

Geometric Construction Notes

A geometric construction is a drawing of geometric shapes using a compass and a straightedge.

When performing a geometric construction, only a compass (with a pencil) and a straightedge are allowed to be used.

We will be performing “process demonstrations” of each construction in class and you will be asked to perform additional process demonstrations as part of your homework. A process demonstration is showing a construction step by step including all the previous steps.

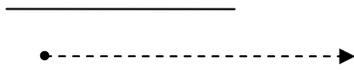
There are seven basic geometric constructions.

1. congruent segment
2. segment bisector
3. congruent angle
4. angle bisector
5. a line perpendicular to a given line through a point not on the line.
6. a line perpendicular to a given line through a point on the line.
7. a line parallel to a given line through a point not on the line.

Other geometric shapes or figures, such as right triangles or equilateral triangles, can be constructed using these seven basic constructions.

Congruent Segment – construct a segment congruent to a given segment.

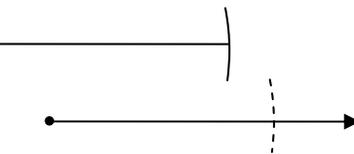
Step 1 draw a ray



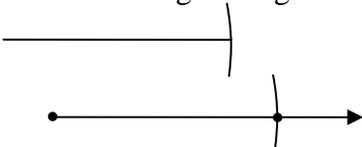
Step 2 – Measure the length of the original segment using your compass.



Step 3 – Mark the length on your ray.



Step 4 – Mark the intersection of the arc and ray to make a segment congruent to the original segment.



Process demonstration



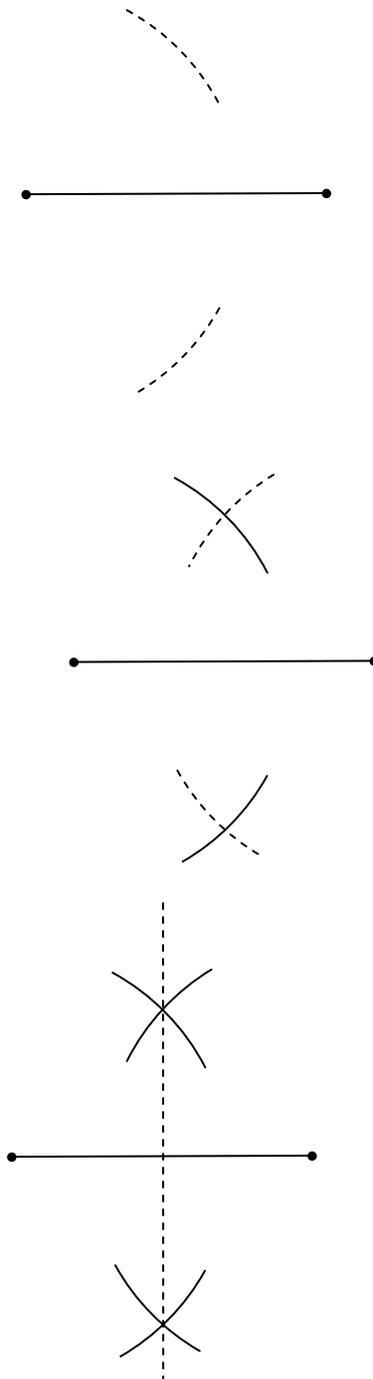
Segment Bisector or Perpendicular Bisector

Step 1 Open your compass to a measure which is more than half of the length of your segment.

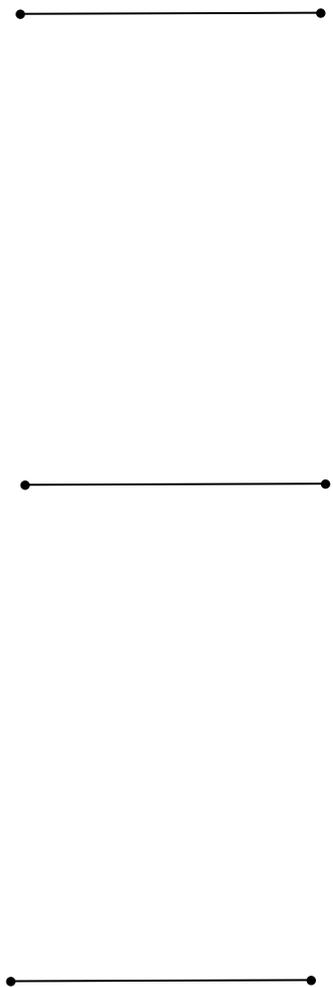
Step 2 Put the point of the compass on one end of the segment and construct an arc above and below the segment.

