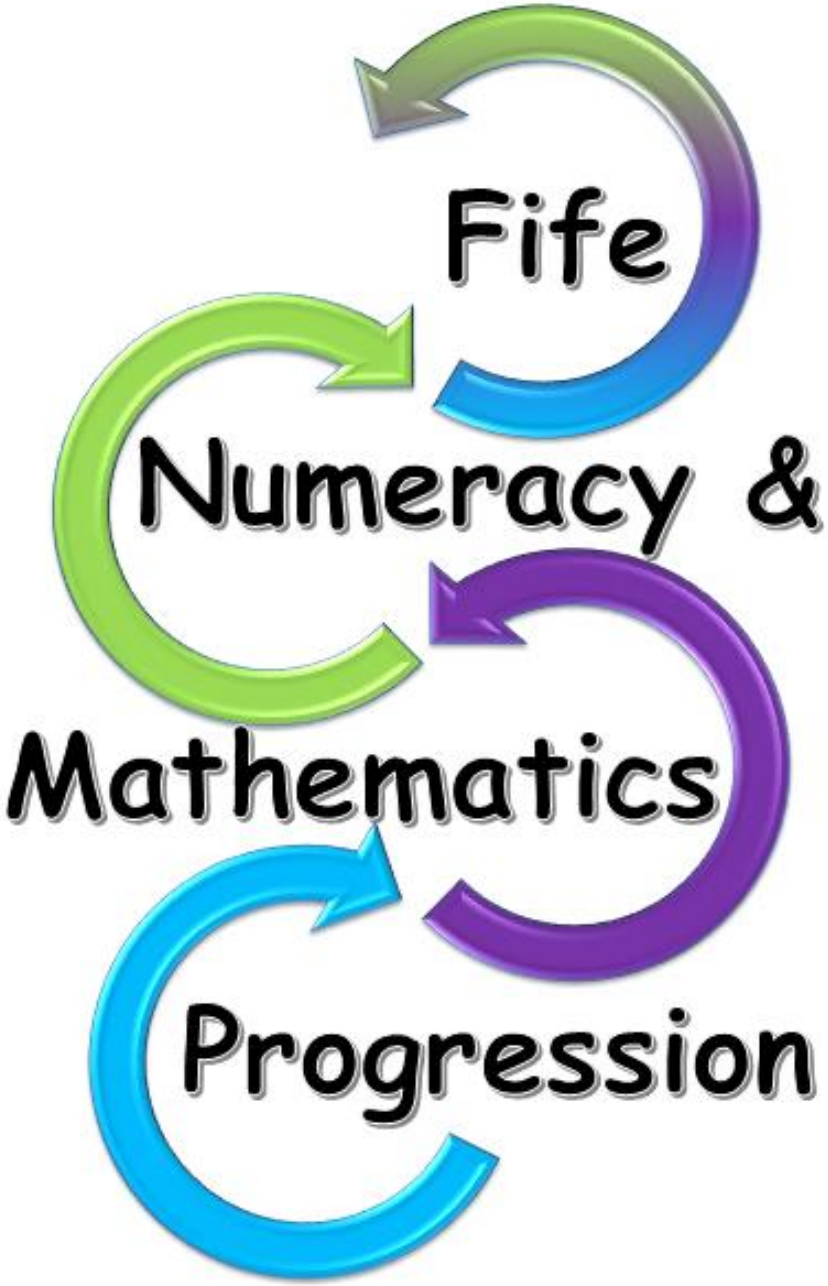

Shape, Position & Movement

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Enquiries about the Council's professional learning programme and the use of this work should be directed to: Fife Council Pedagogy Team at Pedagogy.team@fife.gov.uk

Contents Page

Fife Council

ACKNOWLEDGEMENT

This programme is extensively based on proven approaches and strategies defined within the First Steps in Mathematics resources, Maths Recovery and New Zealand programmes.

Unlike many resources that present mathematical concepts that have been logically ordered and prioritized by mathematicians or educators, First Steps in Mathematics follows a sequence derived from the mathematical development of real children. It is based on five years of research by a team of teachers from the Western Australia Department of Education and Training, and tertiary consultants led by Professor Sue Willis at Murdoch University. The First Steps in Mathematics project team conducted an extensive review of international research literature, which revealed gaps in the field of knowledge about students' learning in mathematics. Using tasks designed to replicate those in the research literature, team members interviewed hundreds of elementary school children in diverse locations. Analysis of the data obtained from these interviews identified characteristic phases in the development of students' thinking about mathematical concepts.

Maths Recovery, founded on years of research by Dr Robert Wright, Professor in Maths Education within Southern Cross University in Australia and colleagues, is now internationally renowned in responding to problems of children's failure in early numeracy and primary mathematics and has been used extensively by many nations, including New Zealand, to develop their own standards and teaching approaches in mathematics.

We are also very grateful to the work done by both Angus and Highland Council. Their input has been key in the development of this progression.

Fife COUNCIL

GUIDANCE

The Fife Numeracy and Mathematics Progression (Shape, Position and Movement) sets out a clear set of learning experiences and outcomes from the following Curriculum for Excellence Numeracy and Mathematics strands:

Properties of 2D Shapes and 3D Objects

Angle, Symmetry and Transformation

The purpose of this document is to provide a continuum of learning both within a level and through the Early, First, Second and Third levels. The developmental stages of learning in numeracy and mathematics are clearly documented and this will support teachers when identifying starting points for learners. The progression is intended to assist teachers as they plan their numeracy and mathematics curriculum.

The 'Points to Consider' and 'Suggested Written Recording' sections will be built up as feedback is received on this document.

Each strand is shown as a pyramid to show how learning and teaching progress within this. The skills at the base of the pyramids are required to be understood for further learning to be built upon and are not aligned to any particular year group (at First Level, statements in blue do *not* equate to Primary 2, for example). Pupils will progress through the pyramids as and when they are ready and able to do so.

The Fife Numeracy and Mathematics Progression focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought and problem solving skills which can be applied in unfamiliar situations.

Early Level Experiences and Outcomes ~ Shape, Position and Movement

I enjoy investigating objects and shapes and can sort, describe and be creative with them.
MTH 0-16a Pg 4

In movement, games, and using technology I can use simple directions and describe positions.
MTH 0-17a Pg 5

I have had fun creating a range of symmetrical pictures and patterns using a range of media.
MTH 0-19a Pg 5

PROPERTIES OF 2D SHAPES AND 3D OBJECTS AIM: Recognise, sort, describe and use simple 2D shapes and 3D objects according to various criteria.

MTH 0-16a

Name familiar shapes.

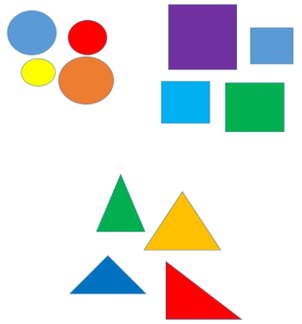
Use shapes creatively.

e.g. in art, in play

Identify cubes, cuboids, cylinders, cones and spheres in everyday objects.

Sort shapes according to given criteria.

Sort shapes according to own criteria.



e.g. all the circles together, all the triangles, all the squares

Recognise shapes (or shapes that are close to) in the environment.

e.g. circles, triangles, squares and rectangles

Draw or make appropriate shapes from an oral description.

Fit shapes together by turning if required.

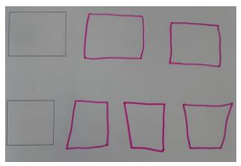
Use appropriate language to describe shapes.

e.g. The round shape is curved.

Use appropriate shapes when drawing from memory.

e.g. draws circular shape for head.

Copy shapes with a degree of mathematical accuracy.



