

2.2.5 Construction of Regular Pentagon

(a) Given Side

- Draw given side AB. (*Figure 2.16(a)*)
- With A and B as centers and radii as AB, draw circles which intersect each other at points C and D. (*Figure 2.16(b)*)
- With the same radius ($= AB$) and C as center, draw an arc which intersects the circles at points E and F. (*Figure 2.16(c)*)
- Join C and D with a straight line which intersects the arc EF at point G. (*Figure 2.16(d)*)
- Join E and G by with a straight line and extend it intersecting the circle at point H. Join F and G by with a straight line and extend it intersecting the circle at point I. (*Figure 2.16(e)*)

- Join H and B with a straight line and I and A also by a straight line. (Figure 2.16(e))
- Then, HB and IA are two other sides of the required pentagon. (Figure 2.16(f))
- Draw arcs with radii equal to AB and centers as H and I. Intersection of the arcs give the vertex J of the required pentagon. (Figure 2.16(g))
- Then ABHJI is the required pentagon.



Figure 2.16(a)

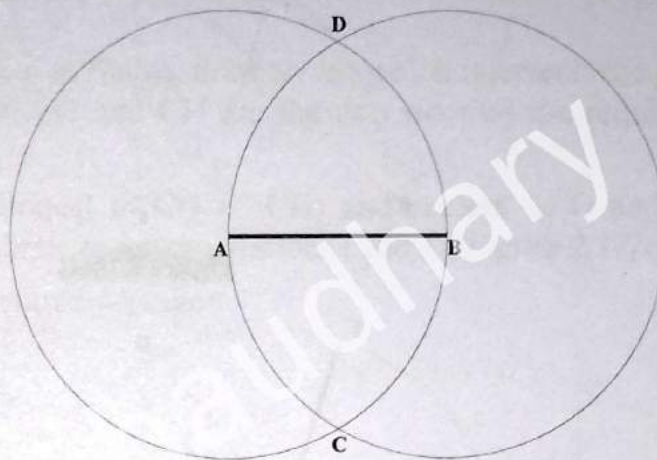


Figure 2.16(b)

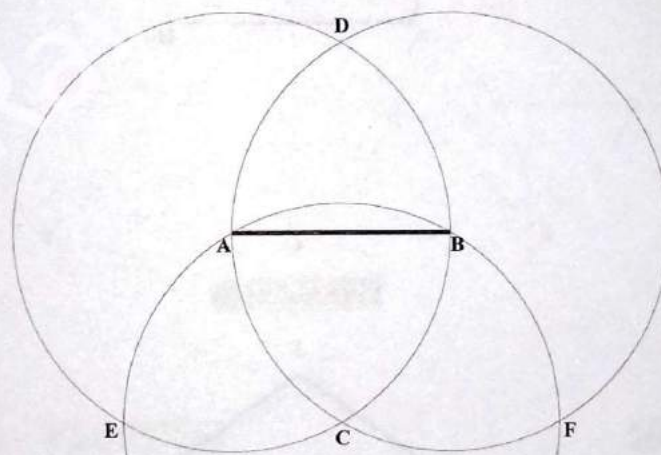


Figure 2.16(c)

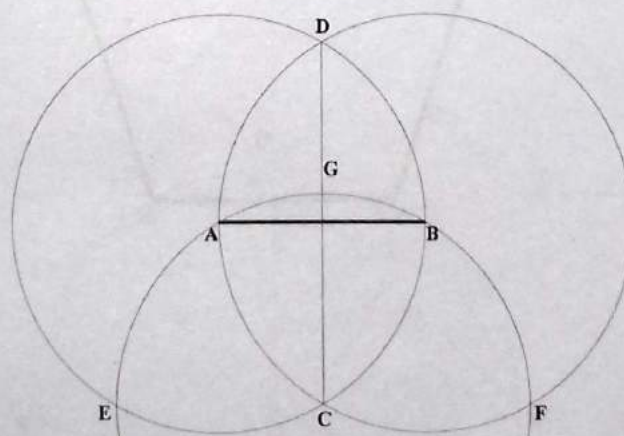


Figure 2.16(d)

