

Title: Constructions and Loci

Key Knowledge/Prior Learning KS2/3 and Retrieval and Suggested Starters

Students should be able to:

- measure and draw lines to the nearest mm
- measure and draw angles to the nearest degree
- make accurate drawings of triangles and other 2D shapes using a ruler and a protractor
- make an accurate scale drawing from a sketch, diagram or description

KS4 National Curriculum – what students will be practicing

Use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

Specific Ambitious Knowledge

Students should be able to:

- use a straight edge and a pair of compasses to do standard constructions
- construct a triangle
- construct an equilateral triangle with a given side or given side length
- construct a perpendicular bisector of a given line
- construct a perpendicular at a given point on a given line
- construct a perpendicular from a given point to a given line
- construct an angle bisector
- construct an angle of 60°
- draw parallel lines
- draw circles or part circles given the radius or diameter
- construct diagrams of 2D shapes
- construct a region, for example, bounded by a circle and an intersecting line
- construct loci, for example, given a fixed distance from a point and a fixed distance from a given line
- construct loci, for example, given equal distances from two points
- construct loci, for example, given equal distances from two line segments
- construct a region that is defined as, for example, less than a given distance or greater than a given distance from a point or line segment
- describe regions satisfying several conditions.

Key Vocabulary/Literacy Opportunities

- Perpendicular

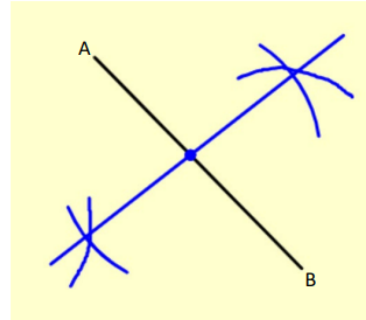
- Bisect
- Locus
- Region
- Line segment

Key Formulae/Knowledge

A **perpendicular bisector** is a line that cuts another line exactly halfway through it. It bisects the line at a right angle.

How to draw a perpendicular bisector:

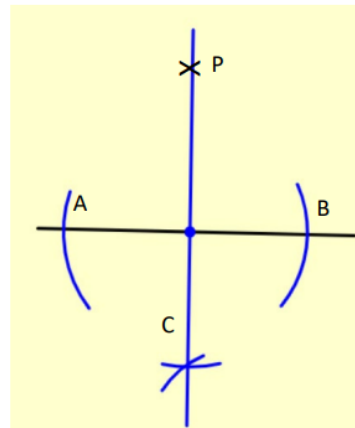
1. Draw a line segment AB.
2. Put the compass point at A, and with more than half of the line segment AB as width, draw arcs above and below the line segment.
3. Repeat step 2 with the point of the compass at B.
4. Using a straight line, join the points of intersection of the curved compass lines (see diagram).



This **construction** involves you drawing a line which is perpendicular (at right angles) to another and the line that you draw has to go through a certain point.

How to draw a perpendicular line to a line from a point:

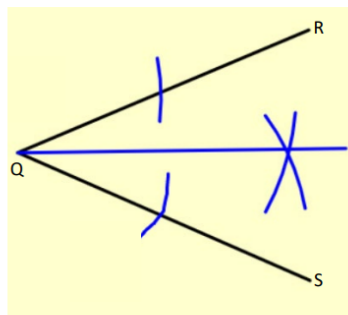
1. Begin with a straight horizontal line and mark point P over the line.
2. Placing the compass on point P and mark the line in two places. Label these points A and B.
3. Placing the compass on point A and draw an arc. Make sure it is over halfway across AB and below the horizontal line.
4. Without changing the distance between your compass point and pencil, place the compass on point B and repeat step 3, making sure the two arcs cross. Mark this point C.
5. Finally, draw a line connecting point C to the original point P. Line PC is perpendicular to AB.



Bisecting an angle involves constructing a line that cuts an angle exactly in half (bisects.)

How to bisect an angle:

1. Open the compass to any width and place the point of the compass at the angle's vertex, Q. Using the compass, draw an arc that crosses both lines QR and QS.
2. Move the compass so that the point is at the location where the first arc intersects the line QR. Using the compass, draw an arc inside of the angle.
3. Without changing the width of the compass, move the point to the location where the first arc intersects the line QS. Using the compass, draw an interior arc that intersects the first interior arc drawn in step 3.
4. Draw a line from the vertex to the point where the arcs intersect.



A **locus** (loci plural) is a set of points that follows a certain location rule, for example, always being 3 m away from a point. **Loci** can be used to construct lines or shapes and you may be asked to construct a **locus** or solve **loci** problems. To do so, you will need to use your ruler and compass.

Maths in Context (Historical, Real Life and Student Thinking Points)

- This links to an explanation of the history of straightedge and compass constructions.
https://en.wikipedia.org/wiki/Straightedge_and_compass_construction#History
-

Projects/Enrichment/Investigations

- https://nrich.maths.org/8098?utm_source=secondary-map
- https://nrich.maths.org/11848?utm_source=secondary-map