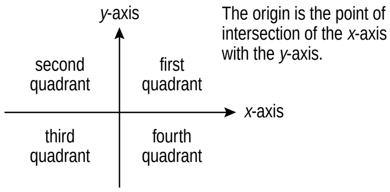
Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:

Use coordinates in all four quadrants

Use, read and write, spelling correctly:
row, column, coordinates, origin, x-axis, y-axis…
position, direction… intersecting, intersection…

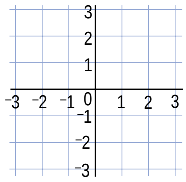
Read and plot points using coordinates in all four quadrants.



- Given an outline shape drawn with straight lines on a coordinate grid (all four quadrants), state the points for a partner to connect in order to replicate the shape.

Plot points determined by geometric information.
For example:

- On this grid, players take turns to name and then mark a point in their own colour. Each point can be used only once.



Game 1
The loser is the first to have 3 points in their own colour in a straight line in any direction.

Game 2
Players take turns to mark points in their own colour until the grid is full. Each player then identifies and records 4 points in their own colour forming the four corners of a square. The winner is the player who identifies the greatest number of different squares.

- The points (⁻3, 1) and (2, 1) are two points of the four vertices of a rectangle.
  Suggest coordinates of the other two vertices.
  Find the perimeter and area of the rectangle.

- Plot these three points: (1, 3), (⁻2, 2), (⁻1, 4).
  What fourth point will make:
  a. a kite? b. a parallelogram? c. an arrowhead?
  Justify your decisions.
  Is it possible to make a rectangle? Explain why or why not.

Use 'plot' and 'line' on a **graphical calculator** to draw shapes.

- Draw your initials on the screen.

- Draw a shape with reflection symmetry around the *y*-axis.

See Y456 examples (pages 108–9).

In geography, interpret and use grid references, drawing on knowledge of coordinates.

As outcomes, Year 8 pupils should, for example:

Use vocabulary from previous year and extend to:
mid-point…

Read and plot points in all four quadrants.

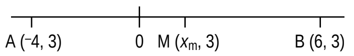
For example:

- The points ($^{-}5$, $^{-}3$), ($^{-}1$, 2) and (3, $^{-}1$) are the vertices of a triangle. Identify where the vertices lie after:
  a. translation of 3 units parallel to the x-axis;
  b. reflection in the x-axis;
  c. rotation of 180° about the origin.

Link to transformations (pages 202–15).

Given the coordinates of points A and B, find the mid-point of the line segment AB.

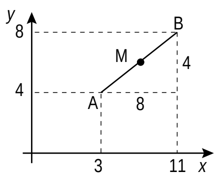
- Two points A and B have the same y-coordinate. Find the mid-point of the line segment AB, e.g.



$x_m = {}^{-}4 + ½ \times 10 = 1$

Generalise the result: the x-coordinate of the mid-point of AB, where A is the point (x_1, y_1) and B is the point (x_2, y_2), is $x_1 + ½(x_2 - x_1) = ½(x_1 + x_2)$.

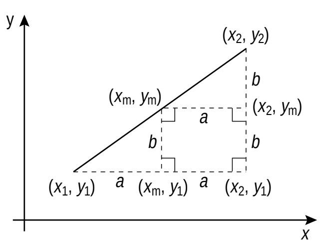
- A is the point (3, 4) and B is the point (11, 8). Find the mid-point (x_m, y_m) of AB.



Complete a right-angled triangle with AB as hypotenuse.
Use the properties of a rectangle to deduce that:
$x_m = 3 + ½ \times 8 = 7$, $y_m = 4 + ½ \times 4 = 6$

Use the properties of a rectangle to generalise the result: the mid-point of the line segment joining A (x_1, y_1) to B(x_2, y_2) is given by:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right).$$



Note that $\frac{x_1 + x_2}{2}$ is the mean of the x-coordinates.