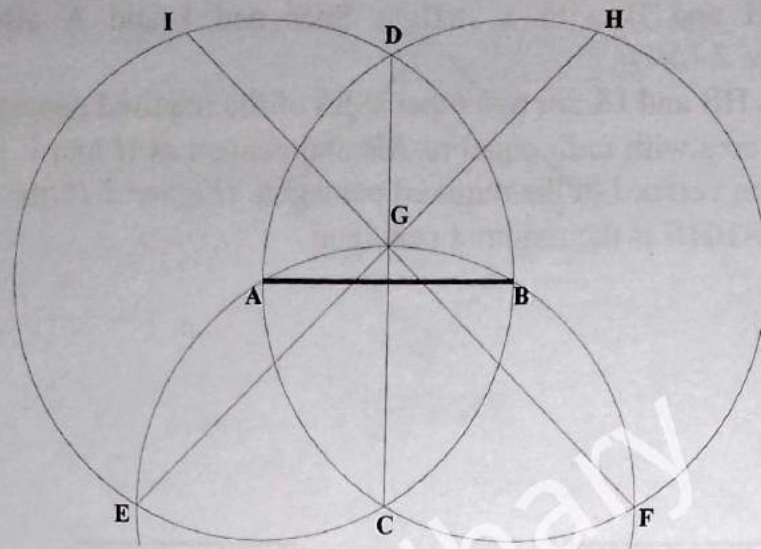


Figure 2.16(e)

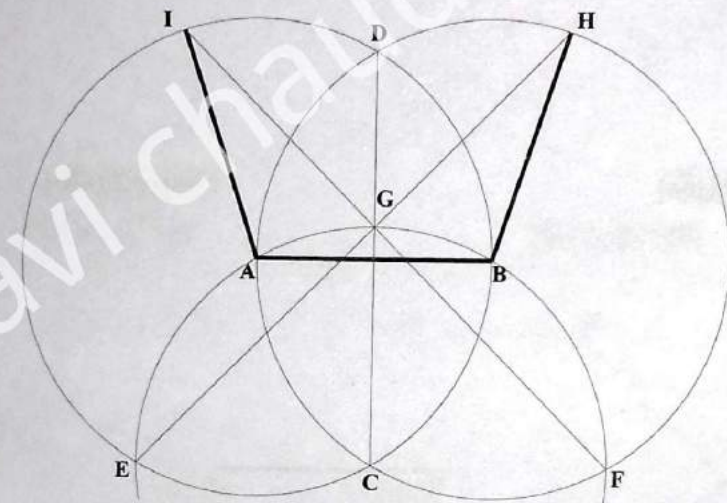


Figure 2.16(f)

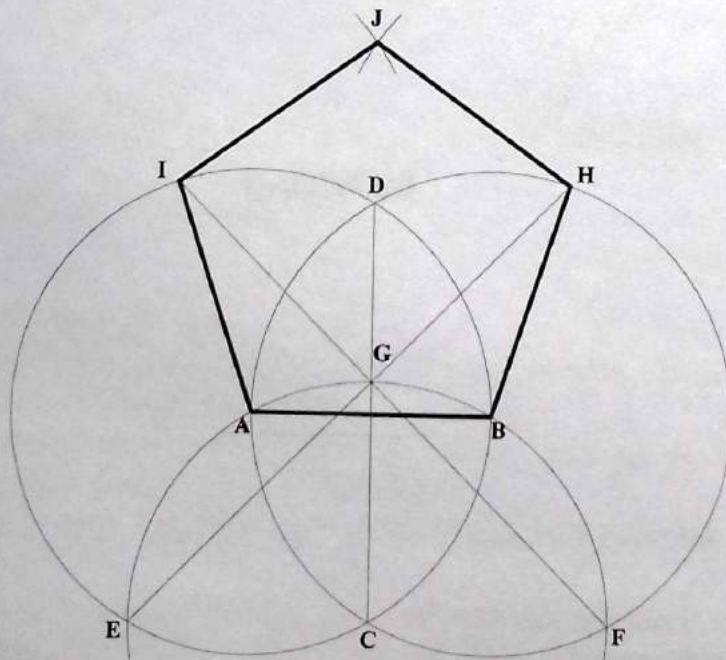


Figure 2.16(g)

(b) Given Circumscribing Circle

- Draw given circumscribing circle with O as its center. Draw its horizontal and vertical diameters AB and CD respectively. (Figure 2.17(a))
- Draw perpendicular bisector of OB and mark its midpoint as point E . (Figure 2.17(b))
- With E as center and EC as radius, draw an arc which intersects AO at point F . (Figure 2.17(c))
- With C as center and CF as radius, draw an arc which intersects the given circle at points G and H . Then CG and CH are the two sides of the required pentagon. (Figure 2.17(d))
- Draw arcs with radii equal to CG ($= CH$) and centers as G and H along the circumference of the circle to get the vertices I and J . (Figure 2.17(e))
- Then $CGIJH$ is the required pentagon.

