



Chapter 12

Geometry— Position and Direction

EYFS 1&2 - Geometry – Position and Direction (When planning ensure you track forwards to year 1)

Early Learning Goal 12

Pupils use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems.
They recognise, create and describe patterns.
They explore characteristics of everyday objects and shapes and use mathematical language to describe them.

KS1 ready

Describe position, direction and movement, including whole, half, quarter and three quarter turns.

Key vocabulary: position, over, under, above, below, on, in, outside, inside, behind, beside, before, after, next to, opposite, between, close, far, apart, middle, corner, top, bottom, front, back, side, direction, left, right, up, down, forwards, backwards, sideways, across, along, around, through, to, from towards, away from, movement, roll, slide, turn, stretch, bend.

Key concepts

Instructions can be given to a programmable toy. This would involve the use of everyday language such as in front of, next to, underneath, to describe the position of their toy.

Learning objectives (see overleaf for exemplification)

Can say what is different and what is the same.
Begins to categorise according to properties such as size.
Uses positional language ('below', 'above', 'next to', 'beside', 'in front', 'behind' and 'on top')
Describes their relative position such as 'behind' or 'next to'.
Uses everyday language to talk about position.
Uses everyday language to solve problems.
Explores characteristics of/uses mathematical language for everyday objects and shapes.

Potential barriers/misconceptions

Pupils don't have the language to confidently describe position and movement.
The computer programme used to determine movement may be a barrier if the coding/ instructions given are too complex.
Pupils are able to respond to instructions themselves but find it more challenging, for example, to move an object around a maze.

Example Questions

Use everyday words to describe the position:
Put your animal in the middle of the table. Now put the pig behind the sheep. Put the cow in front of the horse.
Stand behind the table. Now walk in a straight line to the front of the room.
Who is sitting next to, beside, in front of Ranjit?
Are the felt pens on top of, under or next to the books?
Go forwards three steps. Now go backwards three steps.
Slide the book across the table.
Roll the ball as far as you can.
Turn on the spot.

Here are pictures of a ball, a house and a boat. Put the ball above the horse. Put the boat to the left of the ball.
Stand in front, behind, beside, opposite a partner. Stand between two other children.
Follow my instructions to get through this obstacle course. Go over the mat, through the tunnel, climb to the top of the bars....
Turn to your right and face the window.
Make half a turn on the spot.
Which of these shapes will roll in a straight line? Which will roll in a curved line?
Follow my instructions to get through the maze. Move forwards, turn left, go straight on, turn the corner...

Mental Maths

To listen and identify key vocabulary in books such as:
Rosies' walk
Bear Hunt
Spot

To talk about positions by:
Describing where things are in a picture
Follow instructions around an obstacle course in PE
Identify who they are sitting next to/ behind on the carpet

To talk about movements and direction:
Follow instructions to run forwards, backwards, turn to the left etc.
Give instructions around movement to other children.
Describe the walk to school
Explore and talk about things that turn (taps, handles etc)

Collect and sort objects that will: roll, slide, roll & slide.

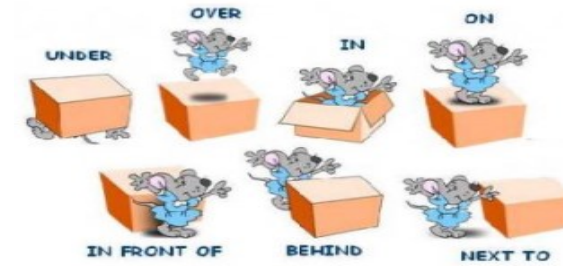
EYFS 2 - Progression (a combination of these models and images can be used for every objective)

Begins to categorise according to properties such as size.

This squirrel comes next.
This squirrel goes between the yellow and the pink squirrel.
This squirrel goes at the end.



Uses positional language ('below', 'above', 'next to', 'beside', 'in front', 'behind' and 'on top')



Describes their relative position such as 'behind' or 'next to'.

I am next to Cemal and Steven. I am behind Jessica. I am in front of Tyrone.



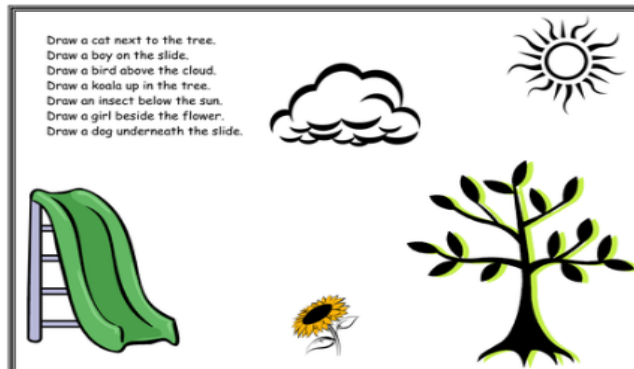
Uses everyday language to talk about position .

*Through the house they ran
Up the stairs and into my room.
On top of my bed,
Under the covers...
I found my cat.*

Anon



Uses everyday language to solve problems.



