

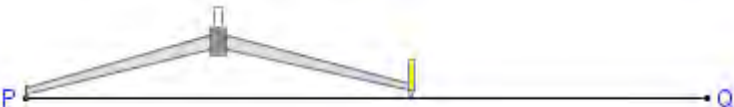
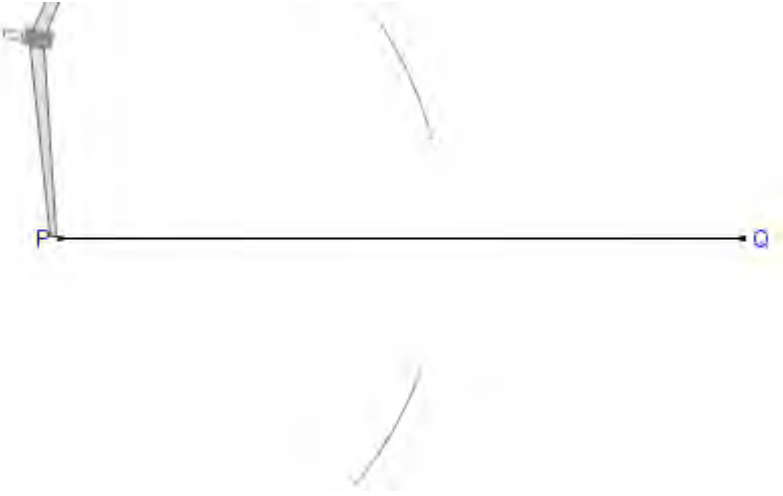
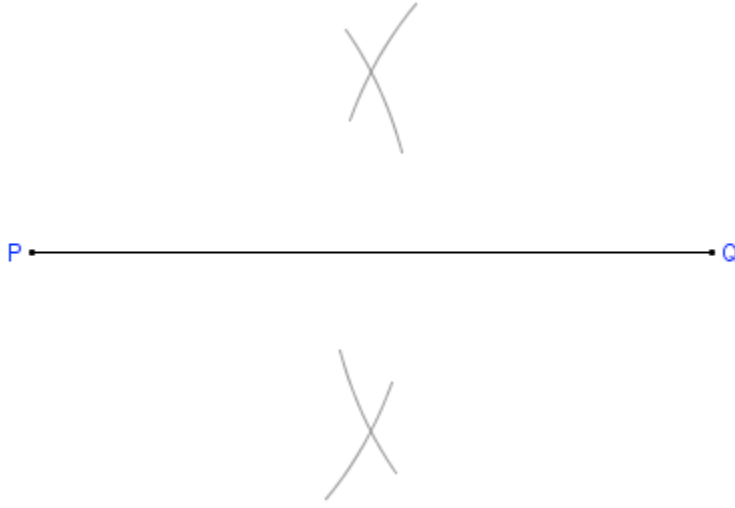
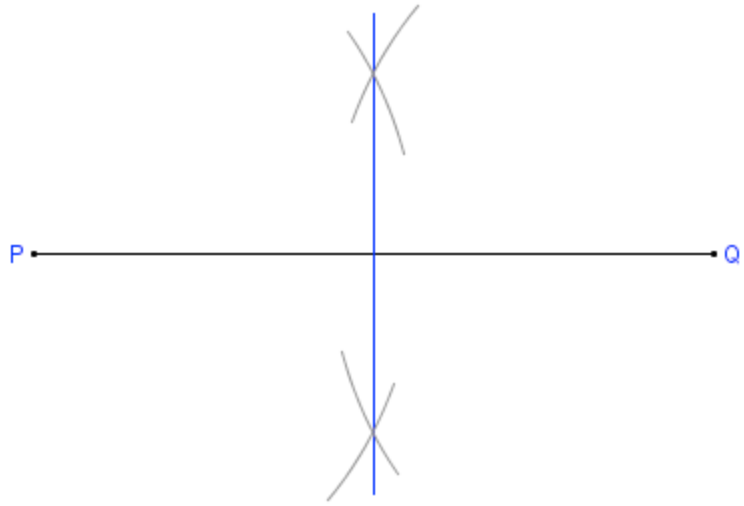


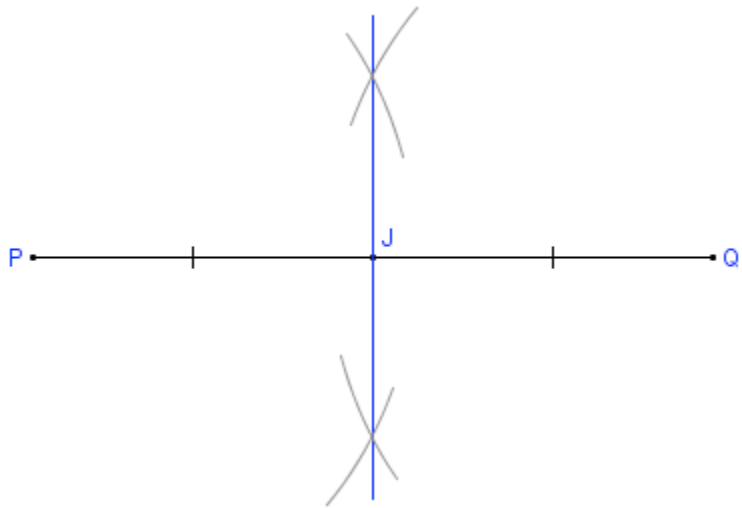
Bisecting a Line / Perpendicular Bisector of a Line

	After doing this	Your work should look like this
	Start with a line segment PQ.	
1	Place the compass on one end of the line segment.	
2	Set the compass width to a approximately two thirds the line length. The actual width does not matter.	
3	Without changing the compass width, draw an arc above and below the line.	
4	Again without changing the compass width, place the compass point on the the other end of the line. Draw an arc above and below the line so that the arcs cross the first two.	




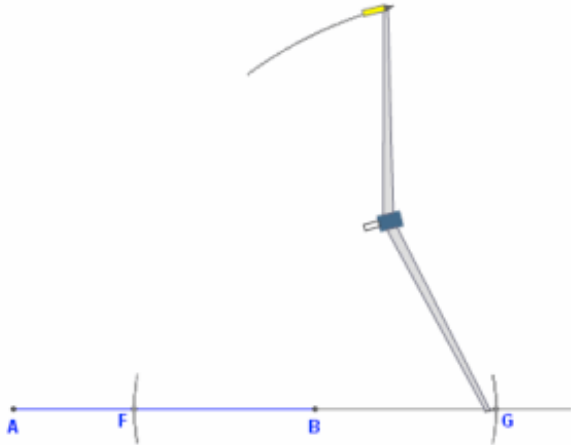
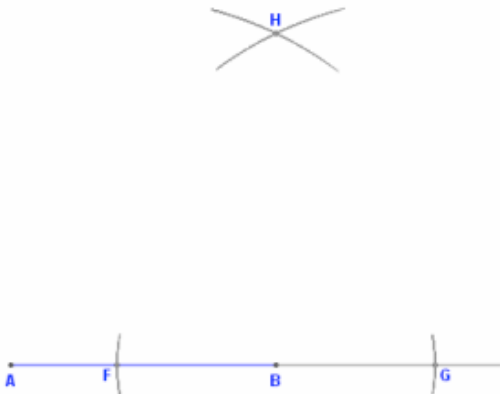
5 Using a straightedge, draw a line between the points where the arcs intersect.