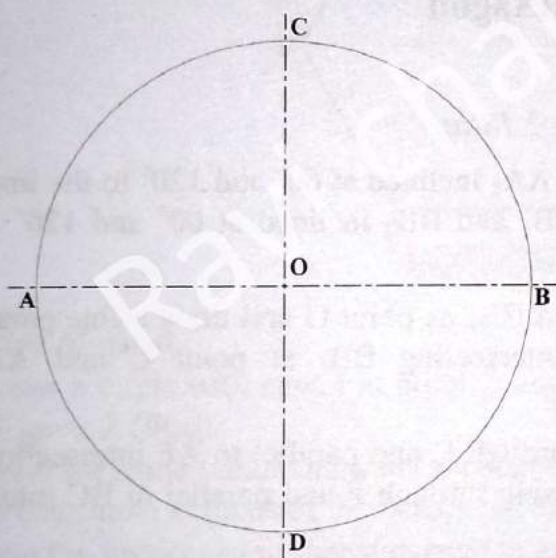


Figure 2.17(a)

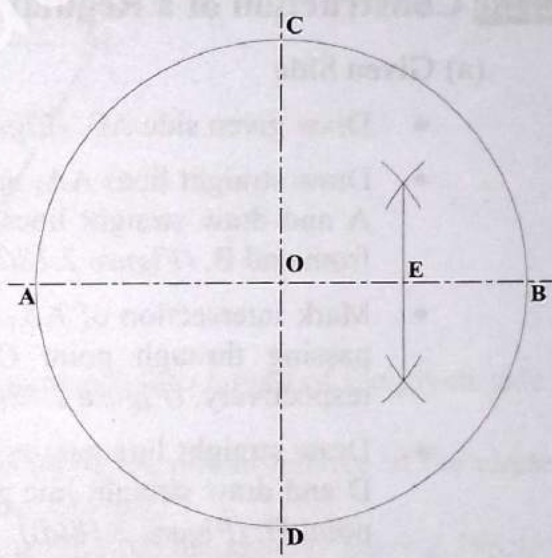


Figure 2.17(b)

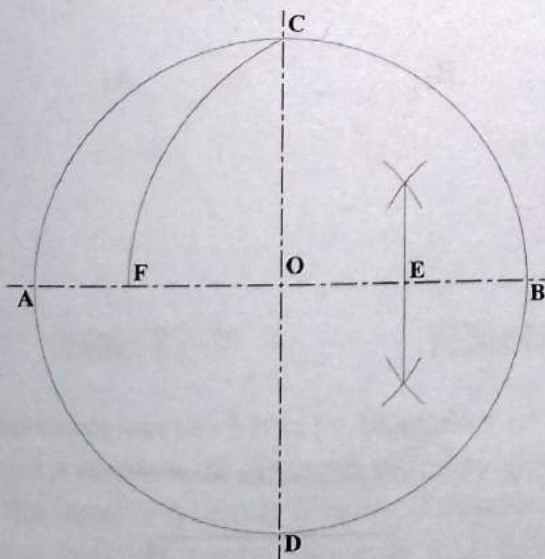


Figure 2.17(c)

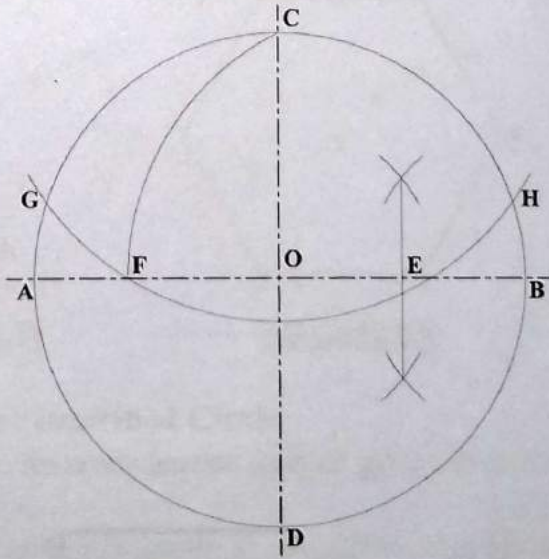


Figure 2.17(d)

