Most construction requires the use of a pencil, ruler and a pair of compasses only.

Occasionally you may have to use a protractor to draw an angle.

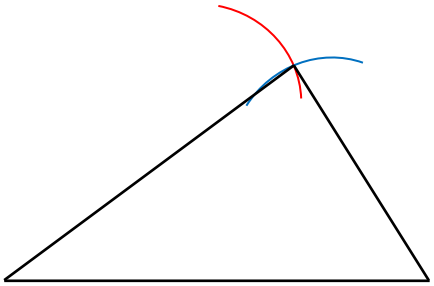
A. Constructing a triangle given the 3 side lengths

- Draw the first line. This gives you two vertices of your triangle. You will then need a pair of compasses to locate the position of the third vertex.
- Open your compasses the length of the second side.
  Place the point of your compasses on one end of your line and draw an arc. (Somewhere near where you may expect the third vertex to be.)

- Repeat using the length of the third side from the other end of your line.

If your arcs don't meet, draw them longer!

- Join from the intersection of the arcs back to both ends of your line.



You must be very accurate.

Your lines should meet exactly.

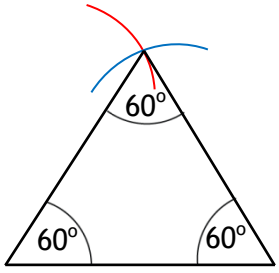
Leave your construction marks visible.

Constructing an equilateral triangle

Follow the same procedure as above.

Note: An equilateral triangle not only has 3 equal side lengths but also 3 equal angles.

So you have just constructed three perfect 60^o angles.

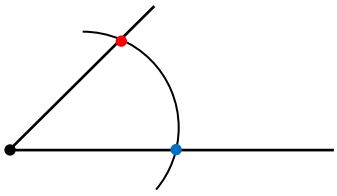


Remember to be very accurate

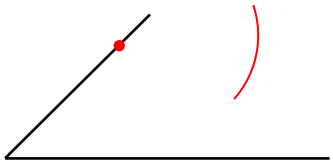
B. Bisecting

Bisecting means ‘cutting in half’ or ‘cutting into two equal pieces’

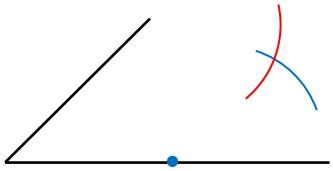
Bisecting an angle



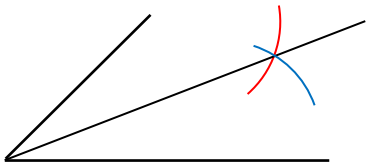
- First you need to find 2 points equidistant from the centre of the angle. Open your compasses a few cm then put the point on the centre of the angle and draw an arc that intersects both branches of the angle.



- Put the point on one of the intersections and draw an arc inside the angle.



- Repeat from the other intersection.

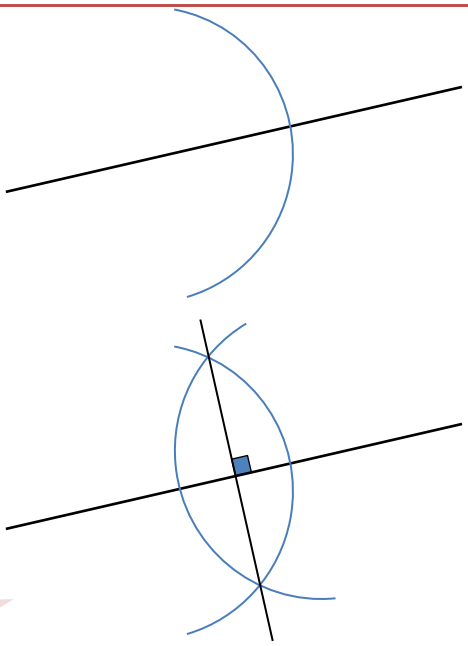


- Draw the bisector through the new intersection and the centre of the angle.

Bisecting a line – Constructing a perpendicular bisector

- Draw your line, unless it is already given.
- Open your compasses a little more than half the length of the line.
  (Just use your eye, about 1cm longer than half the line will be fine.)
- Put the point on one end of the line and draw an arc from above to below the line.
- Without altering your compasses repeat by drawing an arc from the other end of your line.
- Draw the bisector through the two intersetions.