As outcomes, Year 9 pupils should, for example:

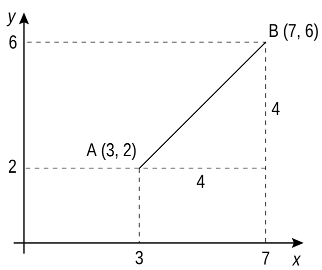
Use vocabulary from previous years and extend to:
Pythagoras' theorem…

Find points that divide a line in a given ratio, using the properties of similar triangles.

Given the coordinates of points A and B, calculate the length of AB.

- *A is the point (3, 2) and B is the point (7, 6). Find the length of AB.*

  Complete a right-angled triangle with AB as the hypotenuse. Use Pythagoras' theorem to calculate AB.



Use Pythagoras' theorem to deduce the general result: the distance, d, between points A (x_1, y_1) and B (x_2, y_2) is given by the formula:

$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

- *The coordinates of point A are (3, 2).*
  The x-coordinate of point B is 11.
  Line AB is 10 units long.
  Find the coordinates of the mid-point of AB.

Link to Pythagoras' theorem (pages 186–9).

Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:

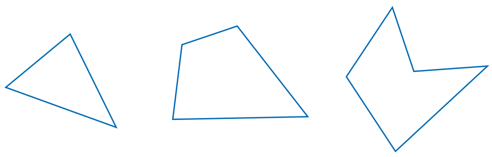
Construct lines, angles and shapes

Use, read and write, spelling correctly:
construct, draw, sketch, measure… perpendicular, distance…
ruler, protractor (angle measurer), set square…

Use ruler and protractor to measure and draw lines to the nearest millimetre and angles, including reflex angles, to the nearest degree.

For example:

- Measure the sides and interior angles of these shapes.



See Y456 examples (pages 92–5).

Link to angle measure (pages 232–3).

As outcomes, Year 8 pupils should, for example:

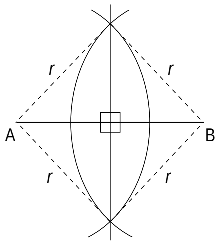
Use vocabulary from previous year and extend to:
bisect, bisector, mid-point… equidistant…
straight edge, compasses… locus, loci…

In work on construction and loci, know that the shortest distance from point P to a given line is taken as the distance from P to the *nearest* point N on the line, so that PN is perpendicular to the given line.

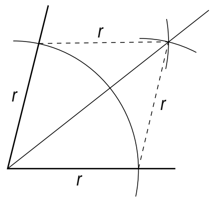
Use straight edge and compasses for constructions.

Recall that the diagonals of a rhombus bisect each other at right angles and also bisect the angles of the rhombus. Recognise how these properties, and the properties of isosceles triangles, are used in standard constructions.

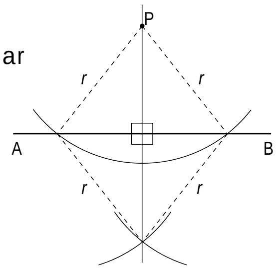
- Construct the mid-point and perpendicular bisector of a line segment AB.



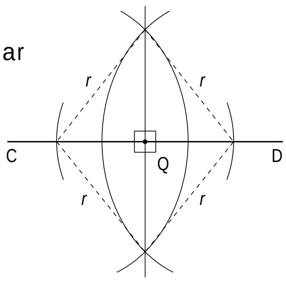
- Construct the bisector of an angle.



- Construct the perpendicular from a point P to a line segment AB.



- Construct the perpendicular from a point Q on a line segment CD.



Know that:
- The perpendicular bisector of a line segment is the locus of points that are equidistant from the two end points of the line segment.
- The bisector of an angle is the locus of points that are equidistant from the two lines.

Link to loci (pages 224–7) and properties of a rhombus (pages 186–7), and to work in design and technology.

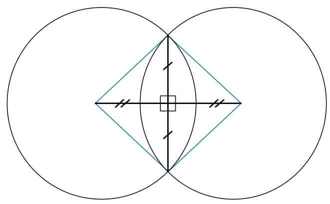
As outcomes, Year 9 pupils should, for example:

Use vocabulary from previous years and extend to:
circumcircle, circumcentre, inscribed circle…

Use straight edge and compasses for constructions.