6 Done. This line is perpendicular to the first line and bisects it (cuts it at the exact midpoint of the line).



Constructing a Square

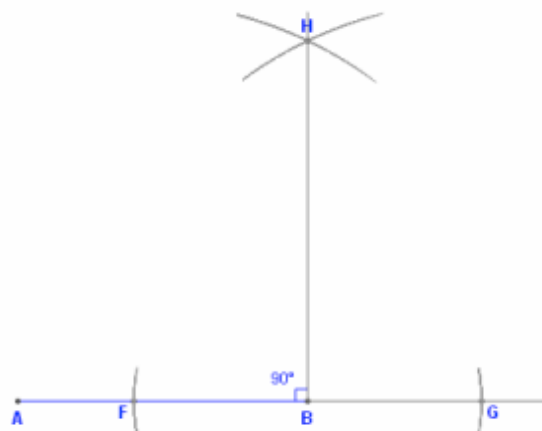
After doing this	Your work should look like this
<p>We start with a given line segment AB> This will become one side of the square.</p>	
<p>1. Extend the line AB to the right.</p>	
<p>2. Set the compasses on B and any convenient width. Scribe an arc on each side of B, creating the two points F and G.</p>	
<p>3. With the compasses on G and any convenient width, draw an arc above the point B.</p>	
<p>4. Without changing the compasses' width, place the compasses on F and draw an arc above B, crossing the previous arc, and creating point H</p>	

After doing this**Your work should look like this**

5. Draw a line from B through H.

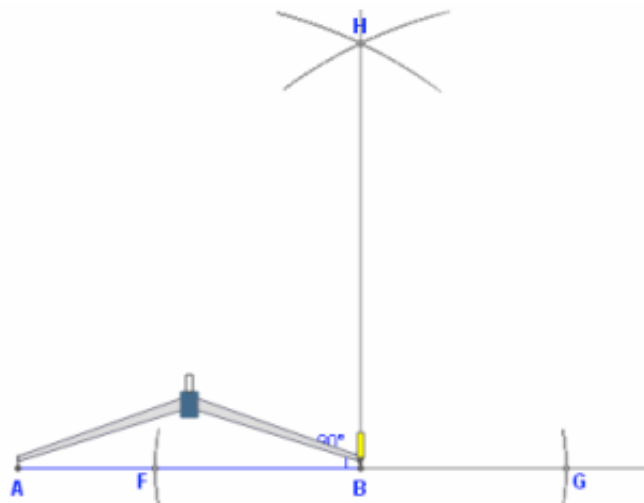
This line is perpendicular to AB, so the angle ABH is a right angle (90°);

This will become the second side of the square

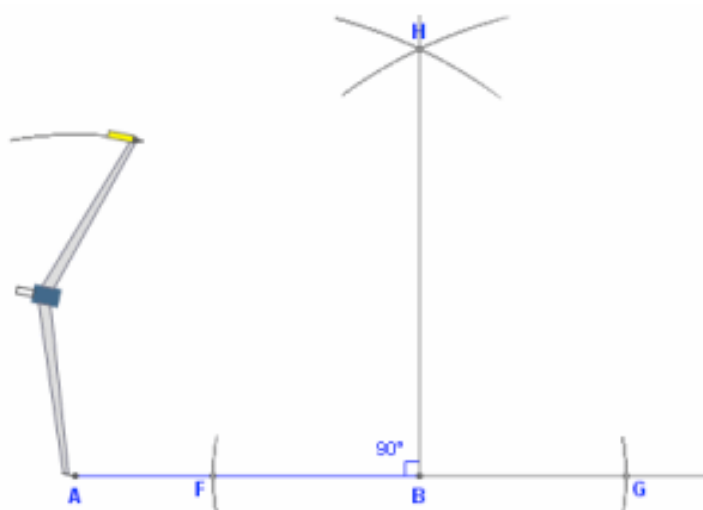


We now create four sides of the square the same length as AB

6. Set the compasses on A and set its width to AB. This width will be held unchanged as we create the square's other three sides.

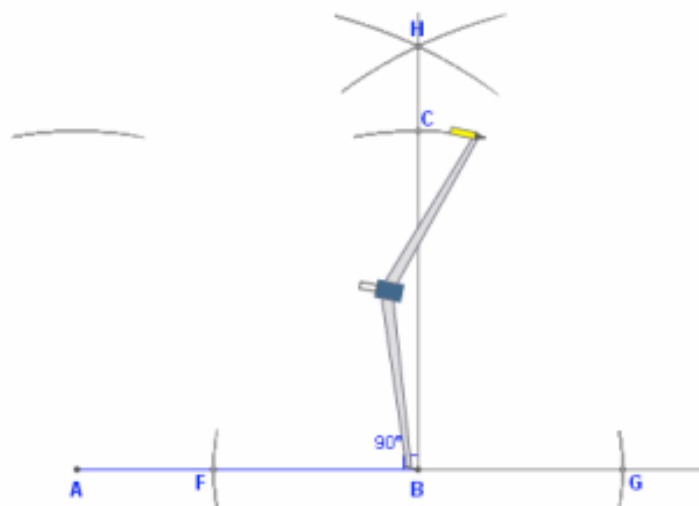


7. Draw an arc above point A.

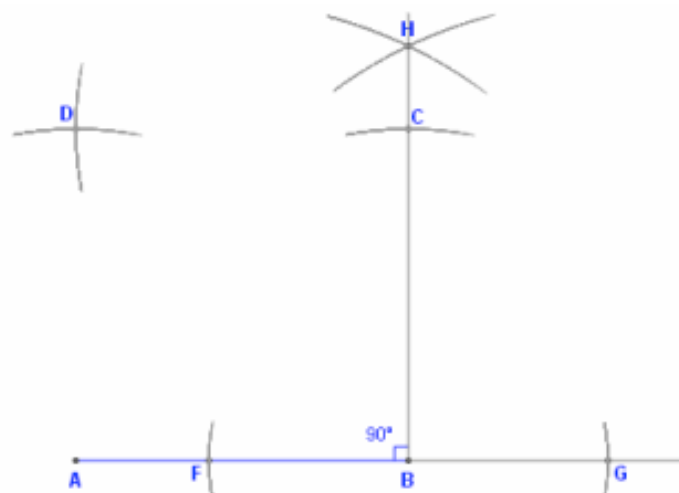


After doing this**Your work should look like this**

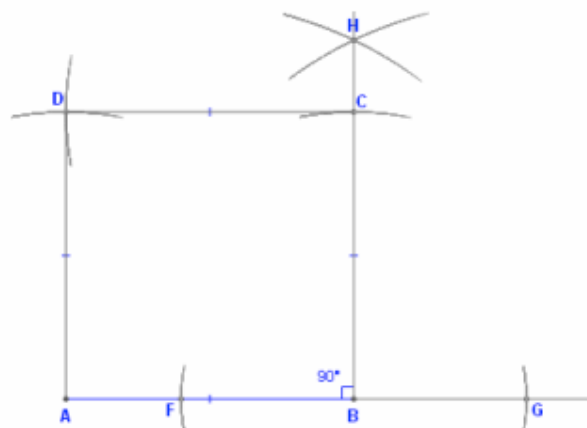
8. Without changing the width, move the compasses to point B. Draw an arc across BH creating point C - a vertex of the square.



9. Without changing the width, move the compasses to C. Draw an arc to the left of C across the exiting arc, creating point D - a vertex of the square.