Explores characteristics of/uses mathematical language for everyday objects and shapes.

Can you describe how you will take the register back to the office?

What is next to your bed at home?



Year 1 - Geometry – Position and Direction (When planning ensure you track back to Reception and forwards to year 2)

National Curriculum
Describe position, direction and movement, including whole, half, quarter and three quarter turns.

Notes and guidance (non-statutory)
Pupils use the language of position, direction and motion, including: left and right, top, middle and bottom, on top of, in front of, above, between, around, near, close and far, up and down, forwards and backwards, inside and outside.
Pupils make whole, half, quarter and three-quarter turns in both directions and connect turning clockwise with movement on a clock face.

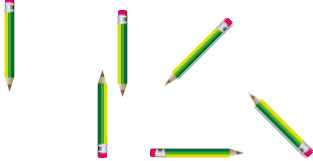
Key vocabulary: left and right, top, middle and bottom, on top of, in front of, above, between, around, near, close and far, up and down, forwards and backwards, inside and outside, half, quarter and three-quarter turns
Key concepts:
In the classroom and in PE lessons vocabulary can be reinforced around position and direction with instructions directing children to face left, right and about turn.
Pupils can give each other instructions to go round obstacles ending up facing in given directions.

Learning objectives (see overleaf for exemplification)

To describe position, direction and movement including back forward.
To identify left and right.
To use prepositional language.
To give directions
To make turns in both directions.
To link turns with the hands on a clock

Potential barriers/misconceptions
Pupils are not secure with their prepositional language.
Pupils may look at the teacher modelling clockwise/anticlockwise etc and be confused if modelled as mirror image.
Pupils unable to differentiate between their left and their right.
Pupils are unfamiliar with a clock face and unclear about the language of quarter and half.

Example Questions
Stand up and face the front wall of the classroom. Make a half turn. Which wall of the classroom are you facing now?
The big hand of the clock is pointing to 3. What number will it point to when it has made a half turn?
Sam turns the pencil one quarter turn. Tick the picture which shows how the pencil looks after the turn.



Put your finger on X. Move your finger up 1 square and then across 3 squares. Tick the fruit your finger's tops on.

🍎	🍏			🍒	🍎	
🍏			X			🍌
🍏	🍏					🍌
	🍒					
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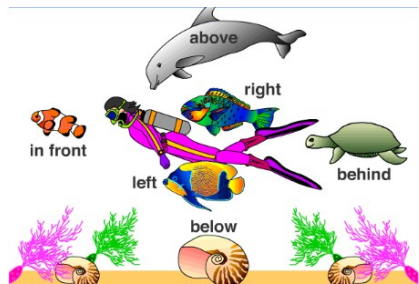
Mental Maths
To use everyday language to describe positions:
- In PE stand in front of, behind, opposite a partner, or between two others.
- Describe how the furniture is arranged in a dolls house: Put a chair in front of the TV
- In the classroom name an object that is above the door, beside the sink
- describe where a smaller object is in a large area– near the edge/corner/middle etc
- describe the position of an object in relation to another. The cat is next to the tree.

Use everyday language to describe directions:
- In PE follow and give instructions to move in particular directions: climb upwards, downwards, across...
- Talk about a journey– how to get from the school to the shop.
- To suggest instructions for how to programme robot.

To understand and use: slide, roll, turn, whole, half
To recognise and talk about movements.
- roll across the mat, slide across the floor
- Identify things that turn about a point– taps, wheels, clocks, scissors.
- Identify things that turn about a line– book, door, lid
- Make things turn– count around a clock face
- Discuss what comes next in a repeating pattern.

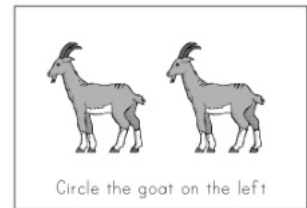
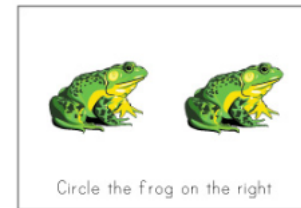
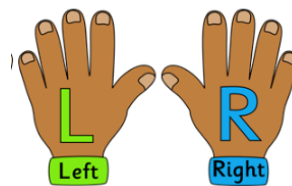
Year 1- Progression (a combination of these models and images can be used for every objective)

To describe position, direction and movement including backward, forward.

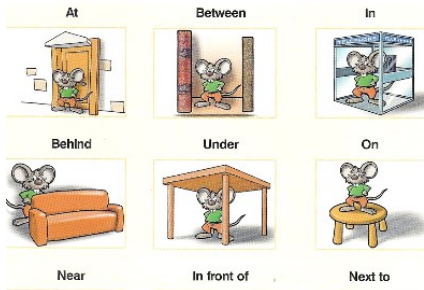


The dolphin is **above** the diver.
 The shell is **below** the diver.
 The clownfish is **in front** of the diver.
 The turtle is **behind** the diver.
 The angelfish is to the **left** of the diver.
 The parrotfish is to the **right** of the diver.
 The diver is **between** the fish.