Not only have you bisected the line but the 2 lines are perpendicular, so you have just constructed a perfect 90^{o} angle.



C. Constructing a 90° angle anywhere on a line

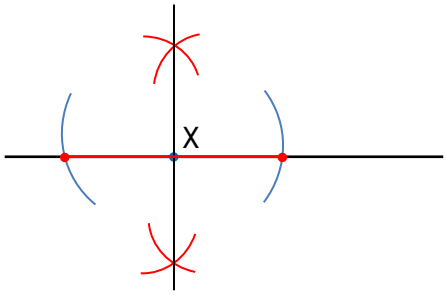
When we bisect a line we create a perpendicular bisector. Therefore to construct a 90° angle wherever we want it, all we need to do is ensure that where we want it is in the centre of a line which we can then bisect.

In the centre of a line

- Just bisect the line

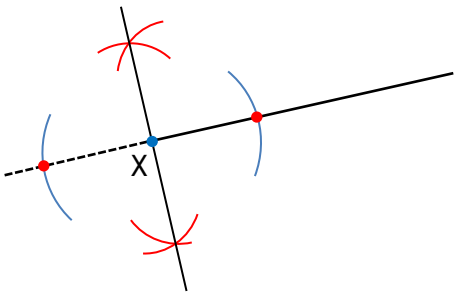
At a point X on the line

- First we need to make point X the centre of a new line.
- Open your compasses and put the point on X, then draw an arc either side of X.
- Now just bisect the line between these arcs.
- Put the compass point on one end of the line and draw arcs above and below the line. (It can be one long arc or two small arcs.)
- Without altering your compasses repeat by drawing arcs from the other end of your line.
- Draw the bisector through the two intersections.



At a point X at an end of the line

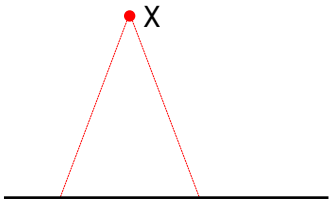
- We need to make point X the centre of a new line, so first we will need to extend the line beyond X.
- Open your compasses and draw an arc either side of X.
- Now just bisect the line between these arcs.
- Put the compass point on one end of the line and draw arcs above and below the line. (It can be one long arc or two small arcs.)
- Without altering your compasses repeat by drawing arcs from the other end of your line.
- Draw the bisector through the two intersections.



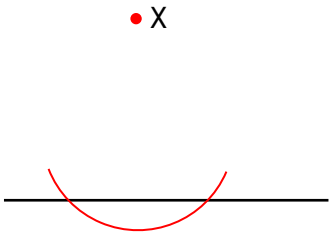
To construct a 90° angle just bisect a line

Do not erase your construction marks, leave them visible

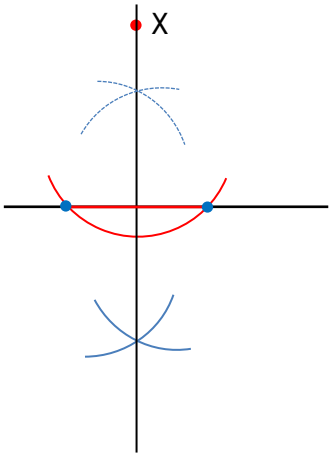
D. Constructing a perpendicular line through a line and a point X



- Think isosceles triangle.
- An isosceles triangle has a perpendicular line of symmetry through the base and the top point X.



- Open your compasses and put the point on point on X.
- Draw an arc that intersects the line in two places.

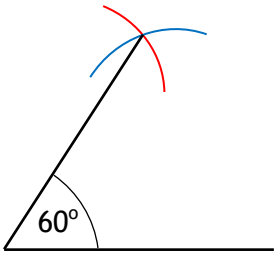


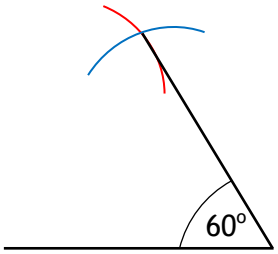
- Bisect the line between the two intersections. Open the compasses a reasonable amount and draw an arc from each end of the line between the intersections.
- You only need to draw arcs below the line as you are going to draw through X. (You can also draw arcs above the line if you wish.)
- Draw the bisector through the two intersections and point X.