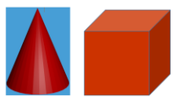
e.g. four lines and four corners.

Match shapes one to one, placing it exactly on top to check (tiling).

Create objects that relate to function.

e.g. make something that can stand by itself.

Describe how two things are alike and how they are different.



These are both red but this one is pointy.

Interpret and begin to use descriptive language.

e.g. 'flat', 'long', 'curved'

Interpret and begin to use spatial language.

e.g. 'rolls', 'stacks', 'slides'

Investigate properties of shapes and objects through play.

Classify 3D objects by attribute or function.

e.g. good for rolling

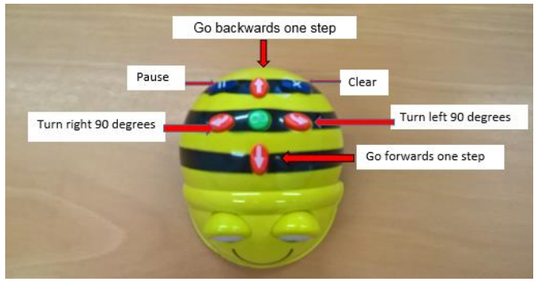
Connect shapes and function and select appropriately.

e.g. Chooses objects with flat faces for stacking.

ANGLE, SYMMETRY AND TRANSFORMATION AIM: Use language of position, and direction accurately to solve simple problems. Identify, describe, complete and create symmetrical patterns with at least one line of symmetry.

MTH 0-17a & MTH 0-19a

Use programmable technology.



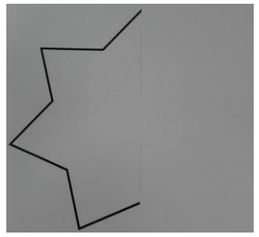
Use technology to create symmetrical patterns.

e.g. flip images, PAINT, Word

Identify patterns and pictures that show symmetry.

Describe the location of an object as being between two other locations. *e.g. the hall is between the office and the staff room.*

Use a fold line to help create symmetrical pictures or cut symmetrical shapes.



Move to show meaning of language of movement, position and orientation.

e.g. Hides behind the frame, climbs to the top of the slide

Draw pictures that show meaning of language of orientation and position.

Create symmetrical patterns and pictures, explaining why they are symmetrical.

Identify symmetry in the environment.



Create symmetrical patterns by folding.

Respond appropriately to language of position and orientation (under, on, near, right, left).

e.g. Put the book under the table.

Respond appropriately to language of movement (forward, back, around, past, turn).

Use language of position, movement and orientation.

e.g. The dog went round the corner.

Create repeated patterns by sliding (translation).

Early Level Overview

Key Aspect	Experiences and Outcomes	National Benchmarks
Properties of 2D Shapes and 3D Objects Pg 4	I enjoy investigating objects and shapes and can sort, describe and be creative with them. **MTH 0-16a**	• Recognises, describes and sorts common 2D shapes and 3D objects according to various criteria, for example, straight, round, flat and curved.
Angle, Symmetry and Transformation Pg 5	In movement, games, and using technology I can use simple directions and describe positions. **MTH 0-17a** I have had fun creating a range of symmetrical pictures and patterns using a range of media. **MTH 0-19a**	• Understands and correctly uses the language of position and direction, including in front, behind, above, below, left, right, forwards and backwards, to solve simple problems in movement games. • Identifies, describes and creates symmetrical pictures with one line of symmetry.

First Level Experiences and Outcomes ~ Shape, Position and Movement

I have explored simple 3D objects and 2D shapes and can identify, name and describe their features using appropriate vocabulary.
MTH 1-16a Pg 8

I can explore and discuss how and why different shapes fit together and create a tiling pattern with them.
MTH 1-16b Pg 8

I can describe, follow and record routes and journeys using signs, words and angles associated with direction and turning.
MTH 1-17a Pg's 9 & 10

I have developed an awareness of where grid reference systems are used in everyday contexts and can use them to locate and describe position.
MTH 1-18a Pg's 9 & 10

I have explored symmetry in my own and the wider environment and can create and recognise symmetrical pictures, patterns and shapes.
MTH 1-19a Pg's 9 & 10

PROPERTIES OF 2D SHAPES AND 3D OBJECTS AIM: Identify, name, classify and describe a range of simple 3D objects and 2D shapes using appropriate mathematical vocabulary. Can recognise these shapes in different orientations and sizes. Create a tiling pattern incorporating at least two different shapes.

MTH 1-16a & MTH 1-16b

Explain why a shape might or might not tile.

e.g. hexagon can but oval cannot because it has round edges.

Use language such as side, face, edge, corner, surface, curved, base and angle when describing shapes.

Identify examples of tiling in the environment.

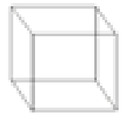
Use language of transformation to explain why shapes are the same.

e.g. If I turn the red triangle round it is the same as the blue one.

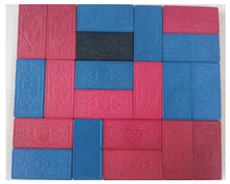
Distinguish between a 3D object and a face.

e.g. recognise that a cube and a square are not the same.

Match standard 3D shapes to drawings or diagrams.



Use multiple identical shapes to decide if it can tile without gaps.



Recognise repetitions of shapes and objects that create patterns.

Identify prisms and pyramids.

Visualise and describe cross sections of 3D objects.

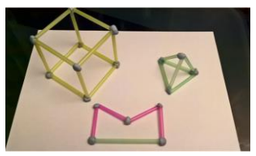
Identify 2D shapes in faces and cross sections of objects.

Recognise when two shapes are exactly the same by fitting one exactly on the other.

Sort 2D shapes and 3D objects using more than one criteria.

shape	big	small
circle		
square		

Identify spatial features and link to strength, stability and storage.



Understand that both 2D shapes and 3D objects can be created by deconstructing and reconstructing other shapes.

Select an object given a description of its features.

e.g. I have two edges, two flat faces and a curved face. What am I?

Examine 3D shapes to match 2D shapes on faces.

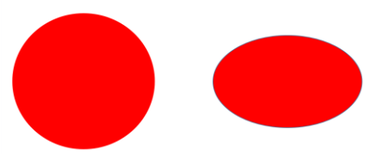
Imagine and draw cross sections of real objects. Cut and check.

Discuss what is present but cannot be seen when looking at a 3D object.

Describe and compare spatial features of 3D objects such as shape of faces, number of edges.

Look at an arrangement of shapes, cover and draw from memory.

Distinguish simple 2D shapes from similar shapes.

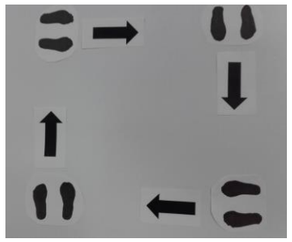


e.g. recognise that a circle and an oval are different

ANGLE, SYMMETRY AND TRANSFORMATION AIM: Use positional and directional language to describe, follow and record locations, routes and directions, including those on grids. Recognise, record and explain symmetrical patterns, pictures, nature and 2D shapes. Note: This pyramid appears over two pages.

MTH 1-17a, MTH 1-18a & MTH 1-19a

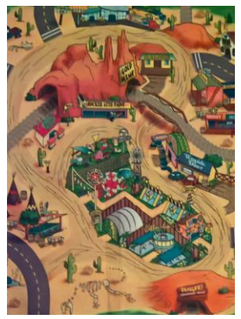
Predict the effect of following a rule involving a simple sequence of movements by imagining.



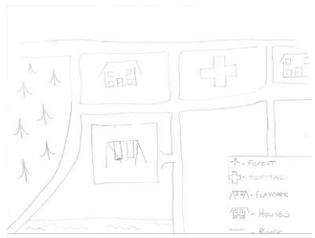
e.g. Two steps forward turn right two steps forward turn right.