To identify left and right.



To use prepositional language.

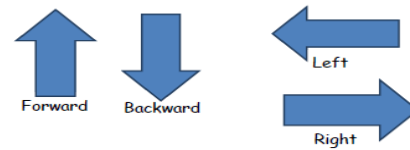


Cats Sleep Anywhere

Eleanor Farjeon (1881 - 1965)

Cats sleep anywhere, any table, any chair. Top of piano, window-ledge, in the middle, on the edge. Open draw, empty shoe, anybody's lap will do. Fitted in a cardboard box, in the cupboard with your frocks. Anywhere! They don't care! Cats sleep anywhere.

To give directions



Giving and Following Directions

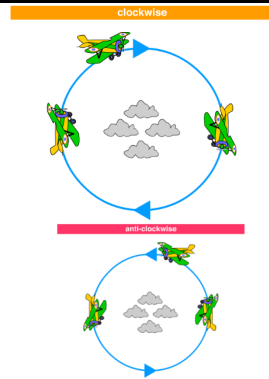
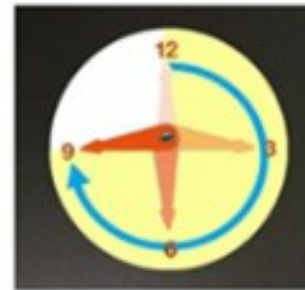
START				

To make turns in both directions.

Whole, half, quarter and three-quarter turns.



To link turns with the hands on a clock



Year 2 - Geometry – Position and Direction (When planning ensure you track back to year 1 and forwards to year 3)

National Curriculum
 Order and arrange combinations of mathematical objects in patterns and sequences
 Use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anticlockwise).

Notes and guidance (non-statutory)
 Pupils should work with patterns of shapes, including those in different orientations. Pupils use the concept and language of angles to describe ‘turn’ by applying rotations, including in practical contexts (for example, pupils themselves moving in turns, giving instructions to other pupils to do so, and programming robots using instructions given in right angles).

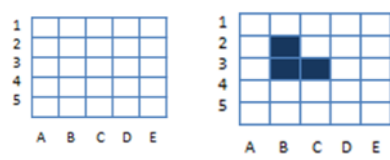
Key vocabulary: left and right, top, middle and bottom, on top of, in front of, above, between, around, near, close and far, up and down, forwards and backwards, inside and outside, half, quarter and three-quarter turns, clockwise, anti-clockwise, route.
Key concepts:
 In the classroom and in PE lessons vocabulary can be reinforced around position and direction with instructions directing children to face left, right and about turn.
 Pupils can give each other instructions to go round obstacles ending up facing in given directions.

Learning objectives (see overleaf for exemplification)
 To order and arrange objects in patterns and sequences.
 To describe the position of objects.
 To give directions.
 To describe and control movement.
 To describe movement in terms of right angles for turns.
 To programme robots to turn.

Potential barriers/misconceptions
 Pupils are not secure with language for position.
 Pupils are still not confident with their left and right- Show how to remember ‘left’ and ‘right’. Make L shape with forefinger and thumb of left hand – not possible with right hand.
 Pupils are unfamiliar with a clock face and unclear about the language of quarter and half.

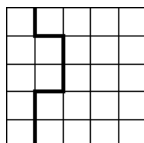
Example Questions

Draw a tick in square D2.




Look at the L shape on the grid. Part of it is in square B3. Write the other two squares it is in

STOP



Follow the route with your pencil. Complete this chart showing the route from START to STOP.
 START
 Left 3
 Up 2....

START



Draw how this triangle will look after a half turn.

Mental Maths

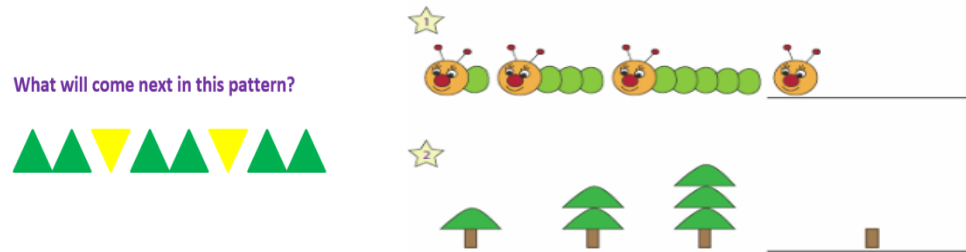
To count along a counting stick as a scale in intervals of 1. (x-axis)
 To count up a counting stick as a scale in intervals of 1 (y axis)
 To count around a clock face in quarter turn, half turn, three quarter turn, full turn.

To describe positions:
 Respond to oral instructions involving higher than, lower than, next to, below, further away from, on the edge of, at the corner of.
 Describe the position of a feature on a map.