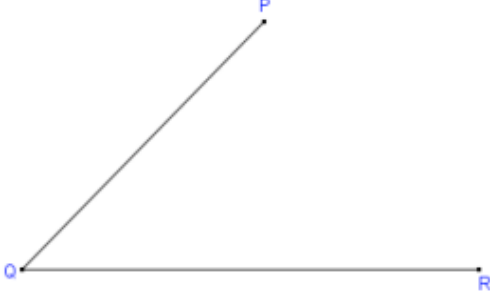

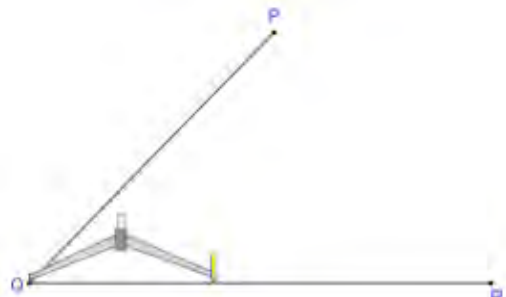
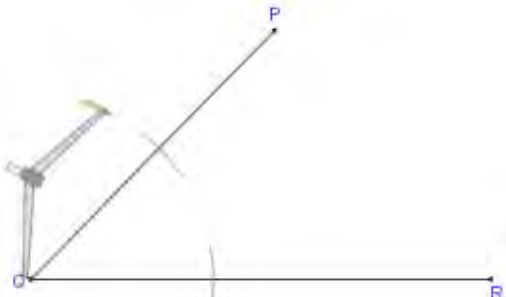



10. Draw the lines CD and AD



Done. ABCD is a square where each side has a length AB

Bisecting an Angle

After doing this	Your work should look like this
<p>Start with angle PQR that we will bisect.</p>	
<p>1. Place the compass point on the angle's vertex Q.</p>	
<p>2. Adjust the compass to a medium wide setting. The exact width is not important.</p>	
<p>3. Without changing the compass width, draw an arc across each leg of the angle.</p>	
<p>4. The compass width can be changed here if desired. Recommended: leave it the same.</p>	

After doing this

Your work should look like this

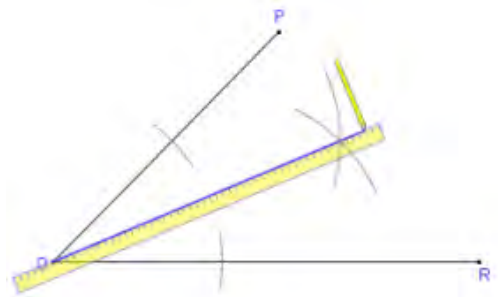
5. Place the compass on the point where one arc crosses a leg and draw an arc in the interior of the angle.



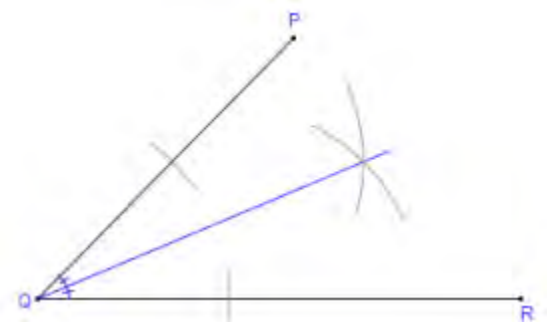
6. Without changing the compass setting repeat for the other leg so that the two arcs cross.







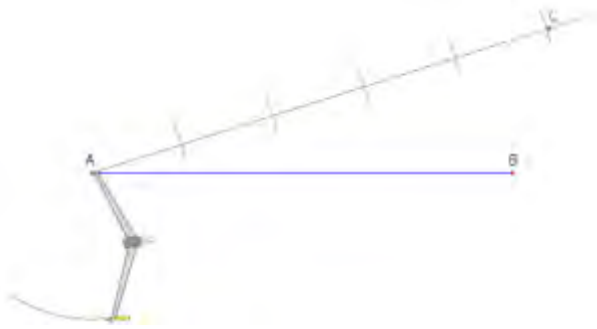
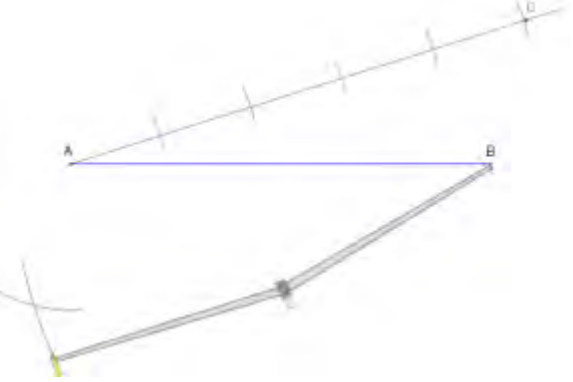
7. Using a straightedge or ruler, draw a line from the vertex to the point where the arcs cross.

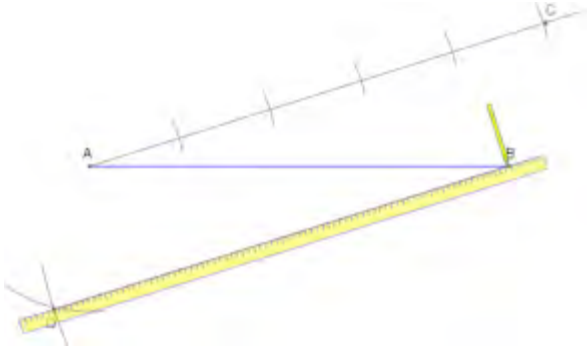
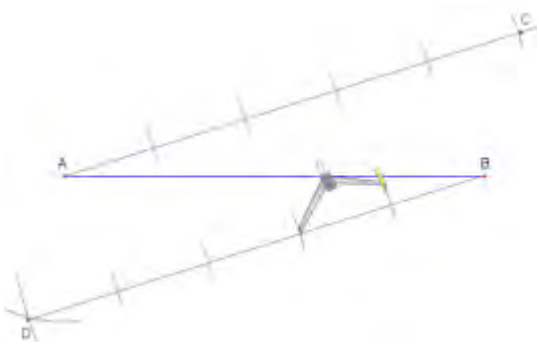
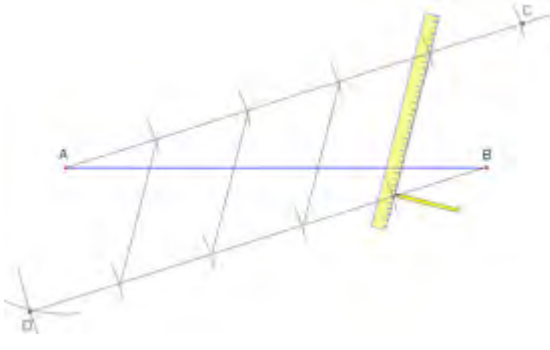
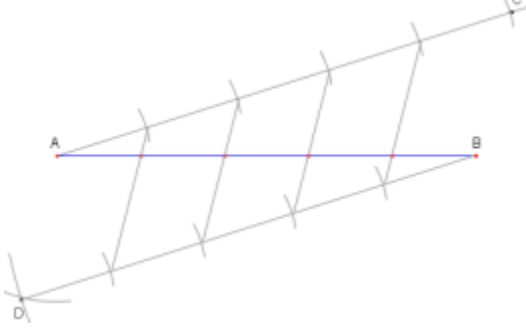


Done. This is the bisector of the angle $\angle PQR$.


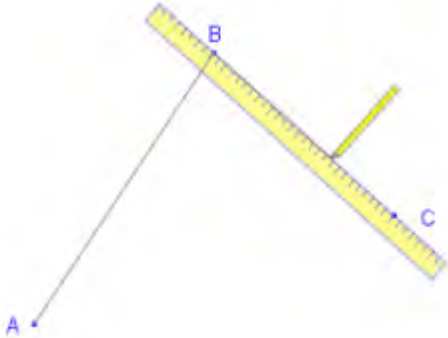
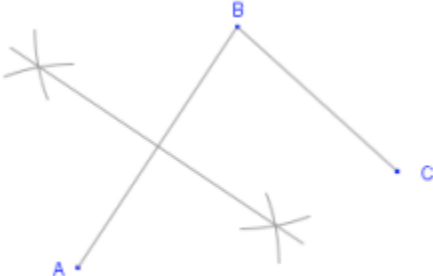
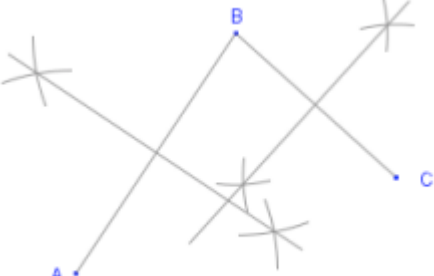


Dividing a Line into Equal Parts

	After doing this	Your work should look like this
	Start with a line segment AB that we will divide up into 5 (in this case) equal parts.	
Step 1	From point A, draw a line segment at an angle to the given line, and about the same length. The exact length is not important.	
Step 2	Set the compass on A, and set its width to a bit less than one fifth of the length of the new line.	
Step 3	Step the compass along the line, marking off 5 arcs. Label the last one C.	
Step 4	With the compass width set to CB, draw an arc from A just below it.	
Step 5	With the compass width set to AC, draw an arc from B crossing the one drawn in step 4. This intersection is point D.	