Use informal methods to estimate, compare, measure and describe the size of angles in the environment in relation to right angles and straight angles.

Discuss location and routes using appropriate language.



Create simple grid maps with legends.

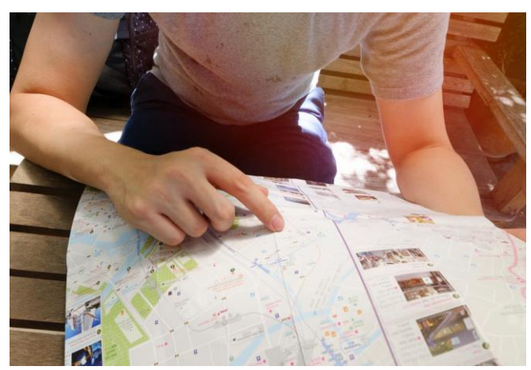


Use directional language to describe a route.

e.g. north, south, right angle, right, left, full turn, half turn, quarter turn, 90°.

Knows and uses the compass points North, South, East & West

Explore relevant maps, identifying features using a legend.



Explore positional language in relation to compass points and their associated angles.

e.g. Identify North Pole on a map and use language East, West, South etc. to show relationship to other features such as angles.

Explore right angles and straight angles in relation to turns.

e.g. In gym carry out a sequence of movements having been given instructions such as 'Turn 90°, roll and turn 180°'.

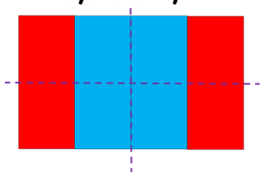
Use grid references to locate a position on a map, understanding the horizontal and vertical location.

START – A1
1st pick up B3
2nd pick up D4
Arrive at destination C5

Use technology to follow & create routes.

e.g. roamer or BeeBot

Create symmetrical patterns with more than one line of symmetry.



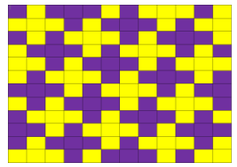
Identify right angles in the environment and in well-known shapes.

Find grid references describing horizontal and vertical location. ***e.g. locate the church on the map and give grid reference.***

Plot location using grid reference.

e.g. Given grid reference, correctly record an item on a grid.

Create tessellating patterns.



Attempt to give a bird's eye view of a route.

Understand that a right angle is 90°

Understand that angles are a measure of turn.

Explore the four main points of a compass (cardinal directions). ***e.g. North, South, East and West***

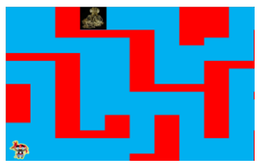
Investigate grids used in simple maps recognising that grid references give position of a complete square and why they are used.

Create symmetrical patterns with one line of symmetry.

Use mirrors to check symmetry in patterns, pictures and shapes.

Visualise whether a shape is symmetrical by imagining a fold line.

Find paths on mazes including those that use technology.



Give instructions for creating paths on squared paper or computer screens that need to be done in order.

e.g forward 3 then turn right forward 2

Ensure order when giving directions.

e.g. At the top of the stairs go through the red door then go along the corridor.

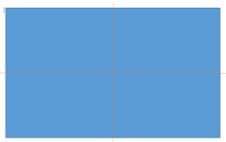
Describe turns using directional language.

e.g. half turns, clockwise, anti-clockwise

Identify symmetry and tessellation in the environment.

Identify symmetry in patterns and pictures.

Identify a line of symmetry in a shape that can be folded.



Follow directions that give between as a location.

e.g. I lost my glove between the playground and the cloakroom. Can you find it?

Place key features on a map in an approximate correct location.

e.g. Draw the tree closer to the playground than the school.

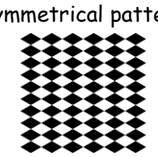
Find paths on informal maps.

Use positional, orientation and movement language to describe routes.

e.g. Grandma's house is by the park. You have to go through the park to get there.

Make symmetrical pictures using a variety of means such as flipping and drawing around templates.

Repeat multiple copies of two or three 2D shapes to give a symmetrical pattern.



First Level Overview

Key Aspect	Experiences and Outcomes	National Benchmarks
Properties of 2D Shapes and 3D Objects Pg 8	I have explored simple 3D objects and 2D shapes and can identify, name and describe their features using appropriate vocabulary. **MTH 1-16a** I can explore and discuss how and why different shapes fit together and create a tiling pattern with them. **MTH 1-16b**	• Names, identifies and classifies a range of simple 2D shapes and 3D objects and recognises these shapes in different orientations and sizes. • Uses mathematical language to describe the properties of a range of common 2D shapes and 3D objects including, side, face, edge, vertex, base and angle. • Identifies 2D shapes within 3D objects and recognises 3D objects from 2D drawings. • Identifies examples of tiling in the environment and applies knowledge of the features of 2D shapes to create tiling patterns incorporating two different shapes.
Angle, Symmetry and Transformation Pg's 9 & 10	I can describe, follow and record routes and journeys using signs, words and angles associated with direction and turning. **MTH 1-17a** I have developed an awareness of where grid reference systems are used in everyday contexts and can use them to locate and describe position. **MTH 1-18a** I have explored symmetry in my own and the wider environment and can create and recognise symmetrical pictures, patterns and shapes. **MTH 1-19a**	• Uses technology and other methods to describe, follow and record directions using words associated with angles, directions and turns including full turn, half turn, quarter turn, clockwise, anticlockwise, right turn, left turn, and right angle. • Knows that a right angle is 90°. • Knows and uses the compass points, North, South, East and West. • Uses informal methods to estimate, compare and describe the size of angles in relation to a right angle. • Finds right angles in the environment and in well-known 2D shapes. • Identifies where and why grid references are used. • Describes, plots and uses accurate two figure grid references, demonstrating knowledge of the horizontal and vertical location. • Identifies symmetry in patterns, pictures, nature and 2D shapes. • Creates symmetrical pictures and designs with more than one line of symmetry.

Second Level Experiences and Outcomes ~ Shape, Position and Movement

Having explored a range of 3D objects and 2D shapes, I can use mathematical language to describe their properties, and through investigation can discuss where and why particular shapes are used in the environment.

MTH 2-16a Pg 13

Through practical activities, I can show my understanding of the relationship between 3D objects and their nets.

MTH 2-16b Pg 13

I can draw 2D shapes and make representations of 3D objects using an appropriate range of methods and efficient use of resources.

MTH 2-16c Pg 13

I have investigated angles in the environment, and can discuss, describe and classify angles using appropriate mathematical vocabulary.

MTH 2-17a Pg's 14 & 15

I can accurately measure and draw angles using appropriate equipment, applying my skills to problems in context.

MTH 2-17b Pg's 14 & 15

Through practical activities which include the use of technology, I have developed my understanding of the link between compass points and angles and can describe, follow and record directions, routes and journeys using appropriate vocabulary.

MTH 2-17c Pg's 14 & 15

Having investigated where, why and how scale is used and expressed, I can apply my understanding to interpret simple models, maps and plans.

MTH 2-17d Pg's 14 & 15

I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid.

MTH 2-18a/MTH 3-18a Pg's 14 & 15

I can illustrate the lines of symmetry for a range of 2D shapes and apply my understanding to create and complete symmetrical pictures and patterns.

MTH 2-19a/MTH 3-19a Pg's 14 & 15

PROPERTIES OF 2D SHAPES AND 3D OBJECTS AIM: Sort, describe and create representations of 2D shapes and 3D objects. Show understanding of the importance of 2D shape and 3D objects within the environment.

MTH 2-16a. MTH 2-16b & MTH 2-16c

Draw prisms, pyramids, cylinders, cubes, cuboids and cones recognisably using various mathematical tools.