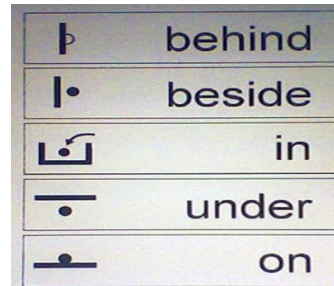
In PE– move clockwise, anticlockwise, face inwards, outwards.
 Turn on the spot, turn through whole, half, quarter turns.
 To give instructions for someone else to follow to find a route through a simple maze drawn on squared paper.

Year 2 - Progression (a combination of these models and images can be used for every objective)

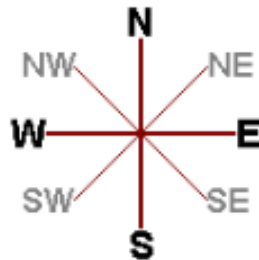
To order and arrange objects in patterns and sequences.



To describe the position of objects.

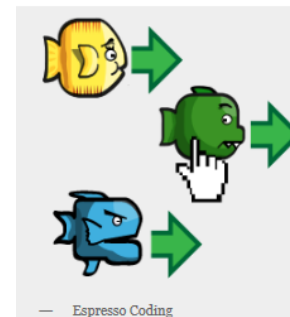


To give directions.

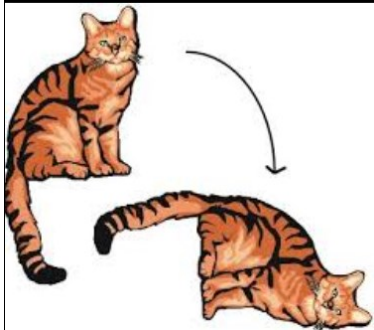


To describe and control movement.

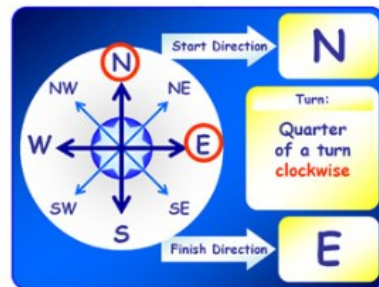
Using computer programmes to control movements of animated characters.



To describe movement in terms of right angles for turns.



90° turn clockwise (rotation)



To programme robots to turn.

The Bee-Bot programming language consists of only five movement commands

- forward 150mm,
- backward 150mm,
- right turn 90 degrees,
- left turn 90 degrees,
- pause (II) for 1 second and make a tick sound.

Plus two device control commands.

- clear (X),
- GO - executes commands.

These are based on a small subset of the Logo programming language.



When a program has finished the Bee-Bot makes a sound and flashes its lights.

Year 3– Although not covered in the year 3 programme of study it is advised that this strand is used to get pupils year 4 ‘ready’.

Year 4 - Geometry – Position and Direction (When planning ensure you track back to year 2 and forwards to year 5)

National Curriculum

Describe positions on a 2-D grid as coordinates in the first quadrant
 Describe movements between positions as translations of a given unit to the left/right and up/down
 Plot specified points and draw sides to complete a given polygon.

Notes and guidance (non-statutory)

Pupils draw a pair of axes in one quadrant, with equal scales and integer labels. They read, write and use pairs of coordinates, for example (2, 5), including using coordinate plotting ICT tools.

Key vocabulary:

Key concepts:

In the classroom and in PE lessons vocabulary can be reinforced around position and direction with instructions directing children to face left, right and about turn.
 Pupils can give each other instructions to go round obstacles ending up facing in given directions.
 Pupils can use treasure maps, battle ship games and back to back drawing to familiarise selves with the giving and receiving of instructions around positional language and directions.

Learning objectives (see overleaf for exemplification)

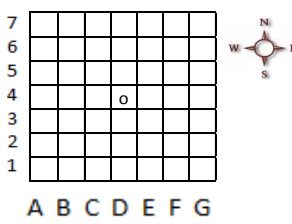
To recognise that two right angles make a half turn, three make three quarters and four complete.
 To describe position on a 2-D grid as co-ordinates.(2,5)
 Describe movements between positions as translations (left, right, up, down)
 To plot specified points.
 To draw a polygon.
 To draw a pair of axes.
 To use coordinate plotting ICT tools.

Potential barriers/misconceptions

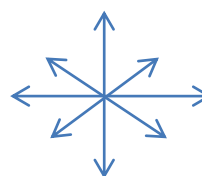
Putting y co-ordinate before the x, resulting in incorrectly placed position – due to:-
 lack of knowledge of order or lack of knowledge concerning names of axes.
 Pupils find it difficult to shift from co-ordinates that are presented inside the box (see below) to coordinate points on the line.
 Pupils are not confident with the use of positional language.
 Pupils are unable to relate turns to right angles and everyday events.
 If pupils do not physically engage with turns, angles etc they will not realise that after turning through half a turn or two quarter turns in the same direction they are then facing in the opposite direction.

Example Questions

Lisa places a counter on a D4 square. She moves it 2 squares east and 3 squares south. Write the position of the square she moves it to.



The arrow labelled N is pointing north. Which arrow is pointing south-west?