Step 3 Without changing the measure of the compass put the point of the compass on the other end of the segment and construct an arc above and below the segment.

Step 4 Draw a segment connecting the two intersections of the arcs.

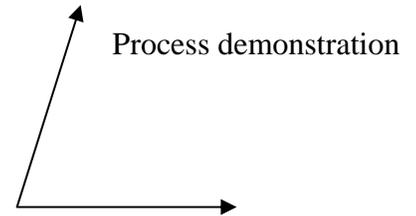
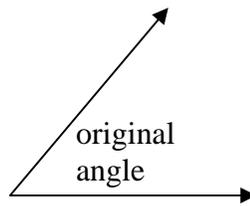


Process demonstration

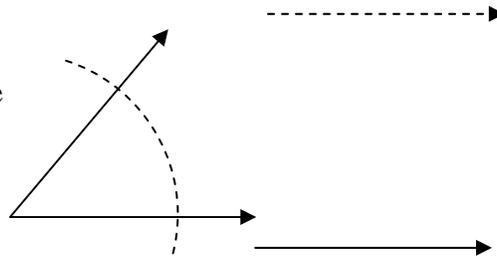


Congruent Angle

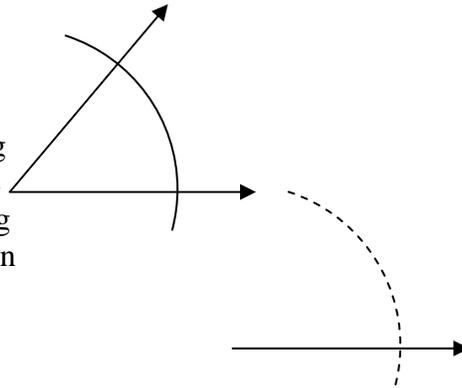
Step 1 – Draw a ray.



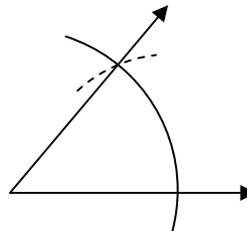
Step 2 – Construct an arc on the original angle with the point of the compass on the vertex of the angle and the arc crossing both sides of the angle.



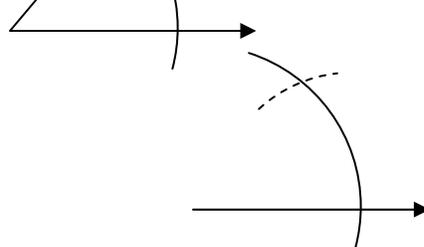
Step 3 – Without changing the compass, construct the same arc on the ray putting the point of the compass on the end of the ray.



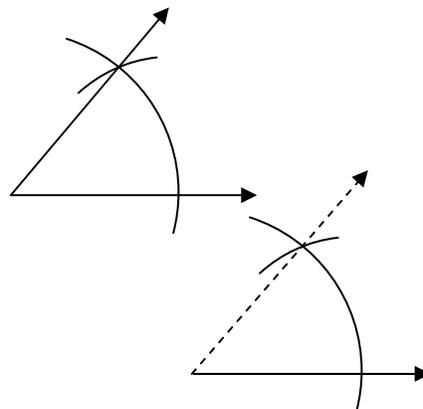
Step 4 – Measure the width of the original angle using the compass.



Step 5 – Without changing the measure on the compass mark off that width on your ray. Put the point of the compass on the point where the arc crosses the ray and construct an arc crossing your arc.

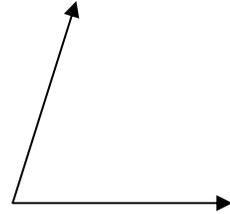
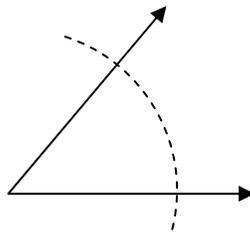


Step 6 – Draw the second side of the angle by connecting the endpoint of the ray (your vertex) with the point where the two arcs intersect.