Can use the relationship between diameter and radius to draw circles of given sizes, using a pair of compasses.

Sort regular and irregular polygons.

Describe and model regular and irregular polygons.

Use technology to create representations of 2D shape and 3D objects and understand that not all parts may be seen.

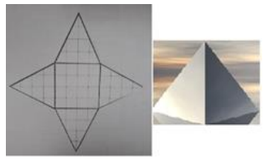
e.g. interactive geoboards

Explain how one shape can be superimposed upon another.

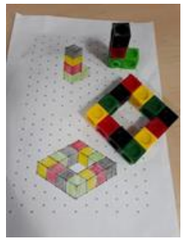
e.g. rotate the shape around the centre and then slide it over to the left.

Use the terms circumference, diameter and radius to accurately describe parts of a circle.

Match prisms and pyramids with nets by considering the number and shape of faces and the properties of each.



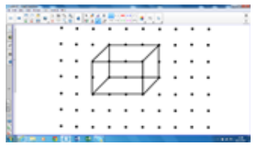
Use cubes to create models which match diagrams.



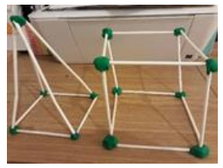
Identify corresponding faces on a net from a given model without folding the net.

e.g. match the red face of the cuboid to the correct part of the net

Draw 2D shapes and representations of 3D objects using square, isometric and blank paper.



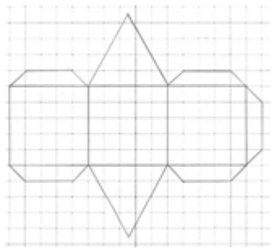
Recreate a skeleton of a prism or pyramid from a given set of measurements.



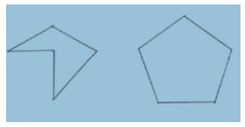
Create models and drawings that fulfil criteria related to faces, edges, angles etc.

Create nets using 3D objects as a template.

Make polyhedra in a variety of forms (skeleton, nets, solid clay) and discuss which features are best represented.



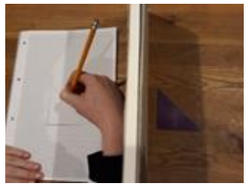
Discuss the similarities and differences between regular and irregular polygons.



Link features such as rigidity and flexibility to structures.

Discuss the effect of geometric shape in art and design.

Describe a geometric diagram or image with precision to allow another to interpret it.



Extend mathematical language to allow for accurate descriptions.

e.g. use regular, irregular, vertex, vertices, edges, faces, angles and diagonal appropriately and consistently.

Visualise 2D shapes and 3D objects following a description.

e.g. create mental images that match known criteria and attributes of shapes and objects.

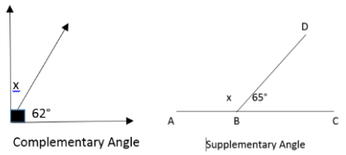
Identify 2D shape and 3D objects in the environment, noting their purpose.

Create skeletons of simple 3D shapes.

ANGLE, SYMMETRY AND TRANSFORMATION AIM: Measure, classify and draw angles. Plot and describe location using the Cartesian coordinate system. Note: This pyramid is displayed across two pages.

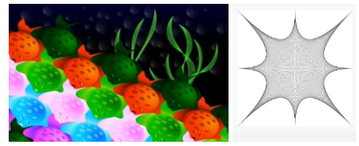
MTH 2-17a, MTH 2-17b, MTH 2-17c, MTH 2-17d, MTH 2-18a & MTH 2-19a

Knows the relationships within complementary and supplementary angles and uses this knowledge to calculate missing angles.

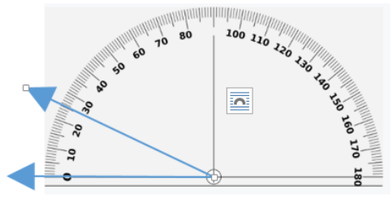


Investigate technology which supports real life contexts involving position, direction and movement.

Create and explain symmetrical patterns and tessellations involving some degree of complexity.

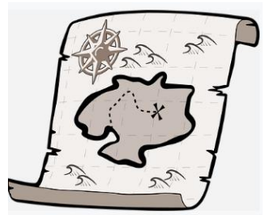


Measure & draws angles accurately, to within ± 2°, using a protractor.

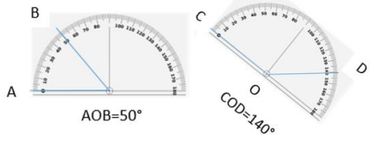


Create routes that use 8 point compass directions.

Use simple scale to calculate actual size or distance. ***e.g. 1cm: 2km***



Experiment with protractors to measure angles.



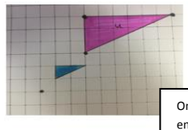
Follow routes that use 8 point compass directions.

On the grid above start at the star and follow the directions in the order below.

1) Go West 3 squares
2) Go North 5 squares
3) Go East 2 squares
4) Go South 4 squares
5) Go North East 3 squares
6) Go North 2 squares
7) Go South West 7 squares
8) Go West 2 squares
9) Go North East 7 Squares
10) Go East 2 squares

Where do you end up??

Use a grid to enlarge and reduce a figure (whole number scales) and to make distortions. *e.g. double widths but not heights.*



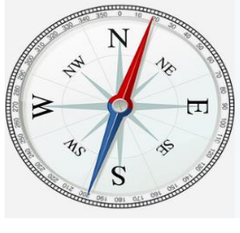
On the grid enlarge the triangle with the scale factor if 3 and centre (2, 3). Label the new triangle U

Enlarge models made with cubes to a small whole number scale.
e.g. given a model made of six cubes, produce one enlarged by a scale factor of three

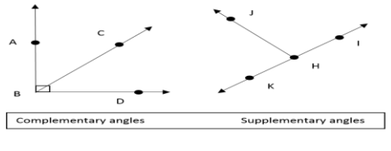
Visualise to predict the effect of specified movements on the position and orientation of figures and objects.

e.g. imagine what a shape will look like if rotated through a 90° turn clockwise

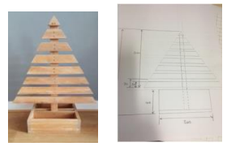
Investigate angles within a compass rose.



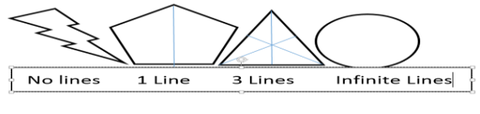
Explore complementary and supplementary angles.



Explore situations where scale is used.



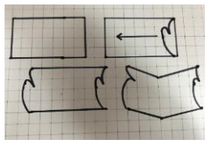
Identify and describe lines of symmetry in 2D shapes.



Relate multiples of 45° to the eight points of a compass rose.

Record routes that involve turning.

Use transformations to modify tessellating shapes to produce other tessellating shapes and informally explain why they work.
e.g.
Escher-type designs based on rectangles



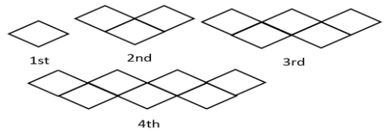
Produce designs that exhibit a specified symmetry (reflection or translation).
e.g. fold paper or use mirrors or computer graphic.

Investigate obtuse, acute and reflex angles by comparing to right angles and straight angles.

Use conventional maps to find locations and paths that meet everyday specifications, such as the closest post office or the safest route.

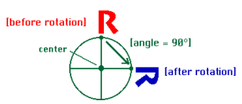
Use appropriate language of transformation in explaining how they tiled a shape or why they think a shape will tile.

Identify the transformations used to produce a spatial sequence and continue the sequence.



