes  identify and describe different nets for the same 3D shape. | 3D shapes and objects and 2D shapes  common characteristics of cubes and prisms  spheres, cylinders, cones, pyramids  common characteristics of rectangles including squares  Geometric terms and properties  face, corner, side, edge  3D shapes (shape and number of faces, function ...)  2D shapes (number of sides, number of angles …)  nets of 3D shapes with flat surfaces  Visualisations and representations  ‘mind pictures’ of 3D and 2D shapes  3D objects from different viewpoints  2D shapes in different orientations  partition of 2D shapes  (e.g. triangles within a square)  depth in 3D shapes  Lines and angles  right 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 3.1  Students 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 shapes  geometric properties that categorise families of 3D shapes  how to describe the defining geometric properties of 3D shapes  nets are 2D representations of the surfaces of 3D shapes  how to model 3D shapes using nets  different ways to represent  and model 3D shapes  families of 2D shapes  geometric properties that categorise families of 2D shapes  how 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 shapes  describe and classify the geometric properties of shapes, including lines and angles  use a range of properties to classify and define families of shapes and objects  describe the similar and different properties of families of shapes  compare shapes within families  use 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 representations  experiment using a range of shapes in play constructions and artwork  classify shapes that do and do not tessellate and describe using geometric properties and terms  represent 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 properties  create 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 reductions  represent enlargements and reductions of shapes on grid paper  use conventions to label shapes and angles  identify and describe geometric properties of similar shapes from a variety of orientations or viewpoints after enlargements and/or reductions  identify and describe changes in 2D shapes that result from enlargement or reduction of the length of  the sides  identify and describe the defining geometric properties of a family of 3D shapes  identify and describe 2D shapes in nets used to create 3D shapes  represent the 3D shape to be created from a net using isometric paper  visualise and construct different shapes using a range of materials including nets  deconstruct shapes to identify the range of possible nets  describe how geometric properties and nets can be used for the classification of 3D shapes  visualise and describe the construction of 3D shapes from 2D nets  predict the 3D shape that will be constructed from a given net and justify the choice using properties that characterise shape families  use 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 properties  vertex, base, apex  congruence (same shape and size)  parallel sides, faces, lines  equal sides and angles  conventions 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 shapes  symmetrical/asymmetrical shapes  transformations of 2D shapes   * enlargements and reductions of shapes   tessellating properties of triangles and quadrilaterals  Visualisations and representations  ‘mind pictures’ of a single flip, slide or turn of 2D shapes  ‘mind pictures’ of 3D shapes  different viewpoints and orientations  nets of shapes  shapes within shapes, angles within angles  conventions for representing  3D shapes (dotted lines, shading, connecting overlays)  Lines and angles  vertical, horizontal and oblique lines  parallel lines  degrees  right 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 statement  Students 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 4.1  Students 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 shapes  subgroups of families of 2D shapes  how to analyse 3D and 2D shapes to identify geometric properties  how to classify subgroups using different combinations of geometric properties  how 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 families  use geometric tools to create shapes using subgroups of a particular family  analyse and compare subgroups of families of shapes based on the defining geometric properties  reclassify subgroups as required and give reasons  visualise and represent families and their subgroups in a variety of ways, such as concept maps or  family trees  describe representations of subgroups of families of shapes using defining geometric properties  identify shapes embedded within other shapes  describe the defining geometric properties, such as rotational symmetry and the sum of internal angles  use geometric properties of subgroups to visualise and construct a variety of models  represent models in a variety of ways  describe constructions using the defining geometric properties of the subgroups and/or family  create specifications for the construction of models by others. | 3D shapes and objects and 2D shapes  triangular prisms and hexagonal prisms  square-based pyramids, tetrahedrons  circle, 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 properties  perpendicular faces, perpendicular lines  congruence  symmetry  rotational symmetry  sum of internal angles of shapes  Visualisations and representations  3D shapes from different viewpoints  2D shapes in different orientations  shapes embedded within other shapes  Lines and angles  intersecting lines  diagonal lines  perpendicular lines  degrees  geometric 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 toys  shapes used in historical architecture  shapes used in furniture, such as shelves or desks  shapes and designs of sets of stationery  shapes used for storage in confined areas such as on a yacht or caravan  designs for storage such as lunchboxes or CD holders | | |

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| Level 5: Level statement  Students 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 5.1  Students 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 shapes  embedded shapes  Geometric terms and properties  similarity   * similar shapes (reductions and enlargements)   congruence   * symbol for labelling   scale plans  Visualisations and representations  conventions for representing 3D shapes (perspective)  sections and cross-sections  Lines and angles  external angles  simple constructions using geometric tools   * perpendicular line (90 degrees) * angle of 60 degrees * bisect a line |
| **Investigations should occur in a range of contexts. For example, students could investigate:**  computer-aided designs  plans of road constructions, sports courts or airport runways  proportions used in historical architecture such as phi  the construction of buildings with a view to producing floor plans and elevations  designs of logos, decals or badges  design templates such as those used in Do It Yourself magazines  the construction of household items and toys  design processes for kitchens or bathrooms. | | |

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| Level 6: Level statement  Students 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 6.1  Students 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 angles  lines and angles can be represented using letter conventions  relationships between shapes, lines and angles  how to use deductive reasoning to make generalisations  how 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 angles  represent lines and angles using letter conventions including pro-numerals  use 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 shapes  relationships between 2D and 3D shapes  Geometric terms and properties  general patterns of triangles, quadrilaterals, parallel and intersecting lines  scale factor  Visualisations and representations  embedded shapes, lines and angles  Lines and angles  letter conventions  angles produced when a transversal crosses parallel lines  generalisations 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 constructions  architectural designs for buildings or bridges. | | |