

A pair of compasses can be used to carry out several constructions.

Bisecting a line by constructing a perpendicular bisector

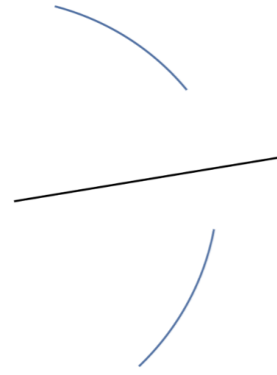
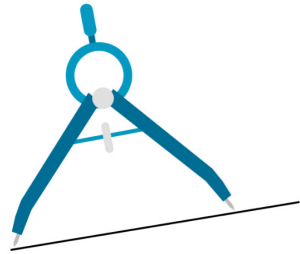
The word bisect means to divide in half.

So, to bisect a line means to divide it into two equal halves.

Example

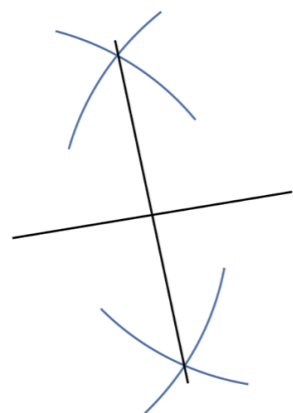
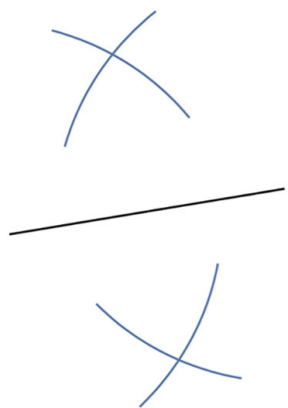
If we are asked to bisect a given line, we will start by opening a pair of compasses so that the opening is greater than half the length of the line.

Next, place the pin at one end of the line (the left end has been chosen here), draw arcs above and below the line.



Then, place the pin at the other end of the line, and repeat the process of drawing arcs above and below the line. It is important that the opening between the pin and pencil is not altered.

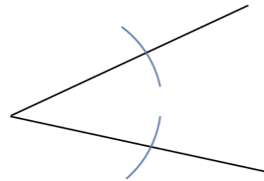
Draw a line connecting the two points where the pairs of arcs intersect. This line bisects the original line at 90°. Remember to leave the construction arcs in your answer.



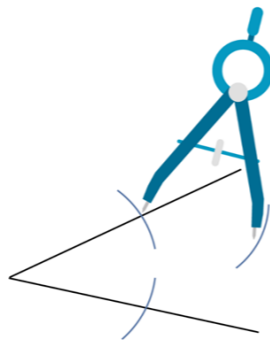
Bisecting an angle

Example

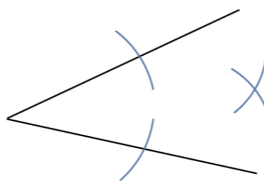
In order to bisect this angle, we would first place the pin of the compasses at the vertex and draw arcs that cross the two lines. The size of the opening between the pin and pencil needs to be kept the same here.



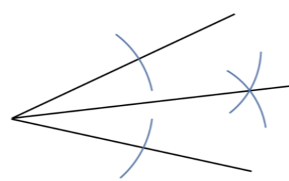
Then, place the pin of the compasses at one of the points of intersection and draw an arc between the two lines.



Maintaining the same opening of the compasses, place the pin at the other point of intersection and draw a second arc that crosses the previous arc.



Finish by drawing a line from the vertex of the two lines through the intersection of the final two arcs. This line bisects the angle.



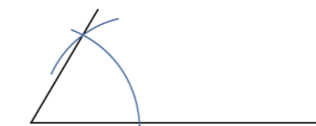
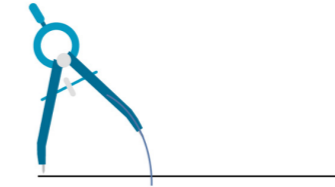
REMEMBER! The construction of angles of 60° and 30° are related, as 30 is half of 60. When an angle of 60° has been constructed, bisecting the angle will result in an angle of 30°. It is the same once we've constructed an angle of 90°, an angle of 45° is constructed by bisecting it.