Visualise and reproduce the folds and cuts used to make a complex symmetrical pattern.
e.g. to copy a frieze or make a 'snowflake.

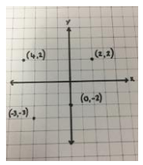
Describe the measurement of rotation of turns as an angle.



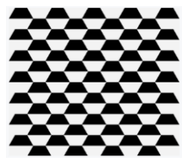
Place or describe key features on a map or path with sufficient care so that others can use them.

e.g. provide a tour map of their school for visitors

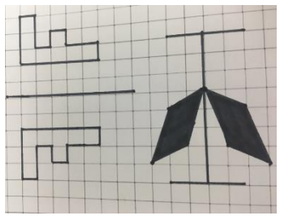
Use coordinates on a grid to identify and plot location.



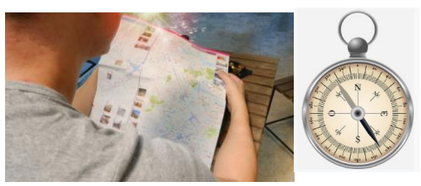
Provided with a single copy of a shape that will tile, produce a tessellating pattern by systematically translating, rotating or reflecting the shape.



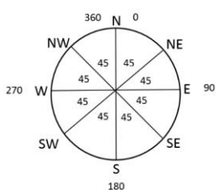
Decide whether reflection or translation is involved in producing a symmetrical arrangement and describe it.



Use distance and direction, including angle multiples of 45°, and common map grid.



Use multiples of 45° to give directions.



Give clear instructions for moving and locating objects in the environment or on maps and plans.

Start at the red star and go North 3 squares.
Turn east 90° then move forward 4 squares.
Turn 45° and move forward 1 square – what object are you on now?

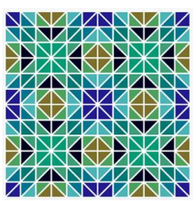
Interpret relevant maps to find way around the actual environment.

e.g. use a plan of the library to find a particular book.

Use appropriate language of transformation in describing how one shape can be superimposed on another.

e.g. turn it upside down and slide it.

Decide whether reflection or translation is involved in producing a pattern in the environment.



Second Level Overview

Key Aspect	Experiences and Outcomes	National Benchmarks
Properties of 2D Shapes and 3D Objects Pg 13	Having explored a range of 3D objects and 2D shapes, I can use mathematical language to describe their properties, and through investigation can discuss where and why particular shapes are used in the environment. **MTH 2-16a** Through practical activities, I can show my understanding of the relationship between 3D objects and their nets. **MTH 2-16b** I can draw 2D shapes and make representations of 3D objects using an appropriate range of methods and efficient use of resources. **MTH 2-16c**	• Describes 2D shapes and 3D objects using specific vocabulary including regular, irregular, diagonal, radius, diameter and circumference. Applies this knowledge to demonstrate understanding of the relationship between 3D objects and their nets. • Identifies and describes 2D shapes and 3D objects within the environment and explains why their properties match their function. • Knows that the radius is half of the diameter. • Uses digital technologies and mathematical instruments to draw 2D shapes and make representations of3D objects, understanding that not all parts of the 3D object can be seen.

Key Aspect	Experiences and Outcomes	National Benchmarks
Angle, Symmetry and Transformation Pg's 14 & 15	I have investigated angles in the environment, and can discuss, describe and classify angles using appropriate mathematical vocabulary. **MTH 2-17a** I can accurately measure and draw angles using appropriate equipment, applying my skills to problems in context. **MTH 2-17b** Through practical activities which include the use of technology, I have developed my understanding of the link between compass points and angles and can describe, follow and record directions, routes and journeys using appropriate vocabulary. **MTH 2-17c** Having investigated where, why and how scale is used and expressed, I can apply my understanding to interpret simple models, maps and plans. **MTH 2-17d** I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid. **MTH 2-18a/MTH 3-18a** I can illustrate the lines of symmetry for a range of 2D shapes and apply my understanding to create and complete symmetrical pictures and patterns. **MTH 2-19a/MTH 3-19a**	• Uses mathematical language including acute, obtuse, straight and reflex to describe and classify a range of angles identified within shapes in the environment. • Measures and draws accurately a range of angles to within ±2°. • Knows that complementary angles add up to 90 degrees and supplementary angles add up to 180 degrees and uses this knowledge to calculate missing angles. • Uses knowledge of the link between the eight compass points and angles to describe, follow and record directions. • Interprets maps, models or plans with simple scales, for example, 1cm:2km. • Describes, plots and records the location of a point, in the first quadrant, using coordinate notation. • Identifies and illustrates line symmetry on a wide range of 2D shapes and applies this understanding to complete a range of symmetrical patterns, with and without the use of digital technologies.

Third Level Experiences and Outcomes ~ Shape, Position and Movement

Having investigated a range of methods, I can accurately draw 2D shapes using appropriate mathematical instruments and methods.

MTH 3-16a Pg 19

I can name angles and find their sizes using my knowledge of the properties of a range of 2D shapes and the angle properties associated with intersecting and parallel lines.

MTH 3-17a Pg 19

Having investigated navigation in the world, I can apply my understanding of bearings and scale to interpret maps and plans and create accurate plans, and scale drawings of routes and journeys.

MTH 3-17b Pg 19

I can apply my understanding of scale when enlarging or reducing pictures and shapes, using different methods, including technology.

MTH 3-17c Pg's 20 & 21

I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid.

MTH 2-18a/MTH 3-18a Pg's 20 & 21

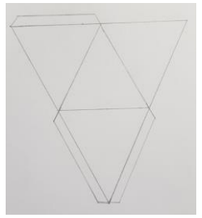
I can illustrate the lines of symmetry for a range of 2D shapes and apply my understanding to create and complete symmetrical pictures and patterns.

MTH 2-19a/MTH 3-19a Pg's 20 & 21

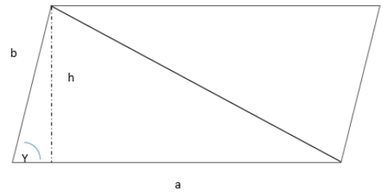
PROPERTIES OF 2D SHAPES AND 3D OBJECTS AIM: Select appropriate methods to draw a variety of geometric shapes including nets.

MTH 3-16a, MTH 3-17a & MTH 3-17b

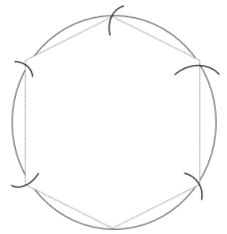
Draw nets to create 3D objects using understanding of construction of 2D shapes.



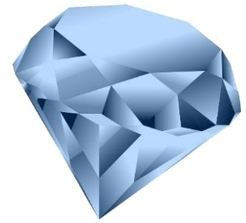
Use knowledge of drawing triangles to support construction of other 2D shapes.



Create a hexagon using a circle with a known radius.

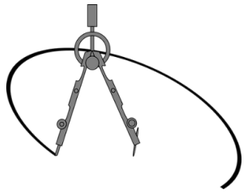


Identify inadequacies in descriptions of shapes.

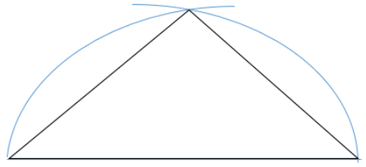


e.g. Claiming that a shape that has triangular faces is a triangular pyramid is untrue as other shapes can be constructed from triangular faces.

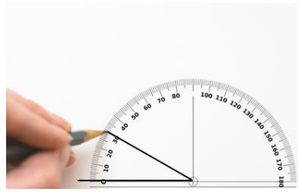
Draw circles accurately.