E. Constructing angles of 60°, 30° and 45°

60°

Follow the same procedure to construct an equilateral triangle, but only draw 2 sides.





30°

- Construct a 60° angle then bisect it.

45°

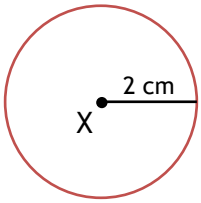
- Construct a 90° angle then bisect it.

F. Locus

A locus is the set of all points that follow a given rule.

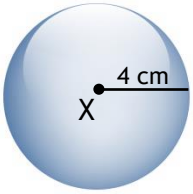
The locus of points 2 cm from a point X on a flat surface (2D)

Is a circle with radius 2 cm, centre X.



The locus less than 2 cm from X will be the inside of the circle.

The locus of points 4 cm from a point X in space (3D)



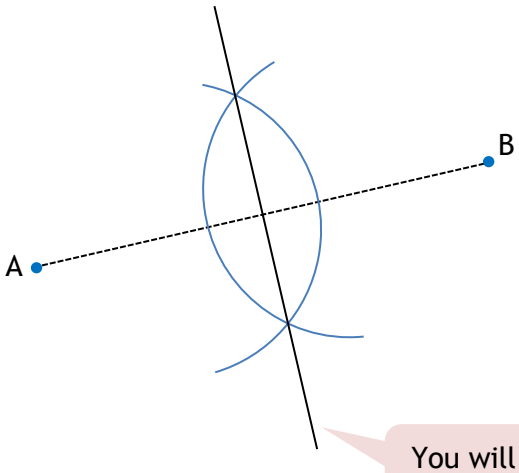
Is a sphere with radius 4 cm, centre X.

The locus of points 2 cm away from a line

Has a line 2cm directly above and below the line and a semicircle with radius 2 cm on each end of the line.

G. Equidistant locus

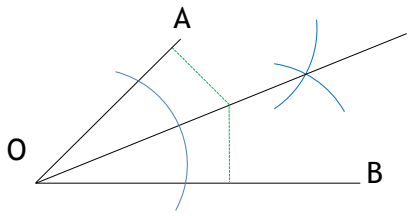
The locus of points equidistant from 2 points



The locus equidistant from 2 points is the perpendicular bisector of the line that joins the 2 points. (Draw the joining line if it helps.)

You will always be the same distance from both A and B from anywhere on this bisector.

The locus of points equidistant from 2 lines



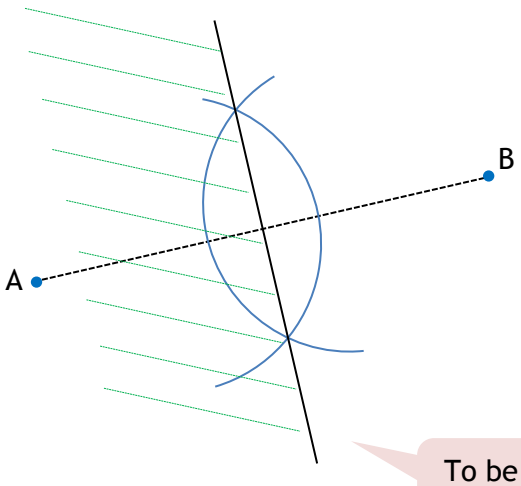
The locus equidistant from the lines OA and OB is the bisector of the angle between the 2 lines.

You will always be the same distance from each line by the shortest route. (The shortest route is perpendicular to each line.)

H. 'Closer to' locus

Before we can locate the locus that are 'closer to' we need to draw the boundary line where you will be equidistant.

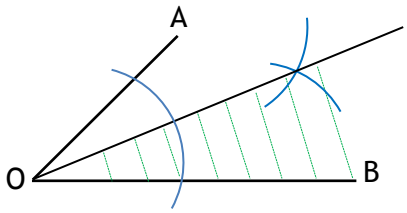
The locus of points closer to A than B



- Bisect the line between the two points. This is the boundary, on one side of the boundary you are closer to A and on the other side you are closer to B.
- Shade the side of the boundary that satisfies the required condition.

To be closer to one point than the other means you will need to be on one side of the boundary.

The locus of points closer to line OB than OA



- Bisect the angle between the lines. This is the boundary.
- Shade the side of the boundary that satisfies the required condition.

To be closer to one line than the other means you will need to be on one side of the boundary.