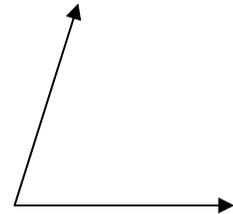
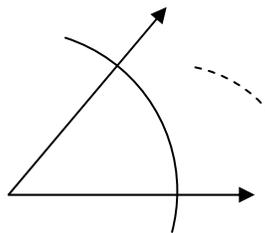


Angle Bisector

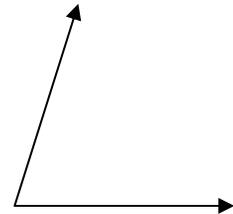
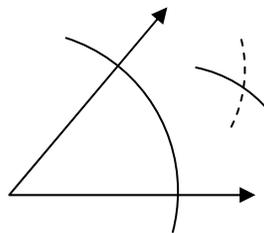
Step 1 – Construct an arc crossing both sides of the angle. Put the point of the compass on the vertex of the angle.



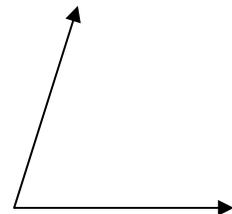
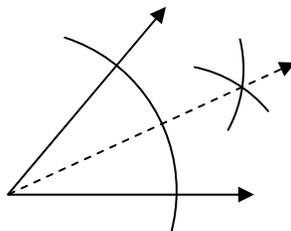
Step 2 – Construct an arc in the interior of the angle putting the compass on one side of the angle where the arc crosses it.



Step 3 – Without changing the compass measure from step 2, put the point of the compass on the other side of the angle where the arc crosses it and draw an arc on the interior of the angle.

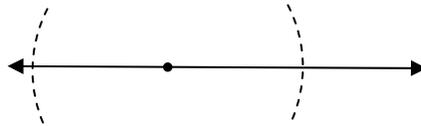


Step 4 – Draw the angle bisector by connecting the vertex of the angle with the point where the two arcs from steps 2 and 3 cross.



A line perpendicular to a line through a point on the line

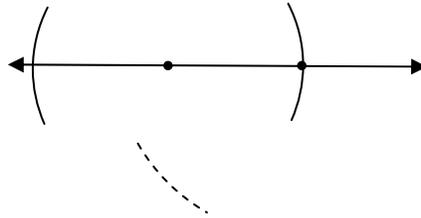
Step 1 – Put the point of the compass on the point and construct two arcs crossing the line one on each side of the point.



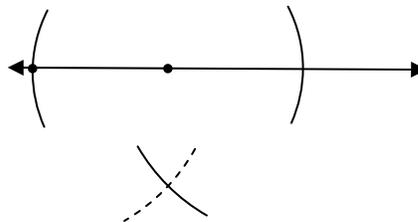
Construct a perpendicular bisector of the line segment.

Step 2 - Open your compass to a measure which is more than half of the length of your segment.

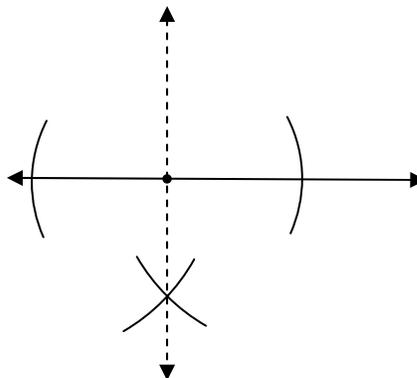
Step 3 – Put the point of the compass on one end of the segment and construct an arc above or below the segment.



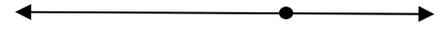
Step 4 – Without changing the measure of the compass put the point of the compass on the other end of the segment and construct an arc above or below the segment.



Step 5 – Draw a segment connecting the intersection of the arcs and the given point.