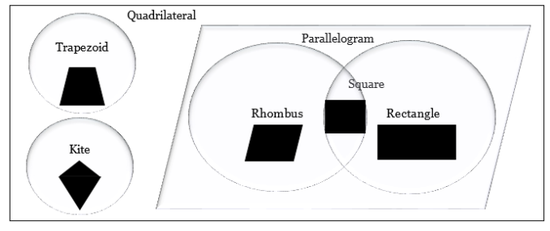
Construct triangles using compasses.



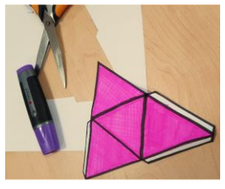
Construct triangles using a protractor.

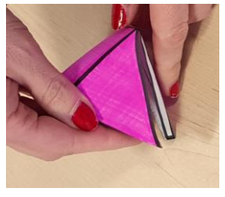


Apply the distinguishing features of common quadrilaterals to determine 'inclusive' relationships.

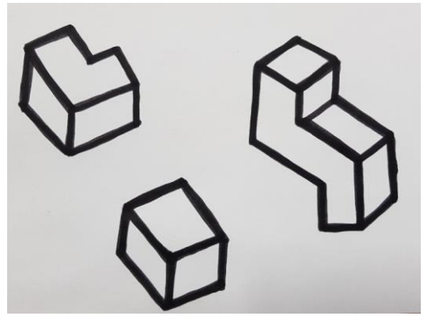


Create own nets to construct 3D objects

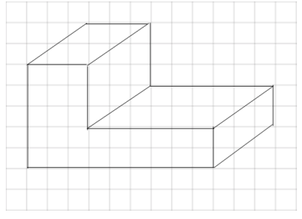




Use conventions of perspective and oblique when drawing 3D shapes.



Construct an arrangement of cubes from an isometric or grid drawing and draw from a different perspective.



Describe features that distinguish one common class of shape from another.

e.g. Prisms have two parallel faces but pyramids do not.

Identify and name perpendicular and parallel lines.

Generate and classify shapes that satisfy a given condition.

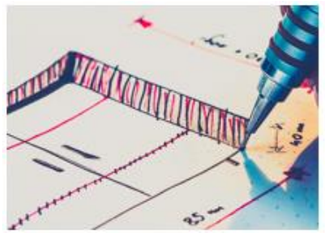
e.g. use straws to produce shapes that have two equal diagonals.

ANGLE, SYMMETRY AND TRANSFORMATION AIM: Interpret scale accurately in real life contexts. Use scale factor to enlarge and reduce shapes. Demonstrate understanding of the relationship between angles and lines. **Note: This pyramid appears over two pages.**

MTH 3-17c, MTH 3-18a & MTH 3-19a

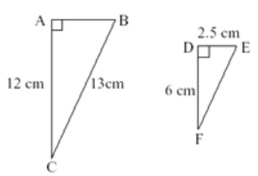
Use knowledge and understanding of scale to enlarge & reduce objects in size using linear scale factor.

Discuss considerations required when creating scale drawings and models.

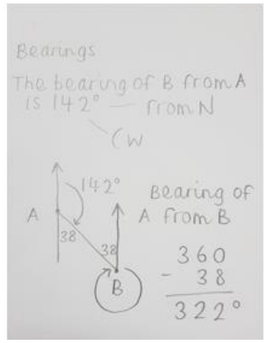


Use technology to enlarge and reduce shapes.

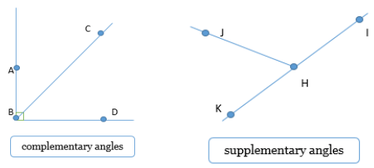
Identify scale factor from given dimensions.



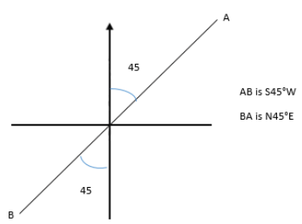
Measure and draw 3 figure bearings within mapping context, including scale drawings.



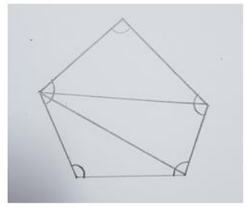
Calculate complementary and supplementary angles.



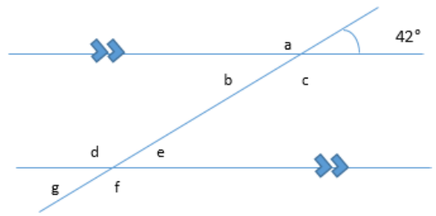
Use language and notation of bearing to give directions.



Use knowledge of interior angles of a triangle to calculate angles in other 2D shapes.

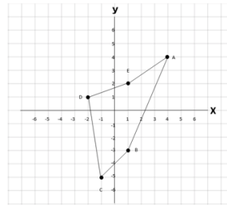


Explore corresponding, alternate and vertically opposite angles.



Investigate parallel, intersecting, perpendicular and transversal lines.

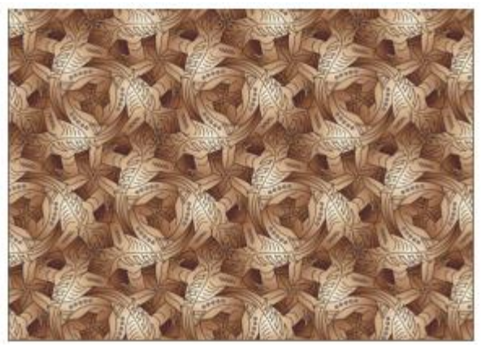
Use coordinates to read, plot and locate position on the Cartesian plane.



Visualise to predict the effect of specified movements on the position and orientation of figures and objects.

e.g. imagine what a shape will look like if rotated through a 270° turn clockwise

Use transformations to modify tessellating shapes to produce other tessellating shapes and informally explain why they work.



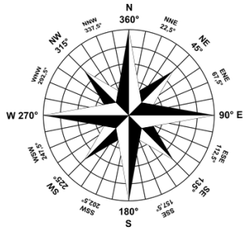
e.g.
Escher-type designs

Describe a route from given directions based upon distance, angle and compass bearings.

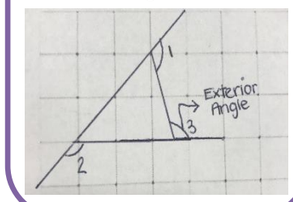
Explore maps using scale to identify actual distances.

Create scale maps which use mostly straight lines and right angles.

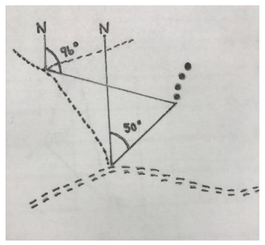
Relate bearings to the compass rose.



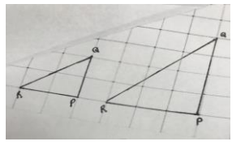
Calculate exterior angles.



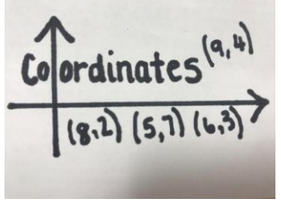
Sketch a route from given directions based upon distance, angle and compass bearings.



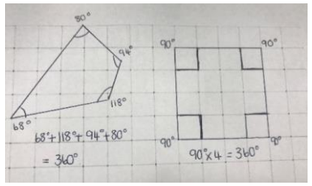
Investigate angles in enlargements and reductions.



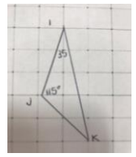
Follow and give directions using coordinates.