Amy is facing North. She turn clockwise through 2 right angles. Which direction is she facing now?

Rashid is facing West. He turns clockwise through 3 right angles. What direction is he facing now?

Mental Maths

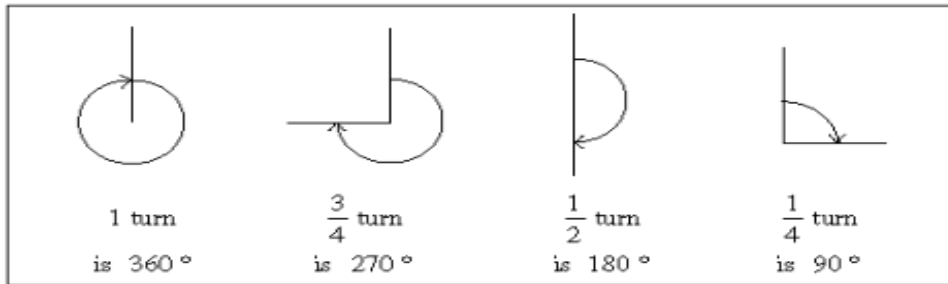
Practise pointing and chanting negative and positive numbers on a scale, using a ‘counting stick’ (forwards and backwards). Hold stick both horizontally and vertically to link to both the x and the y axes

To count along a counting stick as a scale in intervals of 1. (x-axis)
 To count up a counting stick as a scale in intervals of 1 (y axis)
 To count around a clock face in quarter turn, half turn, three quarter turn, full turn.
 To count around a clock face in 90°, 180°, 270° and 360°

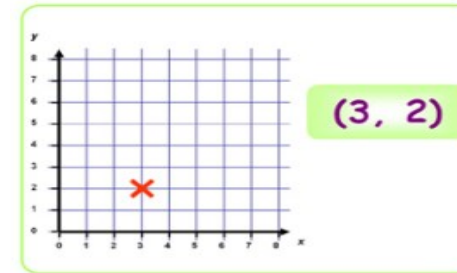
To have rapid recall of positions of the compass– north, south, east, west
 To have rapid recall of positions of the compass, N, NE, E, SE, S, SW, W, NW
 Refer to the ‘symmetrical’ quality of the numbers with 0 as the middle value.
 Describe and find the position of a square on a grid of squares with the rows and columns labelled.
 Play noughts and crosses telling partner where to place on grid.
 Tell a story including the words north, ascend, clockwise, left, horizontal.
 To visualise and explain route from home to schools.
 To recognise horizontal and vertical lines in the classroom environment.

Year 4- Progression (a combination of these models and images can be used for every objective)
 (Year 3- Although not covered in the year 3 programme of study it is advised that this strand is used to get pupils year 4 'ready'.)

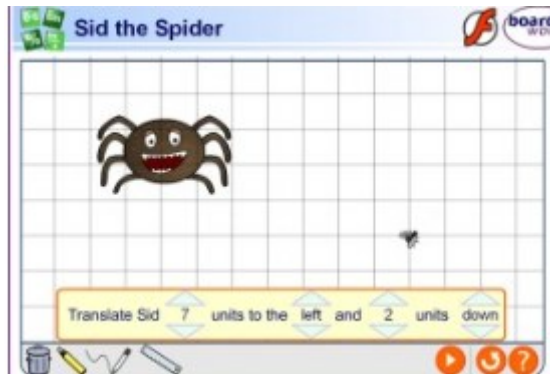
To recognise that two right angles make a half turn, three make three quarters and four complete.



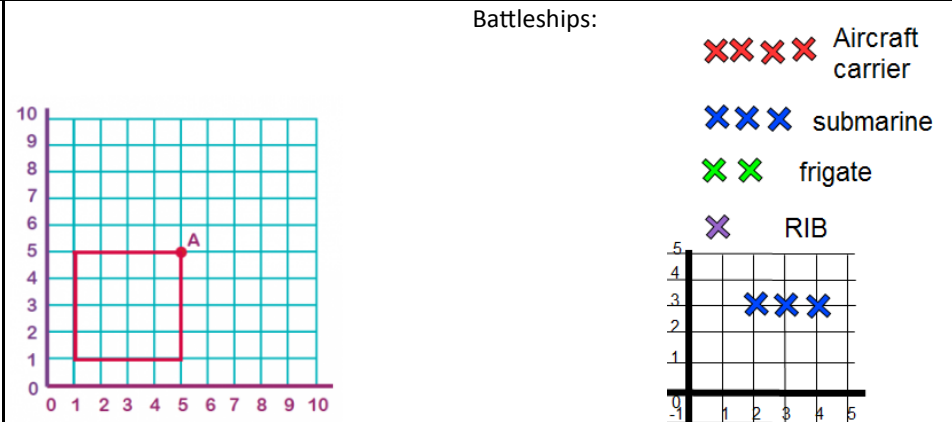
To describe position on a 2-D grid as co-ordinates.(2,5)