	After doing this	Your work should look like this
Step 6	Draw a line from D to B.	
Step 7	Using the same compass width as used to step along AC, step the compass from D along DB making 4 new arcs across the line	
Step 8	Draw lines between the corresponding points along AC and DB.	
Step 9	Done. The lines divide the given line segment AB in to 5 congruent parts.	

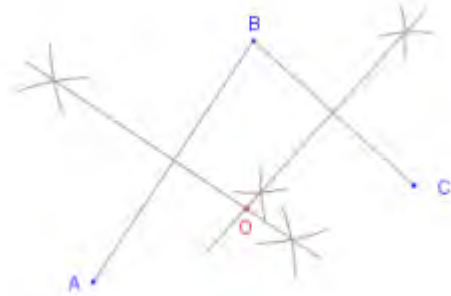
A Circle through 3 Random Points

After doing this	Your work should look like this
<p>We start with three given points. We will construct a circle that passes through all three.</p>	 <p>A diagram showing three points labeled A, B, and C. Point B is at the top, A is at the bottom left, and C is at the bottom right.</p>
<p>1. (Optional*) Draw straight lines to create the line segments AB and BC. Any two pairs of the points will work.</p> <p><i>* We draw the two lines to make it clear when we later draw their perpendicular bisectors, but it is not strictly necessary for them to actually be there to do this.</i></p>	 <p>A diagram showing line segments AB and BC drawn. A yellow ruler is used to draw segment BC, and a yellow pencil is shown drawing segment AB.</p>
<p>2. Find the perpendicular bisector of one of the lines. See Constructing the Perpendicular Bisector of a Line Segment.</p>	 <p>A diagram showing the perpendicular bisector of segment BC. The bisector is a line that passes through the midpoint of BC and is perpendicular to it. The construction is shown with two sets of intersecting arcs centered at B and C.</p>
<p>3. Repeat for the other line.</p>	 <p>A diagram showing the perpendicular bisectors of both segments AB and BC. The bisector of AB is also shown, intersecting the bisector of BC at a point, which is the center of the circle passing through A, B, and C.</p>

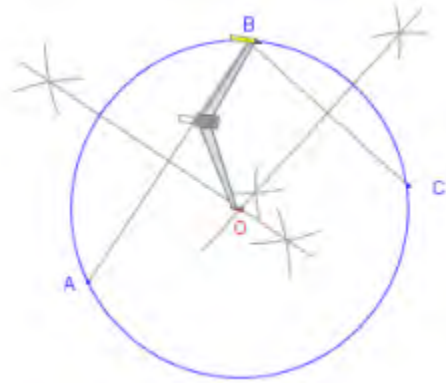
After doing this

Your work should look like this

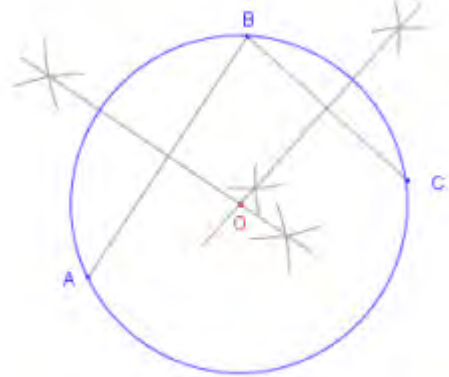
4. The point where these two perpendiculars intersect is the center of the circle we desire.




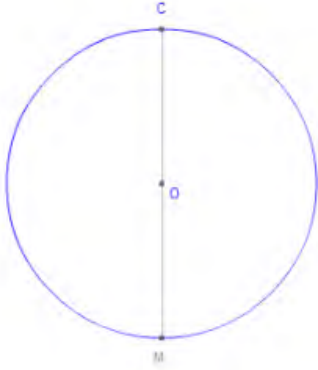
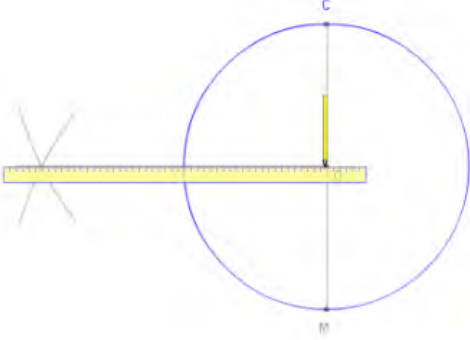
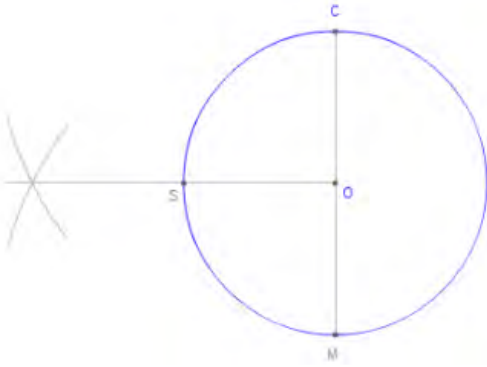
5. Place the compass point on the intersection of the perpendiculars and set the compass width to one of the points A,B or C. Draw a circle that will pass through all three.



6. Done. The circle drawn is the only circle that will pass through all three points.



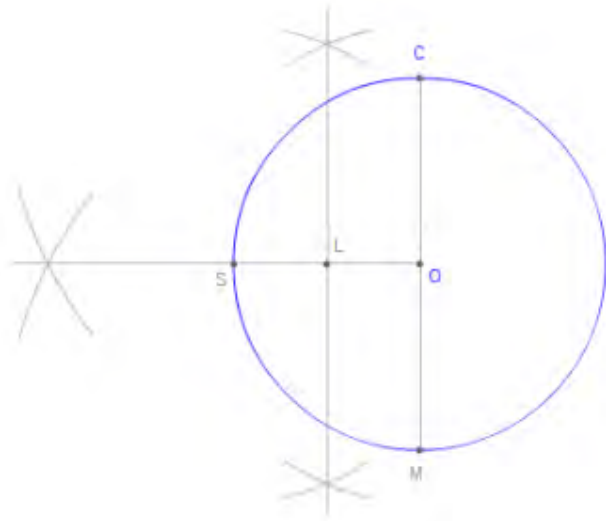
Inscribed Pentagon

After doing this	Your work should look like this
<p>We start with the given circle, center O.</p>	 A blue circle with a central point labeled 'O'.
<p>1. Draw a diameter of the circle through the center point and mark its endpoints C and M. It does not have to be vertical.</p>	 A blue circle with a vertical diameter line passing through center 'O'. The top endpoint is labeled 'C' and the bottom endpoint is labeled 'M'.
<p>2. Construct a perpendicular to CM at the point O.</p>	 A blue circle with a vertical diameter line passing through center 'O'. The top endpoint is labeled 'C' and the bottom endpoint is labeled 'M'. A horizontal line passes through 'O', perpendicular to the diameter. A yellow ruler is placed horizontally across the circle, and a compass is shown on the left side of the ruler, indicating the construction of the perpendicular line.
<p>3. Mark the point S where it crosses the circle.</p>	 A blue circle with a vertical diameter line passing through center 'O'. The top endpoint is labeled 'C' and the bottom endpoint is labeled 'M'. A horizontal line passes through 'O', perpendicular to the diameter. The intersection point of the horizontal line and the circle on the left side is labeled 'S'. A compass is shown on the left side of the circle, indicating the construction of the perpendicular line.