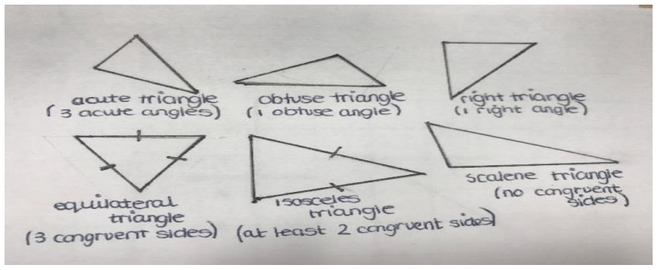
Explore internal angles of quadrilaterals to identify a rule.



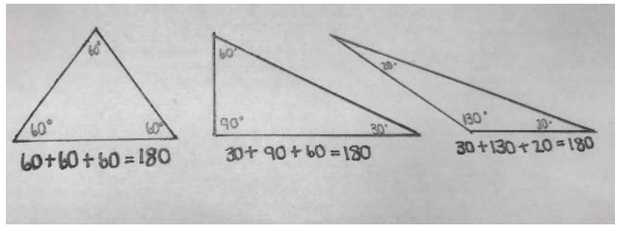
Use knowledge of internal angles of triangles to identify missing information.



Classify triangles according to their properties.

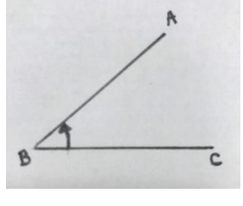


Explore internal angles of triangles to create a rule.

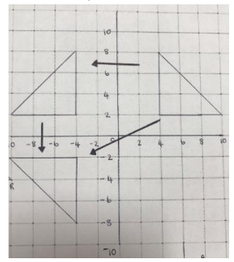


Interpret scale expressed as ratios using maps.

Name angles using 3 letters.

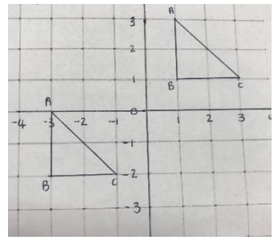


Identify the transformations used to produce a spatial sequence and continue the sequence.

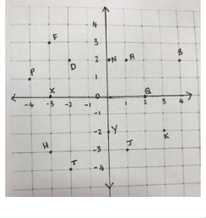


Use appropriate language of transformation in explaining how they tiled a shape or why they think a shape will tile.

Investigate translation and reflection on an axis and rotations on the Cartesian plane using coordinates.



Explore the Cartesian coordinate using all four quadrants.

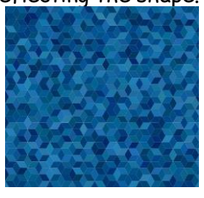


Use appropriate language of transformation in describing how one shape can be superimposed on another. *e.g. Rotate it at right angles around the centre and slide (or translate) it to the left.*

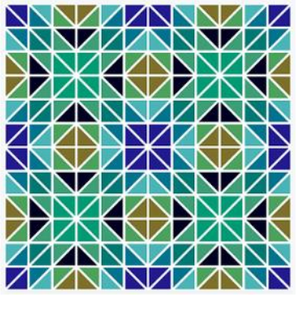
Identifies all lines of symmetry in 2D shapes.

Produce designs that exhibit a specified symmetry (reflection or translation). *e.g. fold paper or use mirrors or computer graphic*

Provided with a single copy of a shape that will tile, produce a tessellating pattern by systematically translating, rotating or reflecting the shape.



Decide whether reflection or translation is involved in producing a pattern.



Third Level Overview

Key Aspect	Experiences and Outcomes	National Benchmarks
Properties of 2D Shapes and 3D Objects Pg 19	Having investigated a range of methods, I can accurately draw 2D shapes using appropriate mathematical instruments and methods. **MTH 3-16a** I can name angles and find their sizes using my knowledge of the properties of a range of 2D shapes and the angle properties associated with intersecting and parallel lines. **MTH 3-17a** Having investigated navigation in the world, I can apply my understanding of bearings and scale to interpret maps and plans and create accurate plans, and scale drawings of routes and journeys. **MTH 3-17b**	• Demonstrates a variety of methods to accurately draw 2D shapes, including triangles and regular polygons (given the interior angle), using mathematical instruments.

Key Aspect	Experiences and Outcomes	National Benchmarks
Angle, Symmetry and Transformation Pg's 20 & 21	I can apply my understanding of scale when enlarging or reducing pictures and shapes, using different methods, including technology. **MTH 3-17c** I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid. **MTH 2-18a/MTH 3-18a** I can illustrate the lines of symmetry for a range of 2D shapes and apply my understanding to create and complete symmetrical pictures and patterns. **MTH 2-19a/MTH 3-19a**	• Names angles using mathematical notation, for example, $\angle ABC$ • Identifies corresponding, alternate and vertically opposite angles and uses this knowledge to calculate missing angles. • Uses the angle properties of triangles and quadrilaterals to find missing angles. • Applies knowledge and understanding of scale to enlarge and reduce objects in size showing understanding of linear scale factor. • Uses bearings in a navigational context including creating scale drawings. • Identifies all lines of symmetry in 2D shapes. • Creates symmetrical patterns and pictures.

Fourth Level Experiences and Outcomes	
I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context. **MTH 4-16a Pg 25** Having investigated the relationships between the radius, diameter, circumference and area of a circle, I can apply my knowledge to solve related problems. **MTH 4-16b Pg 25** Having investigated the relationship between a radius and a tangent and explored the size of the angle in a semi-circle, I can use the facts I have established to solve related problems. **MTH 4-17a Pgs 26 & 27**	I can apply my understanding of the properties of similar figures to solve problems involving length and area. **MTH 4-17b Pgs 26 & 27** I can plot and describe the position of a point on a 4-quadrant coordinate grid. **MTH 4-18a Pgs 26 & 27** I can apply my understanding of the 4-quadrant coordinate system to move, and describe the transformation of, a point or shape on a grid. **MTH 4-18b Pgs 26 & 27** Having investigated patterns in the environment, I can use appropriate mathematical vocabulary to discuss the rotational properties of shapes, pictures and patterns and can apply my understanding when completing or creating designs. **MTH 4-19a Pgs 26 & 27**

PROPERTIES OF 2D SHAPES & 3D OBJECTS AIM: Use Pythagoras' Theorem and Trigonometry to carry out calculations with right-angled triangles and use formulae to carry out calculations with circles.

MTH 4-16a, MTH 4-16b

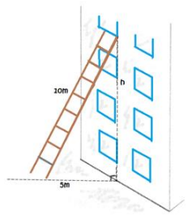
National 5 Link ~ Using Pythagoras' theorem in complex situations including converse and three dimensions.

National 5 Link ~ Using the sine and cosine rules to find a side or angle in a triangle

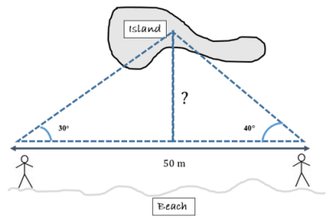
National 5 Link ~ Calculating the length of an arc and the area of a sector.

Uses the Converse of Pythagoras to prove/disprove that a triangle is right-angled.

Solves real-life problems involving Pythagoras' Theorem.



Solves real-life problems using trigonometry.



Calculates the circumference and area of a circle in real-life problems.

Calculates diameter and radius of a circle when given the area or circumference.

Calculates the length of any side of a right-angled triangle using the Theorem of Pythagoras.

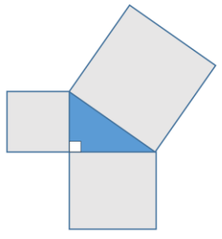
Calculates the size of an angle in a right-angled triangle using trigonometry.

Calculates the length of a side in a right-angled triangle using trigonometry.