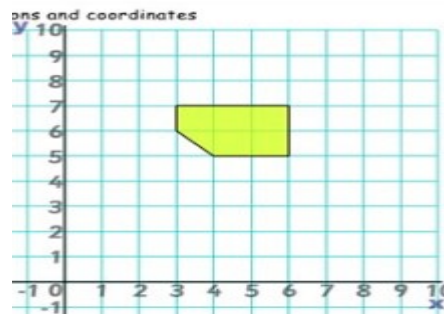
Describe movements between positions as translations (left, right, up, down)



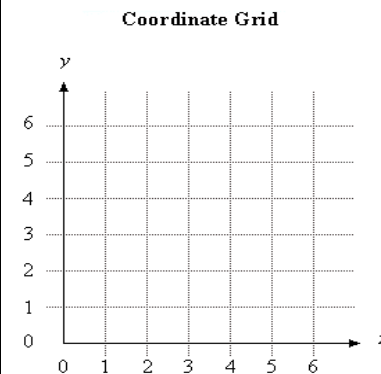
To plot specified points.



To draw polygons



To draw a pair of axes.



COORDINATES

Axes

All graphs have an x-axis and a y-axis. The diagram here has a typical set of axes. The point '0' is called the origin. The horizontal axis is the x-axis. The vertical axis is the y-axis. One way to remember which axis is which is 'x' is a cross so the x-axis is across'.

Year 5 - Geometry – Position and Direction (When planning ensure you track back to year 4 and forwards to year 6)

National Curriculum

Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed.

Notes and guidance (non-statutory)

Pupils recognise and use reflection and translation in a variety of diagrams, including continuing to use a 2-D grid and coordinates in the first quadrant. Reflection should be in lines that are parallel to the axes.

Key vocabulary:

Key concepts:

When a shape has been reflected or translated it hasn't changed.
Using the colouring, cutting out, turning face down approach to explore ideas of reflection– as well as folding shapes along mirror lines and looking at shapes and their images in mirrors.
Tracing paper can be used to explore ideas of rotation and rotational symmetry.

Learning objectives (see overleaf for exemplification)

- To reflect the position of a shape
- To reflect the position of a shape in all four quadrants (extension)
- To translate the position of a shape
- To translate the position of a shape in all four quadrants (extension)
- To use a 2-D grid and coordinates in the first quadrant
- To use a 2-D grid and coordinates in all four quadrants. (extension).

Potential barriers/misconceptions

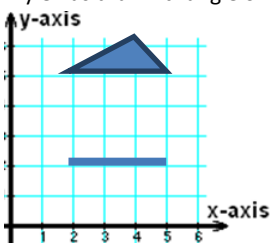
Pupils are unclear about the difference between reflection and translation:

Translation: a transformation in which a shape is slid from one position to another, without turning.
Reflection: A transformation in which a shape is reflected in a mirror line and changed into its mirror image.

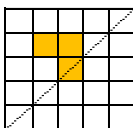
Putting y co-ordinate before the x, resulting in incorrectly placed position – due to:-
lack of knowledge of order or
lack of knowledge concerning names of axes.
When using 4 quadrants, misplaced positions due to lack of understanding of order of negative numbers on a scale.

Example Questions

Kyle has drawn triangle on this grid. Holly has started drawing identical square. What will be coordi-



On the grid join dots to make a triangle which does not have a right angle. Use a ruler. Shade in two more squares to make this design symmetrical about the mirror line.



Mental Maths

- Practise pointing and chanting negative and positive numbers on a scale, using a 'counting stick' (forwards and backwards). Hold stick both horizontally and vertically to link to both the x and the y axes
- To count along a counting stick as a scale in intervals of 1. (x-axis)
- To count up a counting stick as a scale in intervals of 1 (y axis)
- To count around a clock face in quarter turn, half turn, three quarter turn, full turn.
- To count around a clock face in 90°, 180°, 270° and 360°
- To have rapid recall of positions of the compass– north, south, east, west
- To have rapid recall of positions of the compass, N, NE, E, SE, S, SW, W, NW

Refer to the 'symmetrical' quality of the numbers with 0 as the middle value.
Sketch the position of a simple shape after it has been translated, for example 2 units to the left.
To describe to someone else the convention that (3,2) describes a point found by starting at the origin (0,0) and moving three lines across and two lines up.

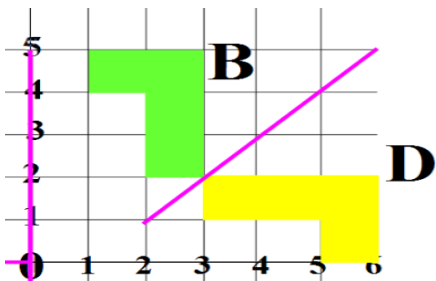
- Respond to questions that involve visualisation:
 - These points are the coordinates of the vertices of a shape: (1,5), (2,5), (4,3), (2,1), (1,1) What is the name of the shape?
 - Three of the vertices of a square are (2,1), (2,4) and (5,4). What are the coordinates of the fourth vertex?