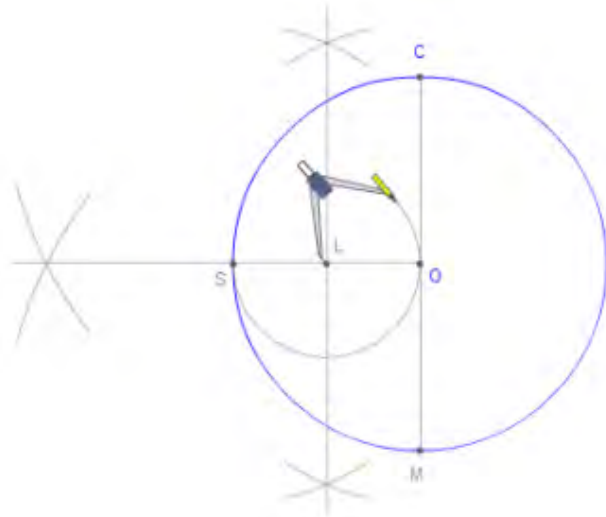
After doing this

Your work should look like this

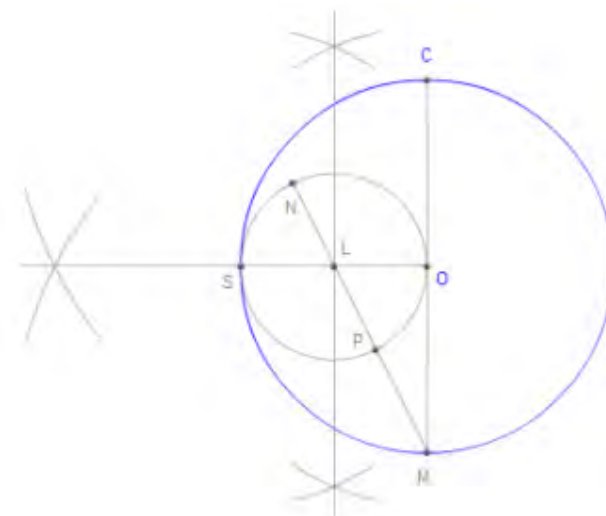
4. Find the midpoint L of the segment SO by constructing its perpendicular bisector.



5. Set the compass on L, adjust its width to S or O, and draw a circle.



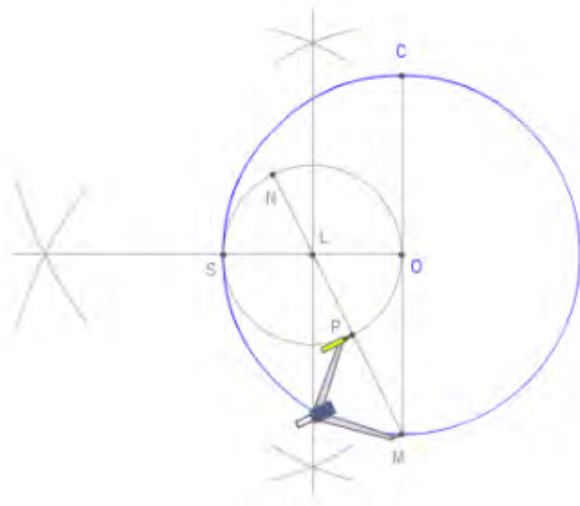
6. Draw a line from M, through L so it crosses the small circle in two places. Label them N and P.



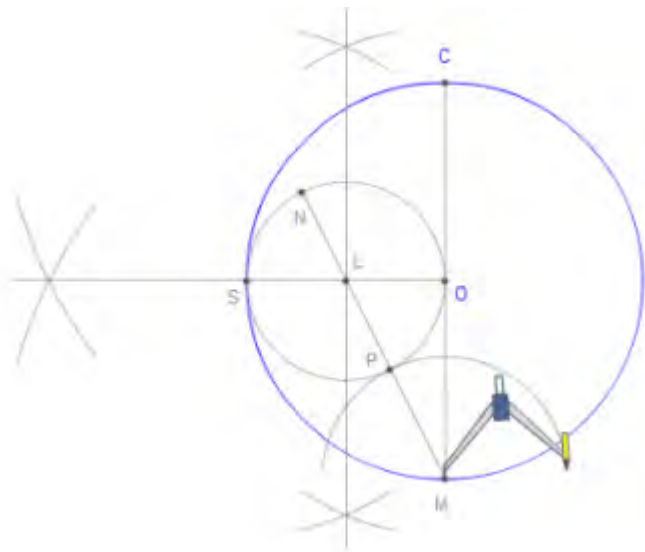
After doing this

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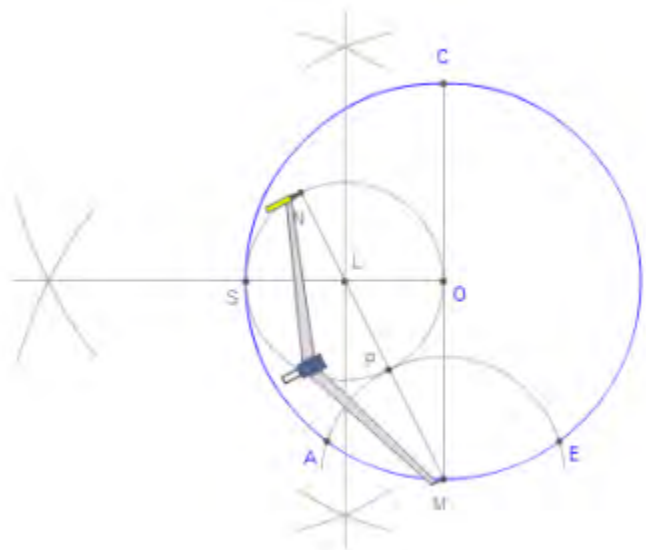
7. Set the compass on M and adjust its width to P.



8. Draw a broad arc that crosses the given circle in two places. Label them A and E.



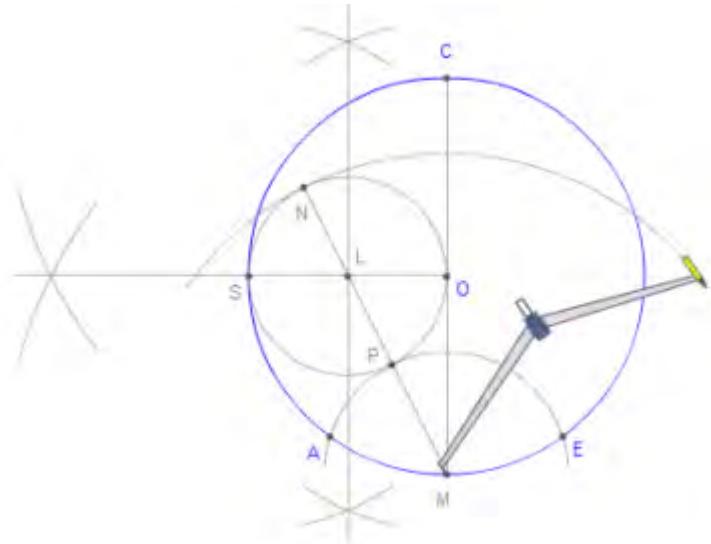
9. Set the compass on M and adjust its width to N.