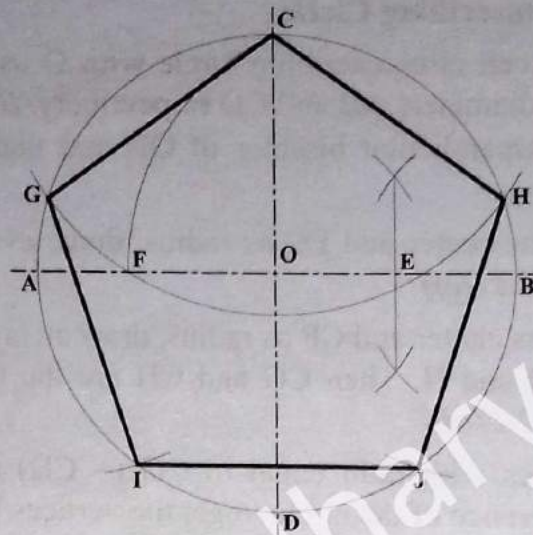


Figure 2.17(c)

2.2.6 Construction of a Regular Hexagon

(a) Given Side

- Draw given side AB. (Figure 2.18(a))
- Draw straight lines AA_1 and AA_2 inclined at 60° and 120° to the line AB from end A and draw straight lines BB_1 and BB_2 inclined at 60° and 120° to the line AB from end B. (Figure 2.18(b))
- Mark intersection of AA_1 and BB_2 as point O and draw a line parallel to AB and passing through point O intersecting BB_1 at point C and AA_2 at point F respectively. (Figure 2.18(c))
- Draw straight line passing through C and parallel to AF intersecting AA_1 at point D and draw straight line passing through F and parallel to BC intersecting BB_2 at point D. (Figure 2.18(d))
- Draw sides BC, CD, DE, EF and FA to get the required hexagon. (Figure 2.18(e))

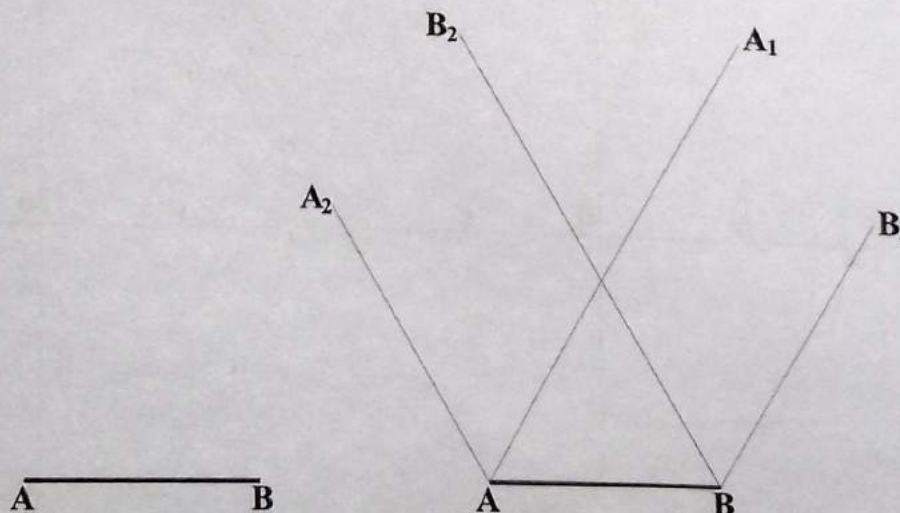
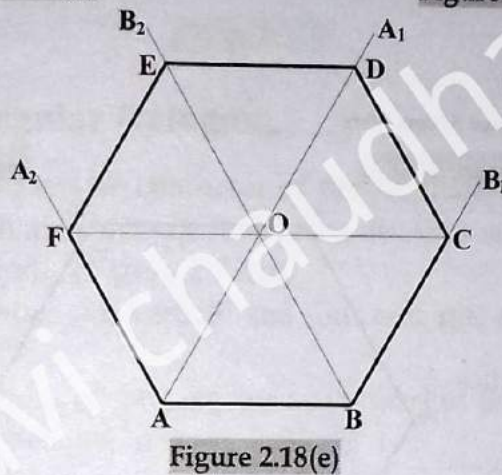
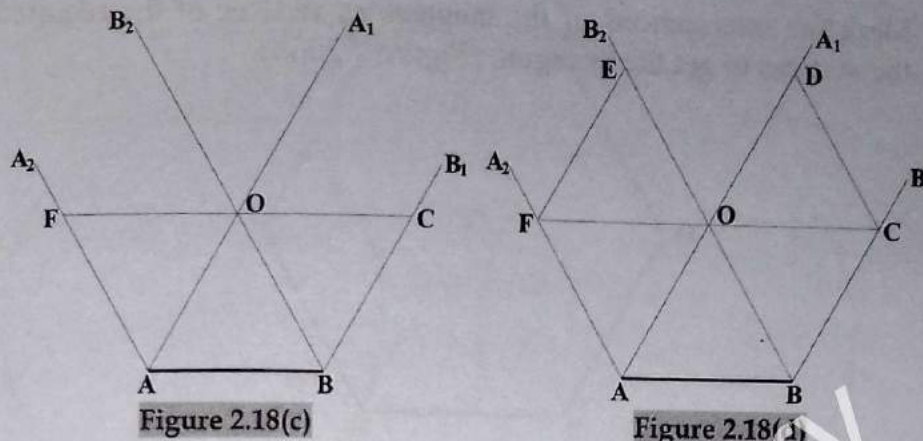