Check that you can:

- use a pair of compasses to draw arcs
- understand the term 'perpendicular', which means 'at a right angle to'
- understand how angles are measured using degrees (°).

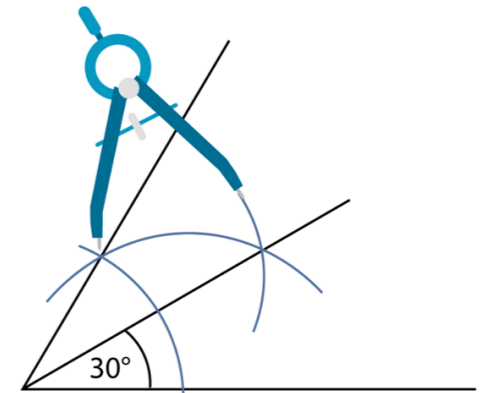
Constructing angles of 60°

- Start by drawing a straight line.
- Place the pin of a pair of compasses at any point on the line (one end of the line chosen here) and draw a long arc that must cross the line. Then, maintaining the same opening of the compasses, place the pin at the intersection of the arc and the line and draw another arc that crosses the first.
- Finish by drawing a line from the starting point (in this case the end of the line) through the intersection of the two arcs. The angle formed will be 60°.



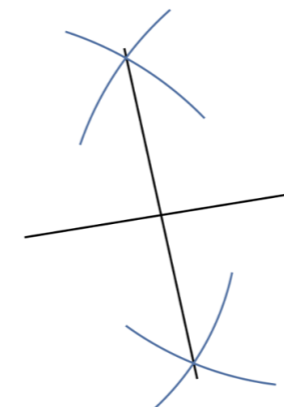
Constructing angles of 30°

- Construct an angle of 60°.
- Construct the angle bisector.
- Carefully label your angle of 30°.



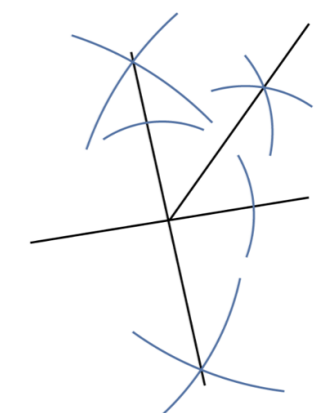
Constructing angles of 90°

The easiest way to construct an angle of 90° is to construct a perpendicular bisector.



Constructing angles of 45°

Start by constructing an angle of 90°, and then bisect it.



Loci is the plural of the word locus. A locus is a set of points that satisfy a given rule. These points may form a line, a curve or a region.

Check that you can:

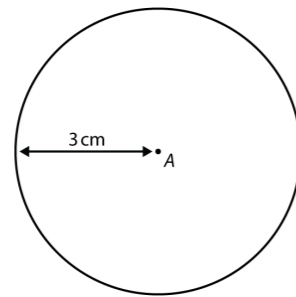
- recognise a perpendicular bisector and an angle bisector and carry out these constructions
- use a pair of compasses to draw arcs and circles
- use a protractor to measure angles.

The four loci

There are 4 loci that we need to learn for GCSE Mathematics. Once you understand the diagram required for each locus, you will need to know how to draw them accurately, using construction techniques if required.

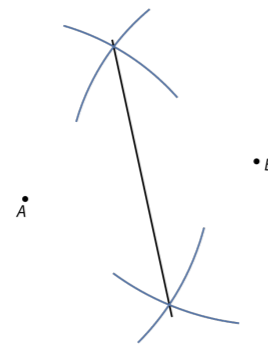
1. The locus of points that are a given distance from one point

For example, if we were asked to construct the locus of points that are 3cm from a point A , this means that we need the set of points that are always 3cm from A . Remember that when there are enough of these points, such that all the points are very close to each other, they form a line. This line is a circle, centered at A , with a radius of 3cm.