Understand how standard constructions using straight edge and compasses relate to the properties of two intersecting circles with equal radii:

- The common chord and the line joining the two centres bisect each other at right angles.
- The radii joining the centres to the points of intersection form two isosceles triangles or a rhombus.

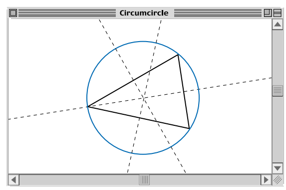


Use congruence to prove that the standard constructions are exact.

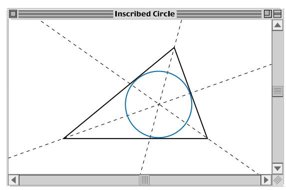
Use construction methods to investigate what happens to the angle bisectors of any triangle, or the perpendicular bisectors of the sides. For example:

- *Observe the position of the centres of these circles as the vertices of the triangles are moved.*

Construct a triangle and the perpendicular bisectors of the sides. Draw the circumcircle.



Construct a triangle and the angle bisectors. Draw the inscribed circle.

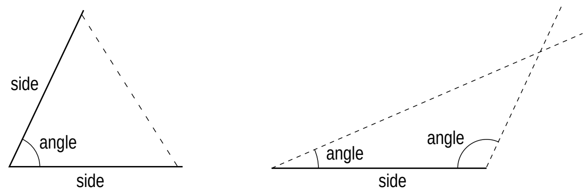


Link to properties of a circle (pages 194–7), and to work in design and technology.

Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:

Construct lines, angles and shapes (continued)

Construct triangles.
Use ruler and protractor to construct triangles:
- given two sides and the included angle (SAS);
- given two angles and the included side (ASA).



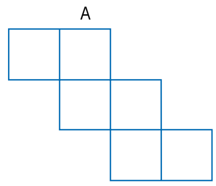
For example:

- Construct ΔABC with ∠A = 36°, ∠B = 58° and AB = 7 cm.
- Construct a rhombus, given the length of a side and one of the angles.

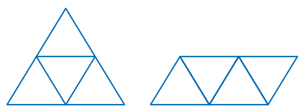
See Y456 examples (pages 102–3).

Construct solid shapes. Use ruler and protractor to construct simple nets. For example:

- Look at this net of a cube.
  When you fold it up, which edge will meet the edge marked A?
  Mark it with an arrow.



- Imagine two identical square-based pyramids.
  Stick their square faces together.
  How many faces does your new shape have?
- Construct on plain paper a net for a cuboid with dimensions 2 cm, 3 cm, 4 cm.
- Construct the two possible nets of a regular tetrahedron, given the length of an edge.



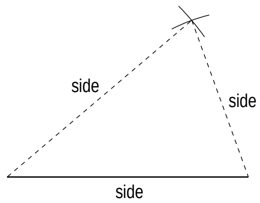
As outcomes, Year 8 pupils should, for example:

Construct triangles.
Construct triangles to scale using ruler and protractor, given two sides and the included angle (SAS) or two angles and the included side (ASA).

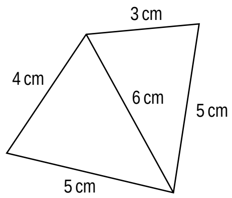
- A tower is 30 metres high.
  It casts a shadow of 10 metres on the ground.
  Construct a triangle to scale to represent this.
  Using a protractor, measure the angle that the light from the sun makes with the ground.

Extend to constructions with straight edge and compasses. For example:

- Construct a triangle given three sides (SSS).



- Construct this quadrilateral.



Link to scale drawings (pages 216–17).

Construct nets of solid shapes. For example:

- Construct a net for a square-based pyramid given that the side of the base is 3 cm and each sloping edge is 5 cm.