Know the number of diagonals in a polygon. i.e. Hexagon has 3 diagonal lines.

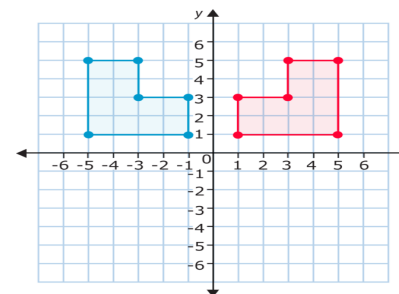
Year 5- Progression (a combination of these models and images can be used for every objective)

To reflect the position of a shape

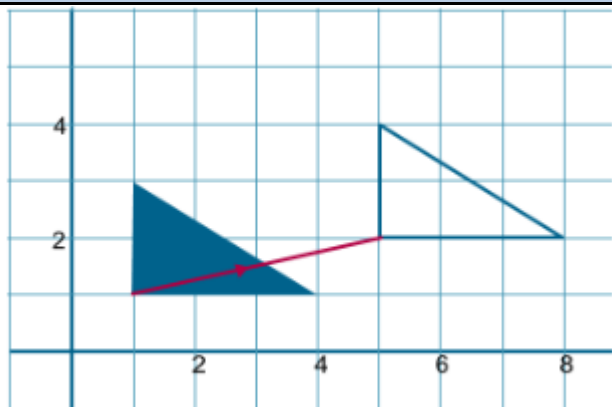
Reflected in a diagonal line:



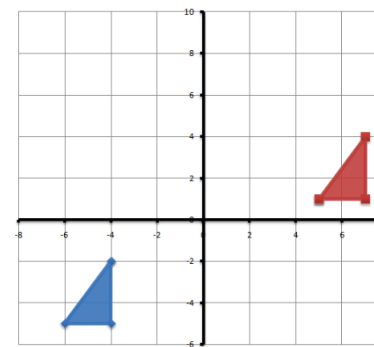
To reflect the position of a shape in all four quadrants (extension)



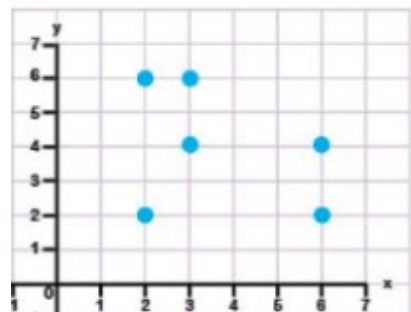
To translate the position of a shape



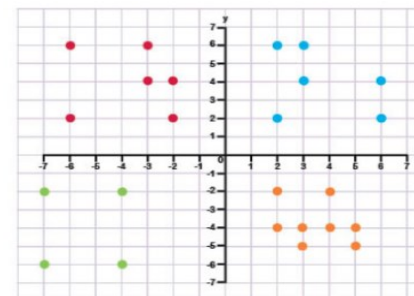
To translate the position of a shape in all four quadrants (extension)



To use a 2-D grid and coordinates in the first quadrant



To use a 2-D grid and coordinates in all four quadrants. (extension).



Year 6- Geometry – Position and Direction (When planning ensure you track back to year 5 for progression)

National Curriculum

Describe positions on the full coordinate grid (all four quadrants)
 Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.

Notes and guidance (non-statutory)

Pupils draw and label a pair of axes in all four quadrants with equal scaling. This extends their knowledge of one quadrant to all four quadrants, including the use of negative numbers.
 Pupils draw and label rectangles (including squares), parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates using the properties of shapes. These might be expressed algebraically for example, translating vertex (a, b) to $(a - 2, b + 3)$; (a, b) and $(a + d, b + d)$ being opposite vertices of a square of side d .

Key vocabulary:

Key concepts

There is no need to limit pupil's experience of coordinates to the first quadrant as the principles are the same in the other quadrants and these provide some useful experience of interpreting and applying negative numbers.
 The use of coordinates to specify the location of points in a plane, rather than spaces, as in street maps, is a significant point to be explained to pupils carefully.

Learning objectives (see overleaf for exemplification)

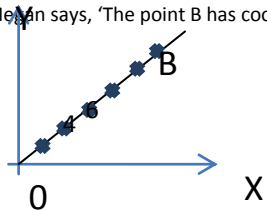
- To describe positions on all four quadrants
- To draw and translate simple shapes on the coordinate plane
- To reflect simple shapes in the axes.
- To draw and label all four quadrants with equal scaling.
- To use the properties of shapes to predict missing coordinates
- To express translations algebraically.

Potential barriers/misconceptions

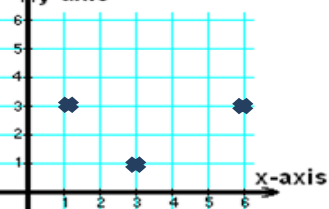
Pupils are only taught using co-ordinates in the first quadrant. They should be able to work in all 4 quadrants. Pupils are unclear about the difference between reflection and translation:
 Translation: a transformation in which a shape is slid from one position to another, without turning.
 Reflection: A transformation in which a shape is reflected in a mirror line and changed into its mirror image.
 Putting y co-ordinate before the x, resulting in incorrectly placed position – due to:-
 lack of knowledge of order or lack of knowledge concerning names of axes.
 When using 4 quadrants, misplaced positions due to lack of understanding of order of negative numbers on a scale.