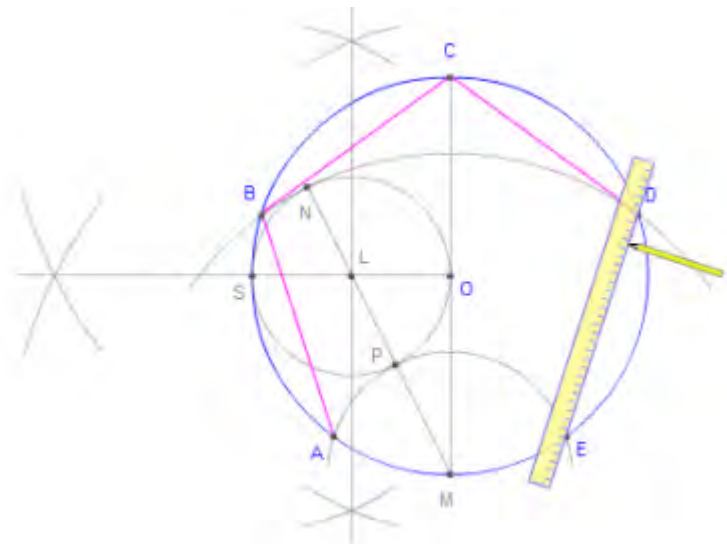
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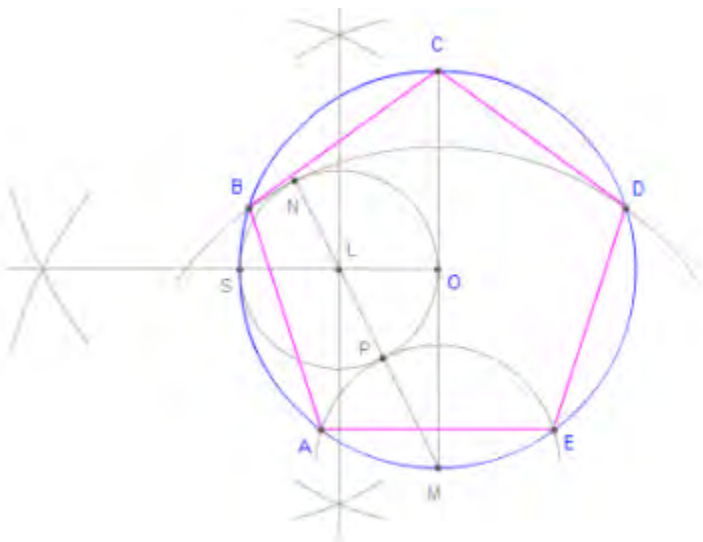
10. Draw a broad arc that crosses the given circle in two places. Label them B and D.



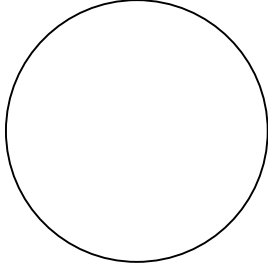
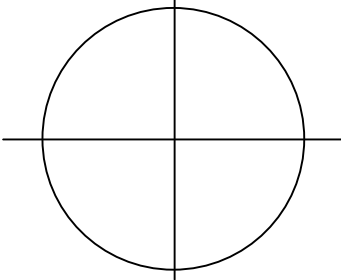
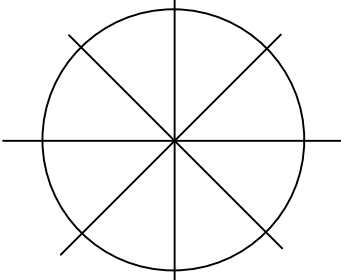
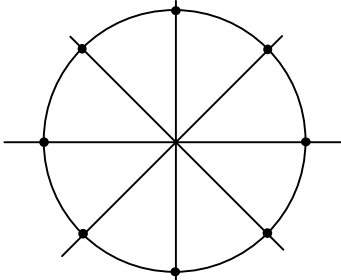
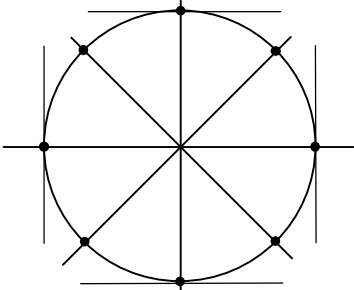
11. Draw a line from A to B, then B to C etc, until you have drawn all five sides of the pentagon.

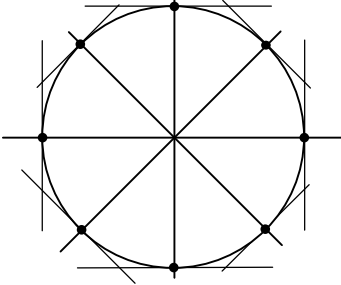
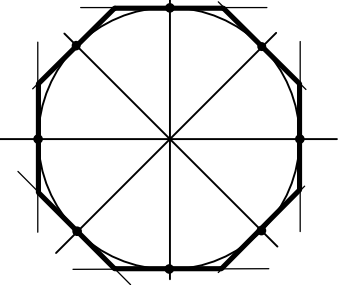


Done. ABCDE is a regular pentagon inscribed in the given circle.




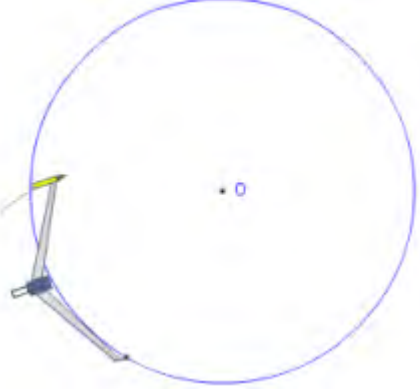


Circumscribed Octagon

After doing this	Your work should look like this
We start with a circle.	
1. Draw a vertical and horizontal diameters passing through the center of the circle.	
2. Draw diagonals passing through the center of the circle with your 45° triangle.	
3. Mark the points the line segments intersect the circumference of the circle.	
4. Draw light horizontal tangent lines through the endpoints of the vertical diameter and light vertical tangent lines through the endpoints of the horizontal diameter.	

After doing this	Your work should look like this
<p>5. Draw light diagonal tangents passing through the remaining points with your 45° triangle.</p>	
<p>Done. Bolden the octagon surrounding the circle and it is complete.</p>	

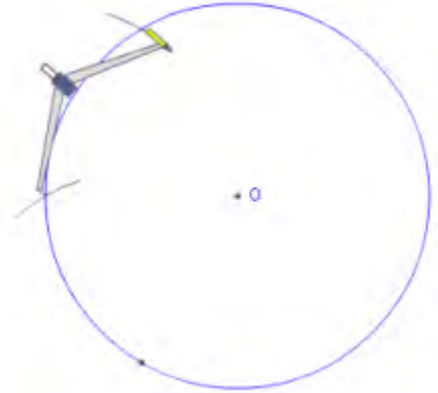
Inscribed Hexagon

After doing this	Your work should look like this
<p>We start with the given circle, center O.</p>	 A diagram of a circle with a center point labeled 'O'.
<p>1. Mark a point anywhere on the circle. This will be the first vertex of the hexagon.</p>	 A diagram of a circle with center 'O'. A small black dot is marked on the lower-left part of the circle's circumference.
<p>2. Set the compass on this point and set the width of the compass to the center of the circle. The compass is now set to the radius of the circle.</p>	 A diagram of a circle with center 'O'. A compass is shown with its point on the marked point on the circle and its pencil tip at the center 'O'. The compass is set to the radius of the circle.
<p>3. Make an arc across the circle. This will be the next vertex of the hexagon.</p>	 A diagram of a circle with center 'O'. A compass is shown with its point on the marked point on the circle and its pencil tip at the center 'O'. An arc has been drawn across the circle, intersecting the circumference at a second point.