As outcomes, Year 9 pupils should, for example:

Construct triangles.
Use the method for constructing a perpendicular from a point on a line to construct triangles, given right angle, hypotenuse and side (RHS). For example:

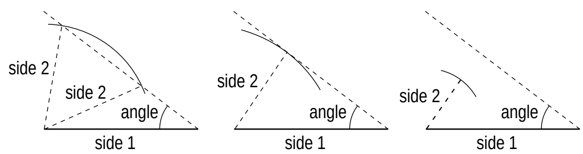
- A 10 metre ladder rests against a wall with its foot 3 metres away from the wall.
  Construct a diagram to scale. Then use a ruler and protractor to measure as accurately as possible:
  a. how far up the wall the ladder reaches;
  b. the angle between the ladder and the ground.

Review methods for constructing triangles given different information. For example:

- Is it possible to construct triangle ABC such that:
  a. A = 60°, B = 60°, C = 60°
  b. BC = 6 cm, AC = 4 cm, AB = 3 cm
  c. BC = 7 cm, AC = 3 cm, AB = 2 cm
  d. A = 40°, B = 60°, AB = 5 cm
  e. A = 30°, B = 45°, AC = 6 cm
  f. BC = 8 cm, AC = 6 cm, C = 50°
  g. BC = 7 cm, AC = 5.5 cm, B = 45°
  h. BC = 7 cm, AC = 4.95 cm, B = 45°
  i. BC = 7 cm, AC = 4 cm, B = 45°
  j. BC= 6 cm, AC = 10 cm, B = 90°?

Know from experience of constructing them that triangles given SSS, SAS, ASA and RHS are unique but that triangles given SSA or AAA are not.

To specify a triangle three items of data about sides and angles are required. In particular:
- *Given three angles (AAA) there is no unique triangle, but an infinite set of similar triangles.*
- *Given three sides (SSS) a unique triangle can be drawn, provided that the sum of the two shorter sides is greater than the longest side.*
- *Given two angles and any side (AAS), a unique triangle can be drawn.*
- *Given two sides and an included angle (SAS), a unique triangle can be drawn.*
- *If the angle is not included between the sides (SSA), there are three cases to consider:*
  i. *the arc, of radius equal to side 2, cuts side 3 in two places, giving two possible triangles, one acute-angled and the other obtuse-angled;*
  ii. *the arc touches side 3, giving one right-angled triangle (RHS);*
  iii. *the arc does not reach side 3 so no triangle is possible.*



Link to congruence and similarity (pages 190–3).

Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:
Find simple loci, both by reasoning and by using ICT	

As outcomes, Year 8 pupils should, for example:

Find simple loci, both by reasoning and by using ICT to produce shapes and paths.

Describe familiar routes. For example:

- Rajshree walked to the youth club.
  She turned left out of her front gate.
  She turned right at the telephone box.
  She went straight on at the crossroads.
  At the traffic lights she turned right then left.
  She turned left at the station.
  The youth club is on the left-hand side of the road.

  Describe her route home from the youth club.

Give practical examples of paths such as:

- the trail left on the ground by a snail;
- the vapour trail of an aircraft;
- the path traced out by a conker on a string;
- the path of a ball thrown into the air;
- the path you follow on a fairground ride;
- the path of the tip of a windscreen wiper.

Visualise a simple path. For example:

- Imagine a robot moving so that it is always the same distance from a fixed point. Describe the shape of the path that the robot makes.
  (A circle.)

- Imagine two trees. Imagine walking so that you are always an equal distance from each tree. Describe the shape of the path you would walk.
  (The perpendicular bisector of the line segment joining the two trees.)

Understand locus as a set of points that satisfy a given set of conditions or constraints. Place counters on a table according to a given rule and determine the locus of their centres. For example:

- Place a red counter in the middle of the table. Place white counters so that their centres are all the same distance from the centre of the red counter. *(Centres lie on a circle.)*

- Place a red counter and a green counter some distance apart from each other. Place white counters so that their centres are always an equal distance from the centres of the red and green counters.
  (Centres lie on the perpendicular bisector of RG.)