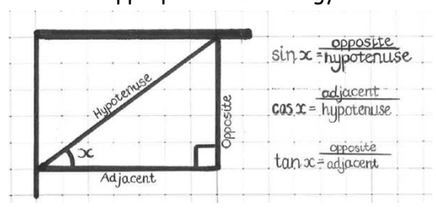
Uses the formula C = πD or C = 2πr to calculate the circumference of a circle.

Uses the formula A = πr² to calculate the area of a circle.

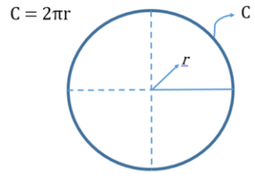
Explores the relationship between sides of a right-angled triangle.



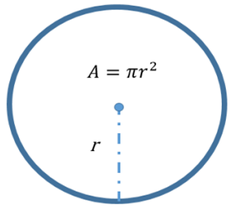
Explores the relationship between the sides of a right-angled triangle and its angles using appropriate technology.



Explores the relationship between a circles radius and its circumference.



Explores the relationship between a circles radius and its area.



ANGLE, SYMMETRY & TRANSFORMATION AIM: **Note: This pyramid appears across two pages**

Interpret symmetry in real life contexts. Use knowledge of similar shapes to find unknown lengths of 2D shapes. Demonstrate understanding of the relationship between angles, lines and triangles in circles

MTH 4-17a, MTH 4-17b, MTH 4-18a, MTH 4-18b, MTH 4-19a

National 5 Link ~ Interrelationship of scale – length, area and volume.

National 5 Link ~ Relationship in a circle between the centre, chord and perpendicular bisector.

National 5 Link ~ Vectors – Adding or subtracting 2D vectors using directed line segments and components (also for 3D).

National 5 Link ~ Vectors – Determining coordinates of a point from a diagram representing a 3D object

National 5 Link ~ Vectors – Magnitude of a 2D/3D vector.

Use and apply area and volume scale factors to solve problems in real-life contexts.

Identify triangles created by chords within a circle and can apply to real-life contexts.

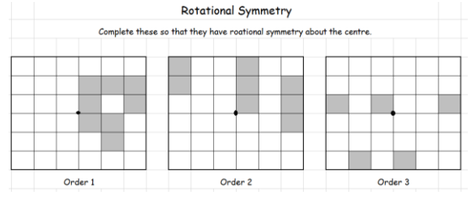
Identifies transformation by reflection or translation of a point or a shape on a grid.

Recognise all forms of symmetry in the real world.

Uses similarity to calculate unknown areas of 2D shapes and volumes of 3D objects.

Applies knowledge of triangles, angles and circles, including semi-circles, to solve problems.

Create designs with different orders of rotational symmetry, where the centre is the origin.

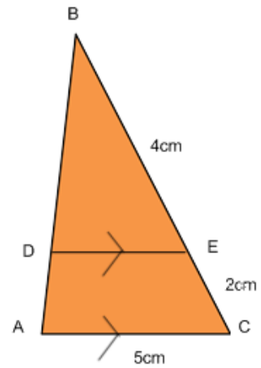


Uses similarity to find unknown lengths of 2D shapes.

Applies knowledge of the relationship between the tangent and the radius to calculate sizes of missing angles.

Applies understanding of translation to reflect or translate an object on a four-quadrant grid.

Check for similarity in two distinct shapes (triangle within a triangle).



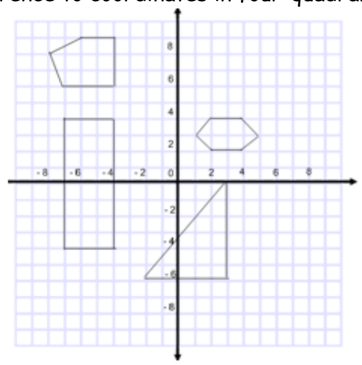
Calculate a reduction or enlargement scale factor.

Calculate an area or volume scale factor.

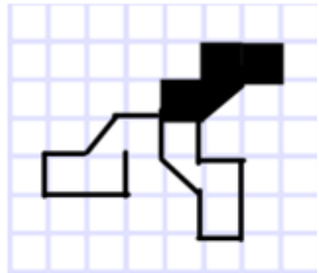
Investigate link between linear scale factors and area/volume scale factors.

Use a given scale factor to enlarge or reduce any shape.

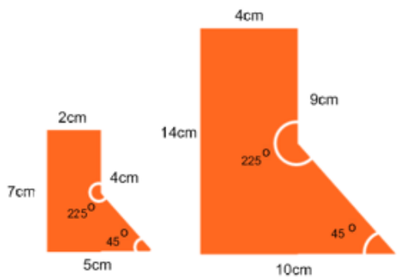
Complete shapes and justify their choice with reference to coordinates in four-quadrants.



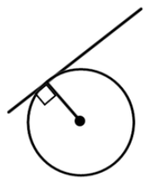
Uses Knowledge of rotational symmetry to complete designs.



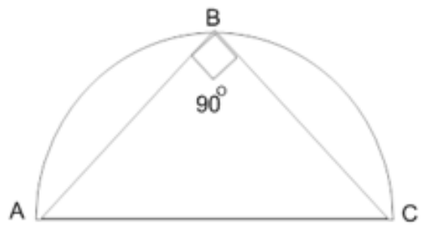
Check for similarity in two distinct shapes.



Understands and can use the relationship between the tangent and radius in a circle.



Understands and can use the properties of triangles in a semi-circle.



Describe and move a point using simple translations.

Explore the differences between similar shapes and congruent shapes.

Practically explores the relationship between the tangent and radius in circles.

Practically explores the relationship and properties of triangles in a semi-circle.

Uses a four-quadrant Cartesian grid to read and plot coordinates.

Describes rotational properties of shapes, pictures and patterns, including the order of rotation.

Fourth Level Overview

Key Aspect	Experiences and Outcomes	National Benchmarks
Properties of 2D Shapes and 3D Objects Pg 25	I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context. **MTH 4-16a** Having investigated the relationships between the radius, diameter, circumference and area of a circle, I can apply my knowledge to solve related problems. **MTH 4-16b**	• Calculates the length of any side of a right-angled triangle using the Theorem of Pythagoras. • Calculates the size of an angle in a right-angled triangle using trigonometry. • Calculates the length of a side in a right-angled triangle using trigonometry. • Uses the formula $C = \pi D$ or $C = 2\pi r$ to calculate the circumference of a circle. • Uses the formula $A = \pi r^2$ to calculate the area of a circle. • Calculates diameter and radius of a circle when given the area or circumference.

Key Aspect	Experiences and Outcomes	National Benchmarks
Angle, Symmetry and Transformation Pgs 26 & 27	Having investigated the relationship between a radius and a tangent and explored the size of the angle in a semi-circle, I can use the facts I have established to solve related problems. **MTH 4-17a** I can apply my understanding of the properties of similar figures to solve problems involving length and area. **MTH 4-17b** I can plot and describe the position of a point on a 4-quadrant coordinate grid. **MTH 4-18a**	• Describes rotational properties of shapes, pictures and patterns, including the order of rotation. • Uses knowledge of rotational symmetry to complete designs. • Uses a four-quadrant Cartesian grid to read and plot coordinates. • Applies understanding of translation to reflect or translate an object on a four-quadrant grid. • Uses similarity to find unknown lengths of 2D shapes. • Applies knowledge of the relationship between the tangent and radius to calculate sizes of missing angles. • Applies knowledge of triangles, angles and circles, including semi-circles, to solve problems. • Identifies transformation by reflection or translation of a point or shape on a grid.

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can apply my understanding of the 4-quadrant coordinate system to move, and describe the transformation of, a point or shape on a grid. **MTH 4-18b** Having investigated patterns in the environment, I can use appropriate mathematical vocabulary to discuss the rotational properties of shapes, pictures and patterns and can apply my understanding when completing or creating designs. **MTH 4-19a**	

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