Figure 2.18(a)

Figure 2.18(b)



Alternative Method

- Draw a circle with center at point O and radius equal to length of the given side. (Figure 2.19(a))
- With the same radius mark off six segments along the circumference of the circle to determine vertices of the hexagon. (Figure 2.19(b))
- Join the vertices in proper sequence to get the required hexagon. (Figure 2.19(c))

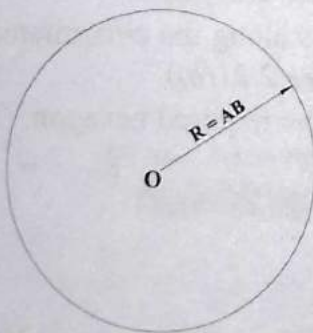


Figure 2.19(a)

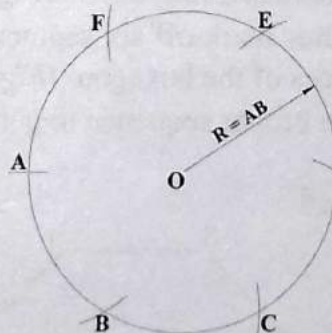


Figure 2.19(b)

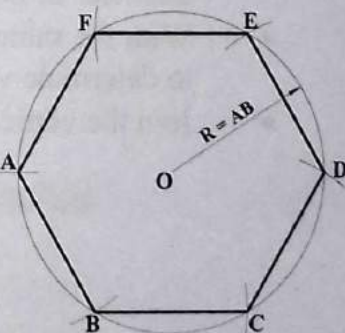


Figure 2.19(c)

(b) Given Distance across Flats or Diameter of the Inscribed Circle

- Draw a circle with diameter equal to given distance across flats or given diameter of the inscribed circle. (Figure 2.20(a))
- Draw two horizontal tangents and four tangents inclined at 60° to the circle. (Figure 2.20(b))

- Mark the intersections of the tangents as vertices of the required hexagon. Join the vertices to get the hexagon. (Figure 2.20(c))

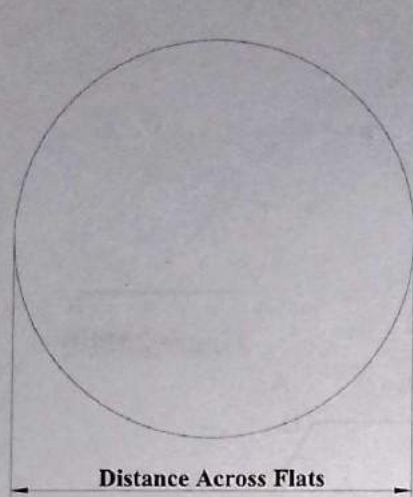


Figure 2.20(a)