- Place white counters so that their centres are the same distance from two adjacent edges of the table. *(Centres lie on the bisector of the angle at the corner of the table.)*

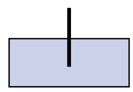
Link to construction (pages 220–3).

As outcomes, Year 9 pupils should, for example:

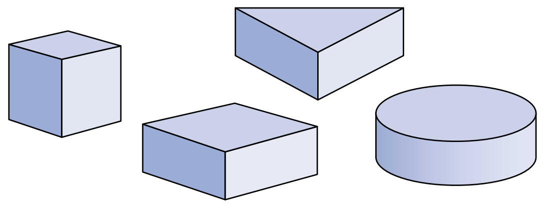
Find loci, both by reasoning and by using ICT to produce shapes and paths.

Visualise paths and loci in two or three dimensions. For example:

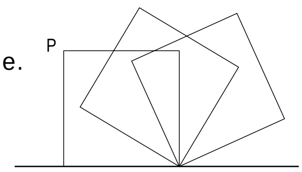
- Imagine the black line is a stick stuck flat to a rectangular card so that it lies in the same plane.



  Hold the card and stick upright and spin it as fast as you can.
  Which of these shapes would you seem to see?



- Imagine a square being rolled along a straight line. What path would the point P trace?



- A spider is dangling motionless on a single web. I move a finger so that its tip is always 10 cm from the spider. What is the locus of my finger tip?
  (The surface of a sphere.)

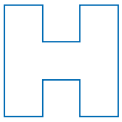
- I hold a ruler in my left hand, then move the tip of my right forefinger so that it is always 8 cm from the ruler. What is the locus of my fingertip?
  (The surface of a cylinder with a hemisphere on each end.)

Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:
Find simple loci, both by reasoning and by using ICT (continued)	

As outcomes, Year 8 pupils should, for example:

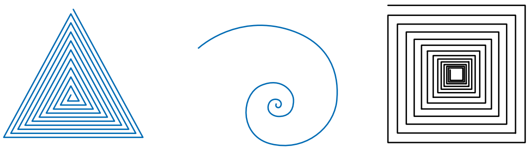
Use ICT to generate shapes and paths.
For example, generate using **Logo**:

- rectilinear shapes



- regular polygons

- equi-angular spirals

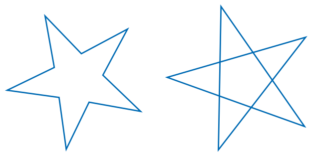


Link to properties of triangles, quadrilaterals and polygons (pages 184–9).

As outcomes, Year 9 pupils should, for example:

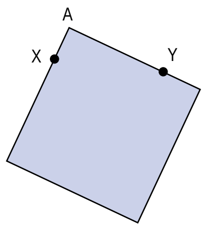
Use ICT to investigate paths.
For example:

- Use **Logo** to produce a five-pointed star.

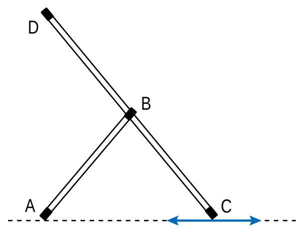


Investigate problems involving loci and simple constructions. *For example:*

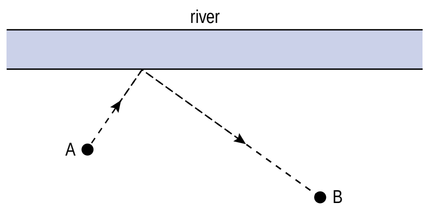
- *Two points X and Y are 10 cm apart.*
  Two adjacent sides of a square pass through points X and Y.
  What is the locus of vertex A of the square?



- *In a design for the mechanism of a shower door, AB is a bracket, fixed at A and joined by a pivot to the middle of the door frame at B. One end of the door frame, C, moves along a groove shown by the dotted line. What is the locus of point D on the other edge of the door?*



- *A man has to run from point A to point B, collecting a bucket of water from the river on his way. What point on the river bank should he aim for, in order to keep his path from A to B as short as possible?*



Link to properties of circles (pages 194–7).