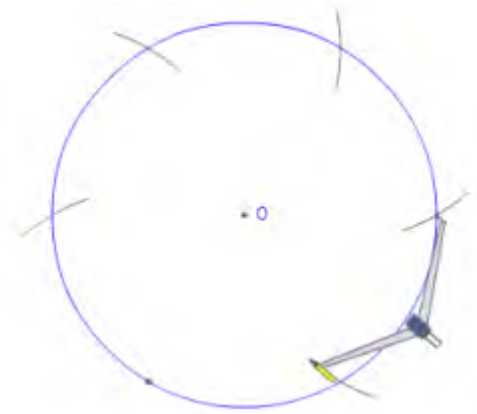
After doing this

Your work should look like this

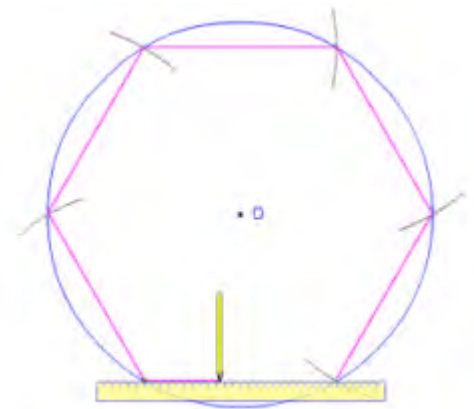
4. Move the compass on to the next vertex and draw another arc. This is the third vertex of the hexagon.



5. Continue in this way until you have all six vertices.

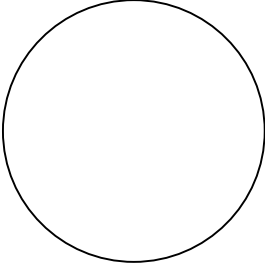
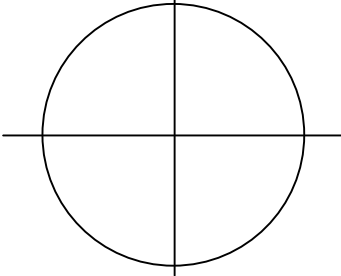
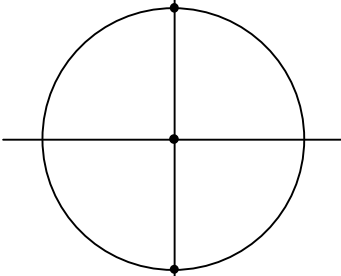
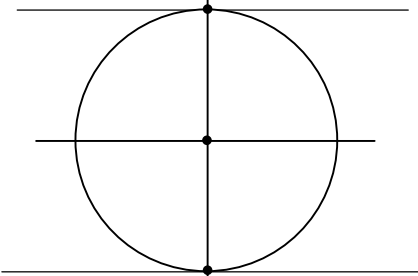
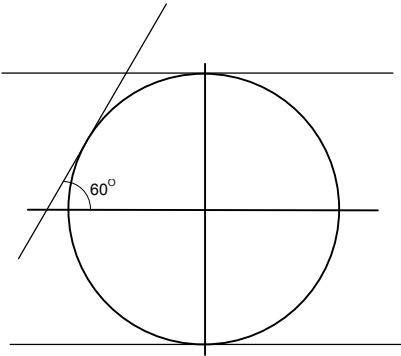


6. Draw a line between each successive pairs of vertices, for a total of six lines.



6. Done. These lines form a regular hexagon inscribed in the given circle.

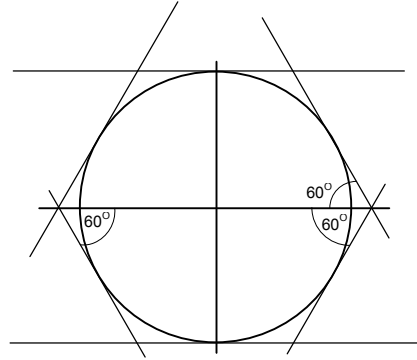
Circumscribed Hexagon

After doing this	Your work should look like this
<p>We start with a circle.</p>	
<p>1. Draw a vertical and horizontal diameters passing through the center of the circle.</p>	
<p>2. Mark the points where the vertical diameter passes through the center and circumference of the circle.</p>	
<p>3. Draw light horizontal tangent lines through the endpoints of the vertical diameter.</p>	
<p>4. Draw a light diagonal line using your 60° triangle such that it is tangent to the circumference at the top-left quadrant of the circle. Extend the line so that it intersects through the top horizontal line and middle horizontal line.</p>	

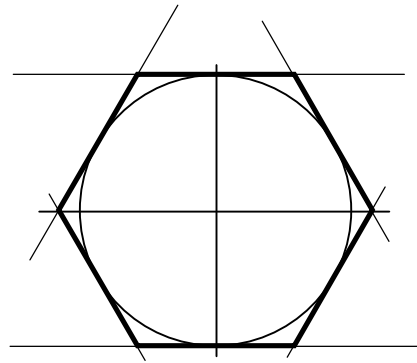
After doing this

Your work should look like this

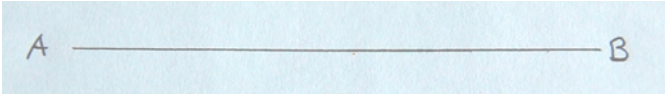
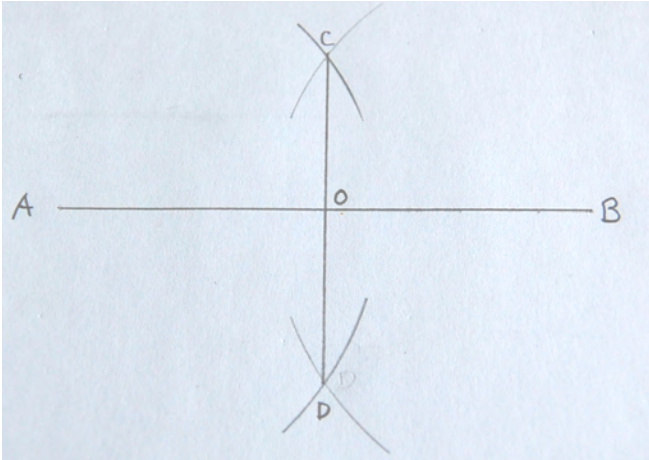
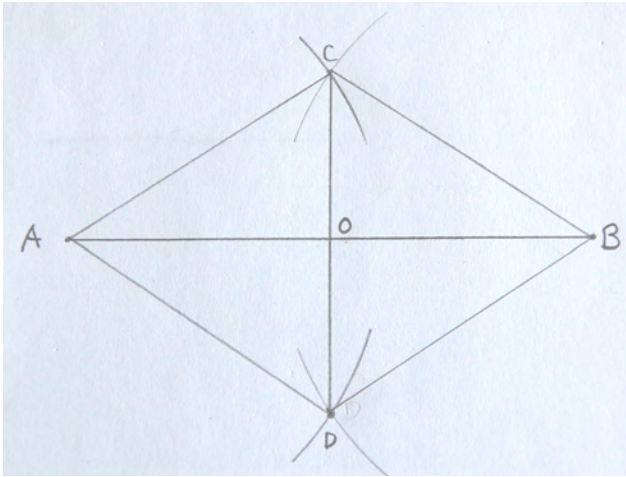
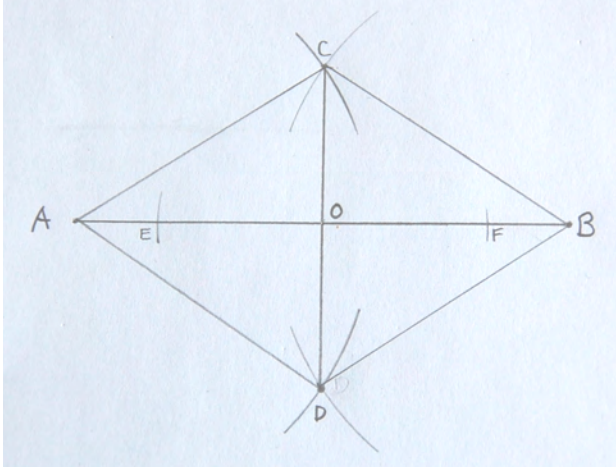
5. Repeat step 4 at the remaining quadrants of the circumference.