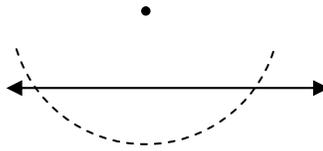


Process demonstration



A line perpendicular to a line through a point not on the line

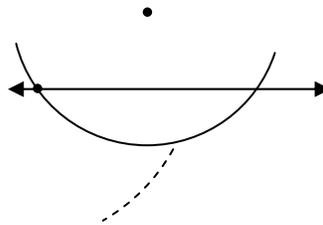
Step 1 – Put the point of the compass on the point and construct an arc crossing the line twice once on each side of the point.



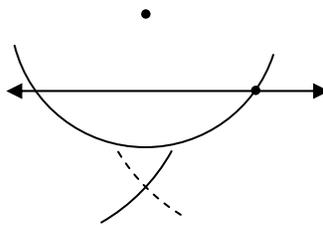
Construct a perpendicular bisector of the line segment.

Step 2 - Open your compass to a measure which is more than half of the length of your segment.

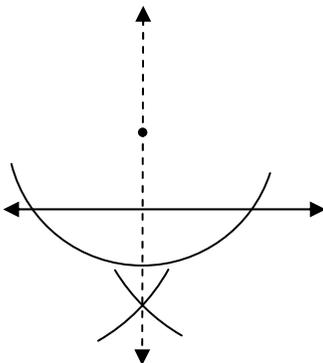
Step 3 – Put the point of the compass on one end of the segment and construct an arc above or below the segment.



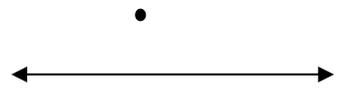
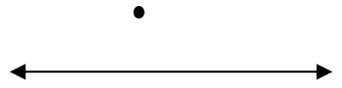
Step 4 – Without changing the measure of the compass put the point of the compass on the other end of the segment and construct an arc above or below the segment.



Step 5 – Draw a segment connecting the intersection of the arcs and the given point.



Process demonstration



Construct a line parallel to a given line through a given point

Step 1 – Draw a transversal through the point intersecting the line.

Construct a congruent angle because if the corresponding angles are congruent then the lines must be parallel.

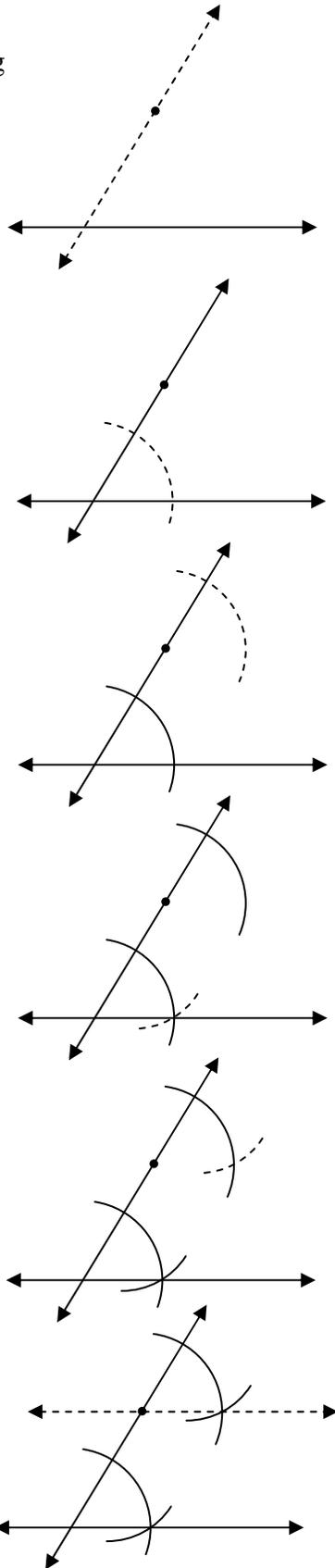
Step 2 – Construct an arc on the angle formed by the transversal and line with the point of the compass on the vertex of the angle and the arc crossing both sides of the angle.

Step 3 – Without changing the compass, construct the same arc at the point crossing the transversal.

Step 4 – Measure the width of the angle formed by the transversal and the line using the compass.

Step 5 – Without changing the measure on the compass mark off that width at the original point. Put the point of the compass on the point where the arc crosses the transversal and construct an arc crossing your arc.

Step 6 – Draw line through the point where the two arcs cross and the given point.



Process demonstration