Figure 2.20(b)

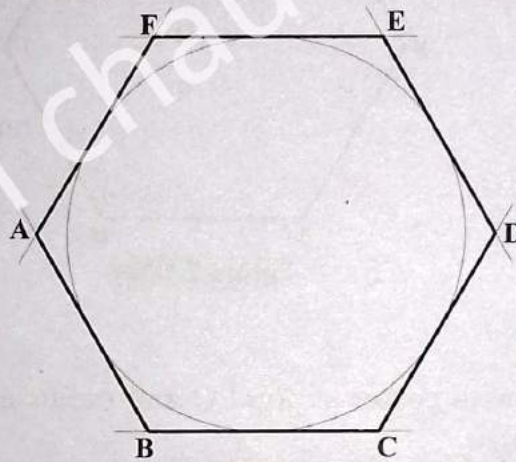


Figure 2.20(c)

(c) Given Distance across Corners or Diameter of the Circumscribing Circle

- Draw a circle with diameter equal to given distance across corners or given diameter of the circumscribing circle. (Figure 2.21(a))
- With the same radius mark off six segments along the circumference of the circle to determine vertices of the hexagon. (Figure 2.21(b))
- Join the vertices in proper sequence to get the required hexagon. (Figure 2.21(c))

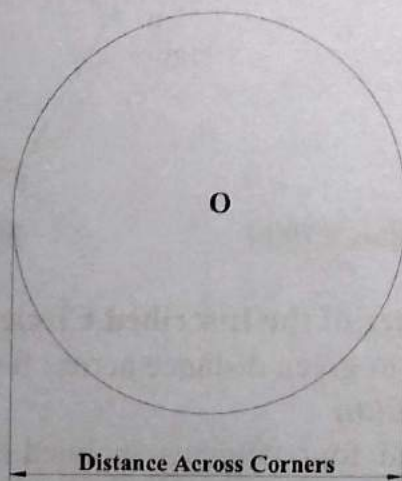


Figure 2.21(a)

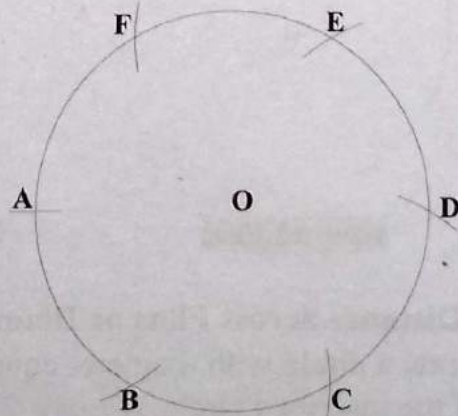


Figure 2.21(b)

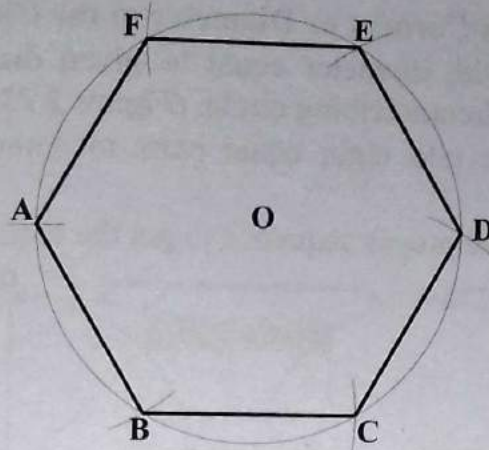


Figure 2.21(c)

2.2.7 Construction of a Regular Octagon

(a) Given Distance across Flats or Diameter of the Inscribed Circle

- Draw a circle with diameter equal to given distance across flats or given diameter of the inscribed circle. (Figure 2.22(a))
- Draw two horizontal, two vertical and four tangents inclined at 45° to the circle. (Figure 2.22(b))
- Mark the intersections of the tangents as vertices of the required octagon. Join the vertices to get the octagon. (Figure 2.22(c))