Example Questions

Here is a graph. The dots on the line are equally spaces. What are the coordinates of the point A?
 Megan says, 'The point B has coordinates (11,5).' Use the graph to explain why she cannot be correct.



These are four corners of a rectangle. What are the coordinates of the fourth corner?



These are the coordinates of three points of a parallelogram: $(20,27)$, $(15,17)$ and $(35,17)$. Write the coordinates of point A.

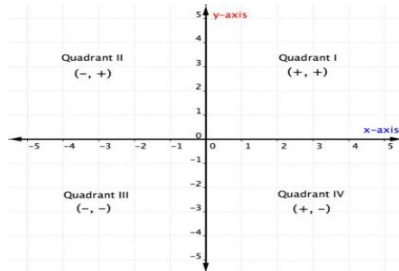
Mental Maths

- Practise pointing and chanting negative and positive numbers on a scale, using a 'counting stick' (forwards and backwards). Hold stick both horizontally and vertically to link to both the x and the y axes
- To count along a counting stick as a scale in intervals of 1. (x-axis)
- To count up a counting stick as a scale in intervals of 1 (y axis)
- To count around a clock face in quarter turn, half turn, three quarter turn, full turn.
- To count around a clock face in 90° , 180° , 270° and 360°
- To have rapid recall of positions of the compass– north, south, east, west
- To have rapid recall of positions of the compass, N, NE, E, SE, S, SW, W, NW
- Refer to the 'symmetrical' quality of the numbers with 0 as the middle value.

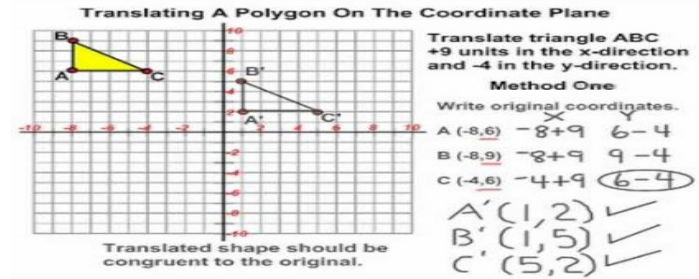
- To sketch the position of a simple shape after it has been translated, ie. 3 units to the right and 2 units down.
- Respond to questions such as:
 - The points $(-1,1)$, $(2,5)$ and $(6,2)$ are three of the four vertices of a square. What are the coordinates of the fourth vertex?
 - Draw a polygon with each vertex lying in the first quadrant. Plot its reflection in the y axis and name the coordinates of the reflected shape.
 - Identify parallel and perpendicular lines in quadrilaterals.
 - To know that two lines that cross each other are intersecting lines and the point at which they cross is an intersection.

Year 6 - Progression (a combination of these models and images can be used for every objective)

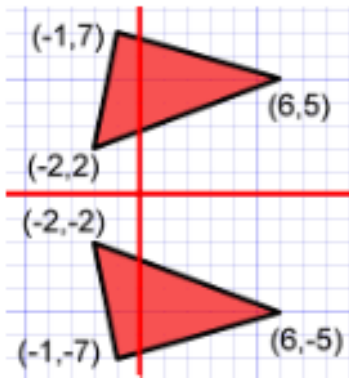
To describe positions on all four quadrants



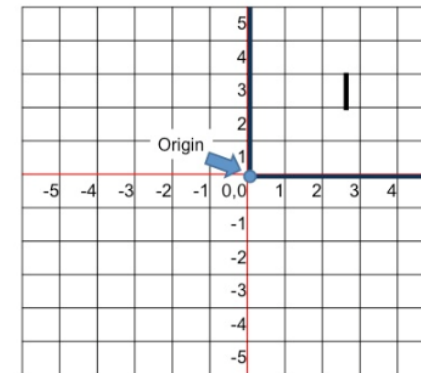
To draw and translate simple shapes on the coordinate plane



To reflect simple shapes in the axes.

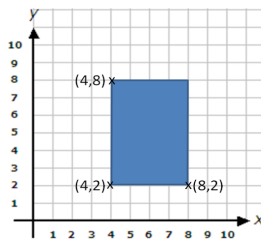


To draw and label all four quadrants with equal scaling.



To use the properties of shapes to predict missing coordinates

- A square has vertices at (0,0), (3,0) and (3,3). What is the co-ordinate of the fourth vertex?
- A square has vertices at (3,0), (0,3) and (-3,0). What is the co-ordinate of the fourth vertex?
- A square has vertices at (0,0), (2,0). Give two possible answers for the positions of the other two vertices.
- A square has vertices at (-1, 1) and (-2, -3). Give two possible answers for the positions of the other two vertices.



To express translations algebraically.