2. The locus of points that are equidistant from two fixed points

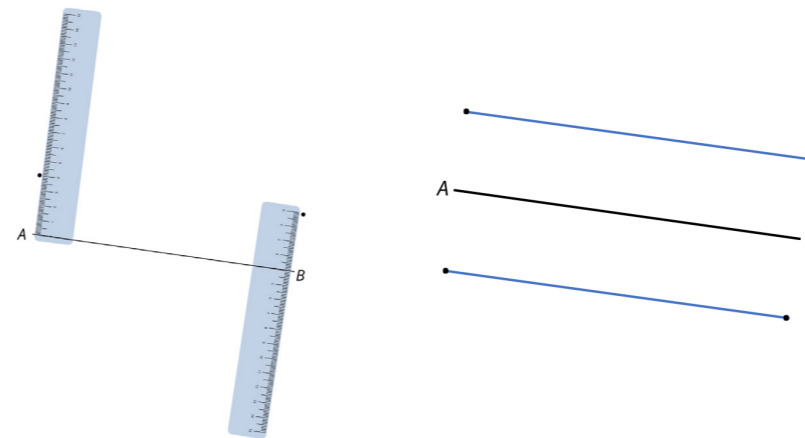
For example, the set of points that are equidistant (equal distance) from two points A and B form the perpendicular bisector of the line from A to B . We do not need to draw the line AB to construct the perpendicular bisector (although to do so is not incorrect).



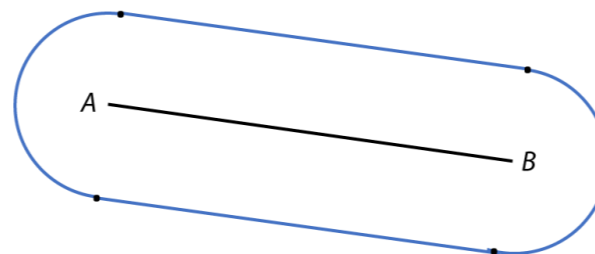
3. The locus of the points that are a given distance from a line

For example, to draw the locus of the points that are 4cm from the line AB , we need to draw lines on either side of AB that are parallel to it and are also 4cm away from it.

We could do this by placing a ruler at 90° to the line and marking points 4cm away. If we do this at both ends of AB , then by connecting the points, we will end up with parallel lines. Repeating the process on the other side of AB results in another parallel line, 4cm away from AB .

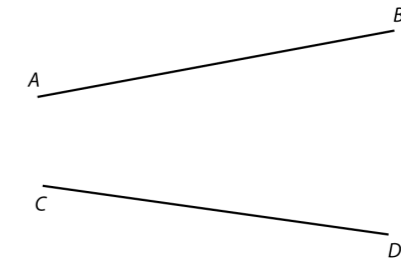


At the ends of the line, we have the points A and B . At each of these points, we draw a semicircle of radius 4cm. Every point on the semicircles will be 4cm away from either point A or point B .

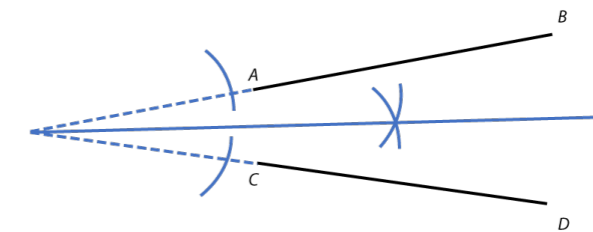


4. The locus of points that are equidistant from two non-parallel lines

For example, in order to construct the locus of points that are equidistant from AB and CD , we would need to find the angle bisector of the two lines.



To construct the locus, we first need to extend the lines back until we form a vertex. From this vertex, we now construct the angle bisector.



If the question had not asked us to construct this line, we could use a ruler and protractor instead.

REMEMBER! You will need to use your knowledge of perpendicular bisectors and angle bisectors, and determine when to use these construction techniques to indicate a specified locus from lines and points.