GCSE Maths – Geometry and Measures

Constructions

Notes

WORKSHEET

Constructions

There are four ruler and compass constructions you may be asked to do:

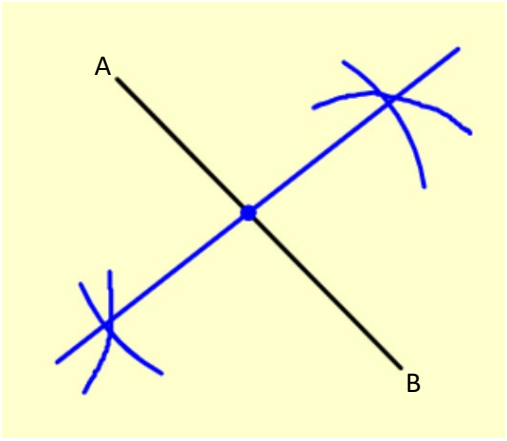
- **perpendicular bisector** of a line segment
- constructing a **perpendicular line** to a given line from/at a given point
- bisecting a given angle
- locus of all points around a line or given point.

Perpendicular bisector

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).

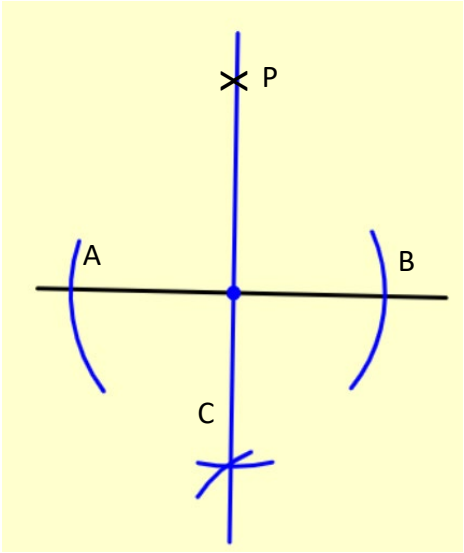


Perpendicular to a line from a point

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.

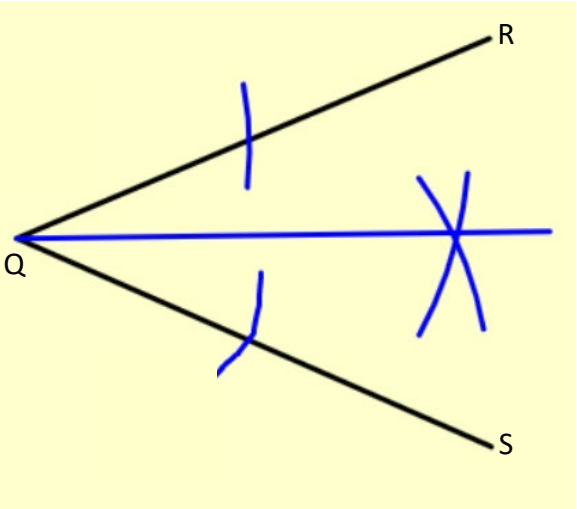


Angle bisector

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.

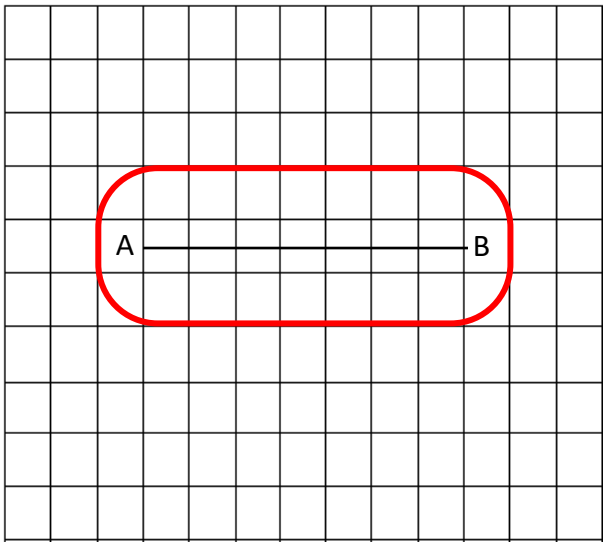


Locus of all points

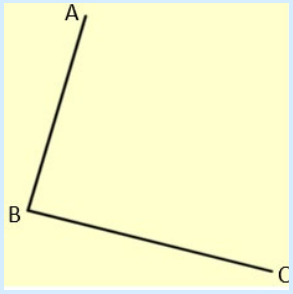
A **locus** (loci plural) is a set of points that follows a certain location rule, for example, always being 3 m away from a point. **Loci** can be used to construct lines or shapes and you may be asked to construct a **locus** or solve **loci** problems. To do so, you will need to use your ruler and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

How to draw the following locus where every point on the locus is 2 cm from the line AB:

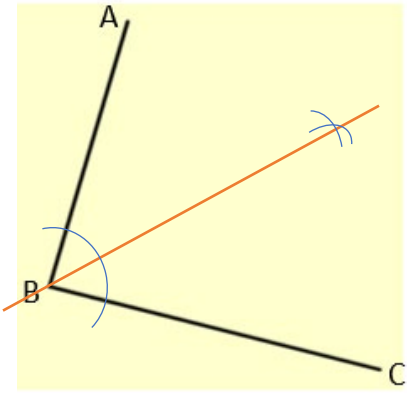
1. Set the pair of compasses to have distance 2 cm from the point and draw a semicircle around point A with radius 2 cm.
2. While keeping the pair of compasses the same size, repeat for point B, drawing a semicircle at B with radius 2 cm.
3. Using a ruler, join up the two circles, as is shown in the diagram. Every point on the red line is exactly 2 cm away from the line AB.



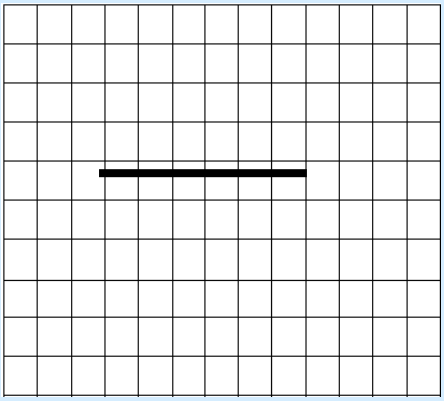
Example: Draw the locus of points that are equidistant from lines AB and BC



1. *Place the compass at B and draw an arc that passes through both the lines AB and BC.*
2. *Place the compass at each of the points where the first arc crossed and draw two small arcs which lie in between lines AB and BC.*
3. *The angle bisector is the line which passes through point B and the point where the two small arcs intersect. This line gives the locus of points which are equidistant from AB and BC.*

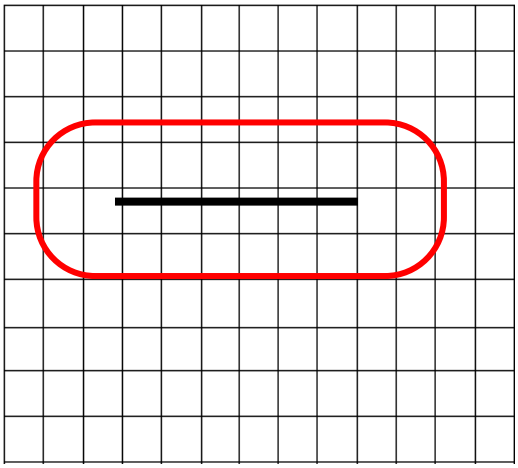


Example: Draw the locus of all points which are 2 cm away from the line below on the grid.



1. *Using your compass, draw two semicircles centred at each end of the line with radius 2 cm.*
2. *Join up the two semi circles, drawing the horizontal lines parallel to the given line.*

These gives a locus of points which are all 2 cm from the given line.

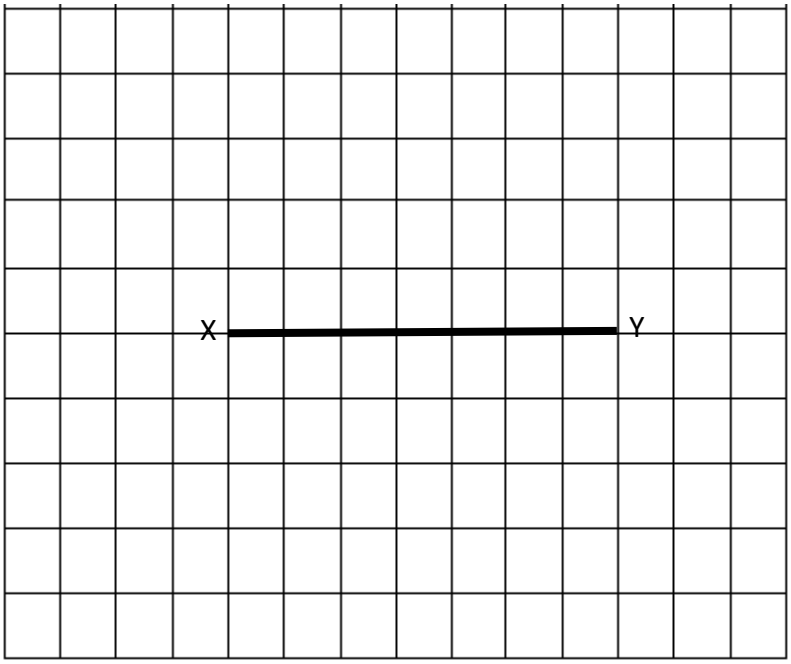


Constructions – Practice Questions

1. Construct the perpendicular bisector of the line AB.

2. Construct a line starting from a point which is perpendicular to line AB. You must show construction lines.

3. Draw the locus of all the points that are exactly 3cm away from the line XY.



Worked solutions for the practice questions can be found amongst the worked solutions for the corresponding worksheet file.