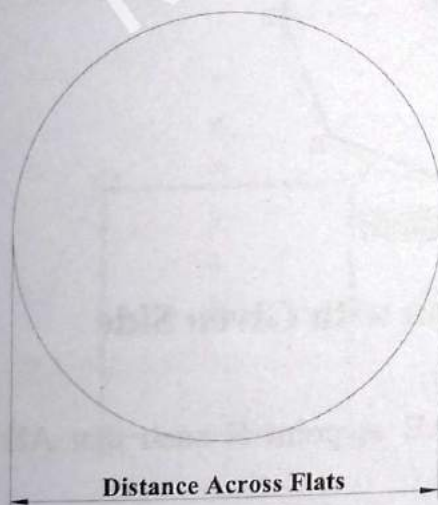


Figure 2.22(a)

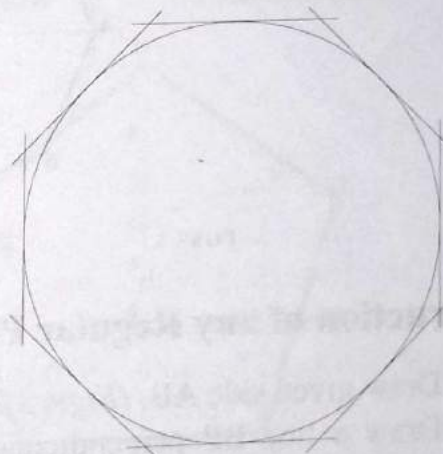


Figure 2.22(b)

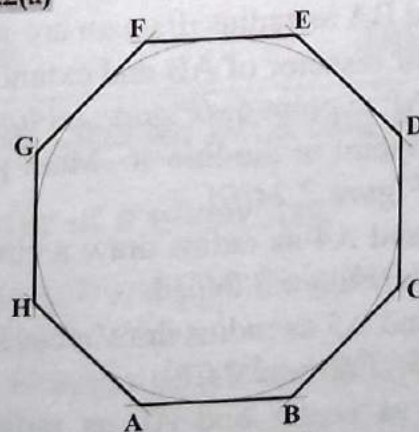


Figure 2.22(c)

(b) Given Distance across Corners or Diameter of the Circumscribing Circle

- Draw a circle with diameter equal to given distance across corners or given diameter of the circumscribing circle. (Figure 2.23(a))
- Divide the circle into eight equal parts to determine vertices of the octagon. (Figure 2.23(b))
- Join the vertices in proper sequence to get the required octagon. (Figure 2.23(c))

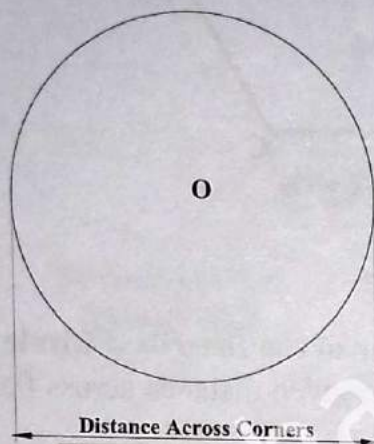


Figure 2.23(a)

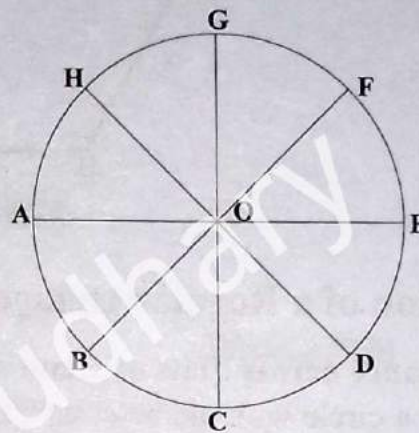


Figure 2.23(b)

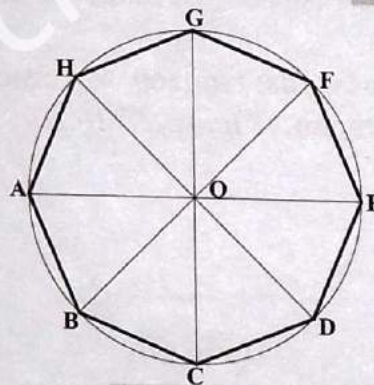


Figure 2.23(c)