6. Bolden the hexagon and it is complete.



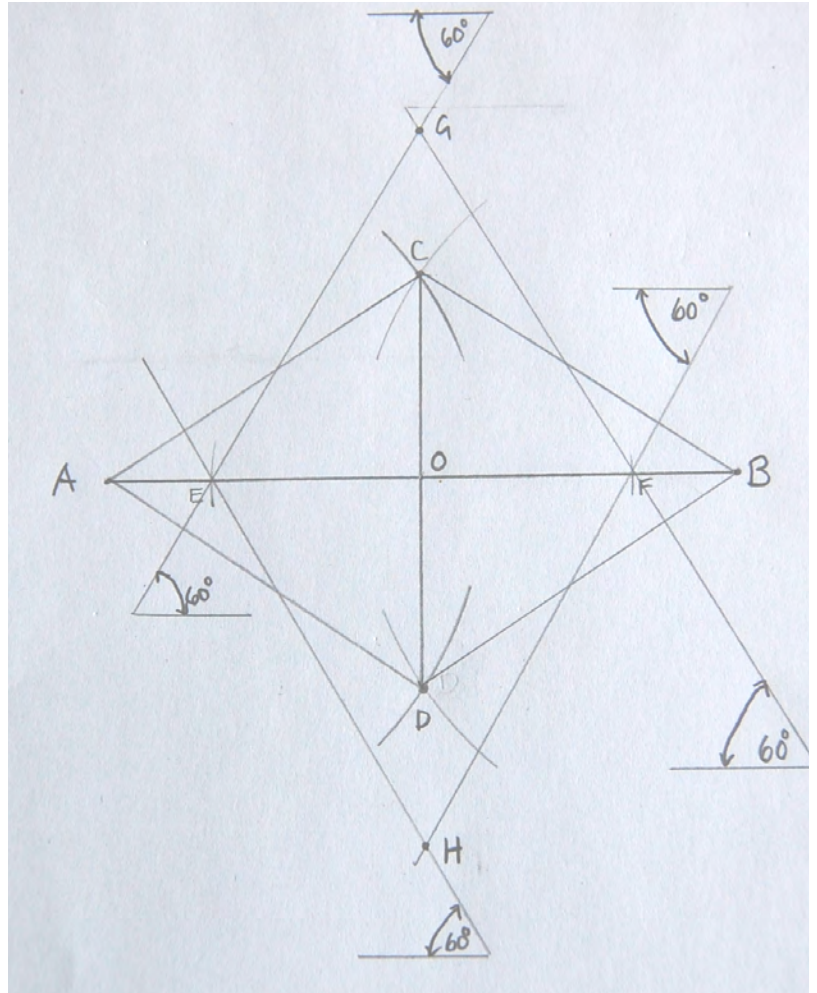
Constructing an Ellipse

After doing this	Your work should look like this
We start with a horizontal line, AB.	
1. Draw a perpendicular bisector CD through the horizontal line AB. The two lines intersect at point O. Connect AC, CB, BD, and DA.	
2. Connect AC, CB, BD, and DA.	
3. Adjust your compass to the width of CO. Place the compass point at O. Draw an arc through AO and OB. The intersection on the left is E and on the right, F.	

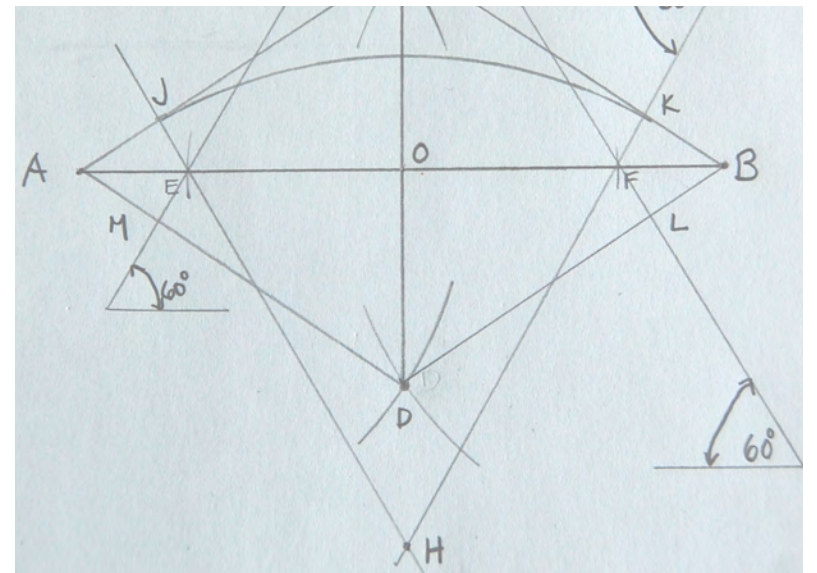
After doing this

Your work should look like this

4. Using your 30/60/90 triangle, draw 60° lines through points E and F. Be sure to extend the 60° lines beyond the parallelogram such that they intersect at G above and H below.



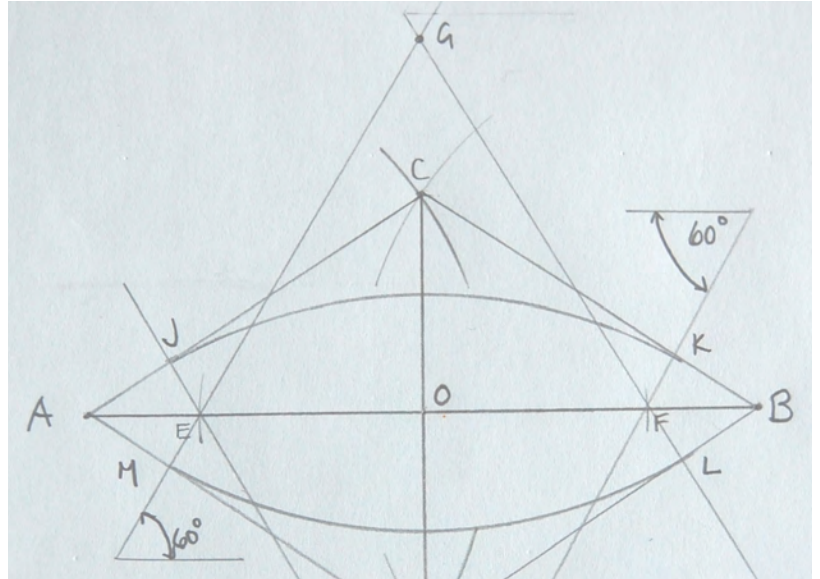
5. The 60° lines pass through the parallelogram through points J, K, L, and M. Adjust your compass to the width of HJ. Place the compass point at H and draw an arc from point J to point K to create the top portion of the ellipse.



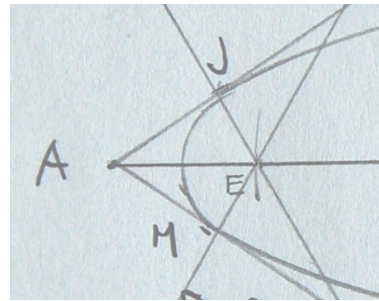
After doing this

Your work should look like this

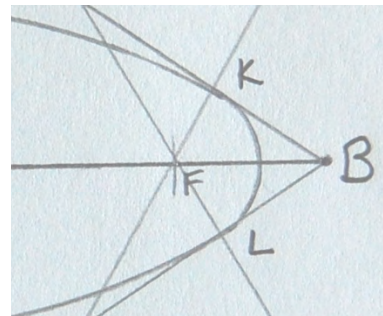
6. Repeat step 5. Adjust the compass width to GL (should be the same as HJ). Place the compass point at G and draw an arc from point L to point M to create the bottom part of the ellipse.



7. Adjust the compass width to EJ. Place the compass point at E and draw an arc from point M to point J.



8. Repeat step 7. Adjust the compass width to FK (should be the same as EJ). Place the compass point at F and draw an arc from point K to point L.



Done. Darken the outline of the ellipse.