2.2.8 Construction of any Regular Polygon with Given Side

- Draw given side AB. (Figure 2.24(a))
- Draw a line BP perpendicular to AB at point B such that $AB = BP$. (Figure 2.24(b))
- Join A and P with a straight line. (Figure 2.24(c))
- With B as center and BA as radius draw an arc AP. (Figure 2.24(d))
- Draw a perpendicular bisector of AB and extend it which intersects the line AP at point 4 and the arc AP at point 6. (Figure 2.24(e))
- Mark point 5 as midpoint of the line 46. Mark points 7, 8, 9, such that $56 = 67 = 78 = 89$ (Figure 2.24(f))
- With 4 as a center and A4 as radius draw a circle, in which a square with a side AB can be inscribed. (Figure 2.24(g))
- With 5 as a center and A5 as radius draw a circle, in which a pentagon with a side AB can be inscribed. (Figure 2.24(h))
- Similarly, using 6 as center and A6 as radius a circle inscribing a required hexagon can be drawn and so on.

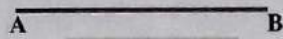


Figure 2.24(a)

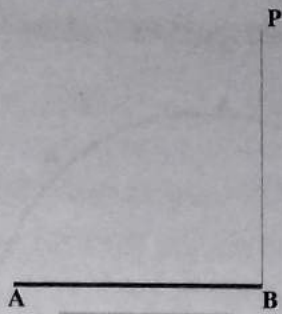


Figure 2.24(b)

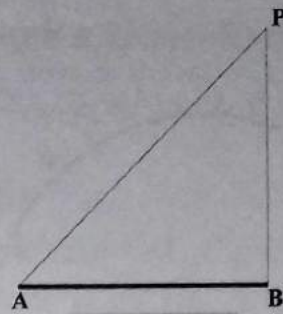


Figure 2.24(c)

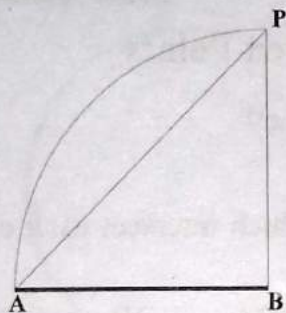


Figure 2.24(d)

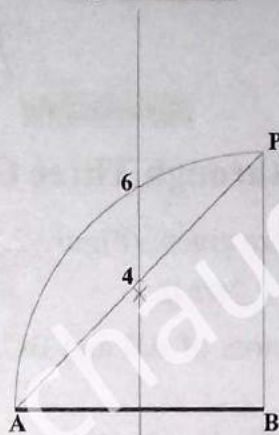


Figure 2.24(e)

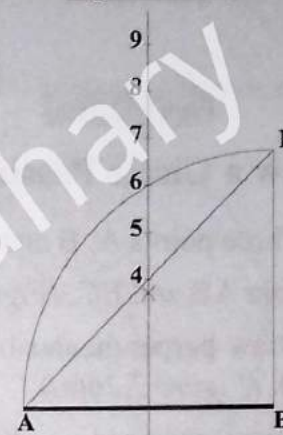


Figure 2.24(f)

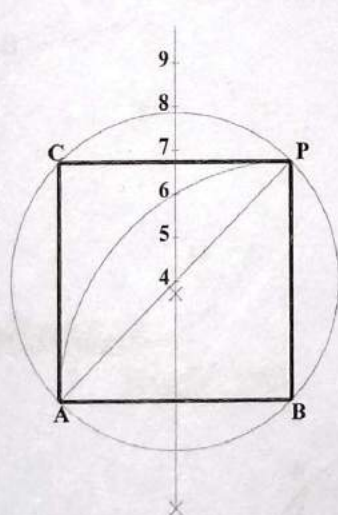


Figure 2.24(g)

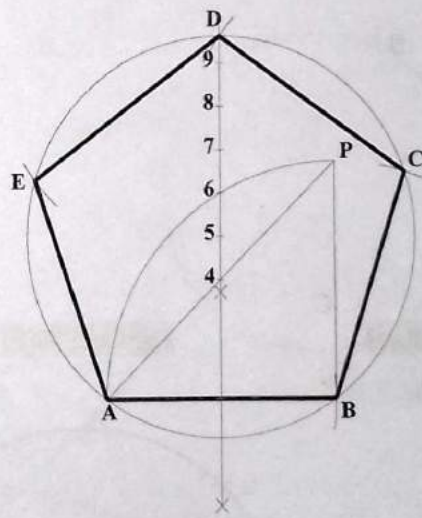


Figure 2.24(h)