**(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.

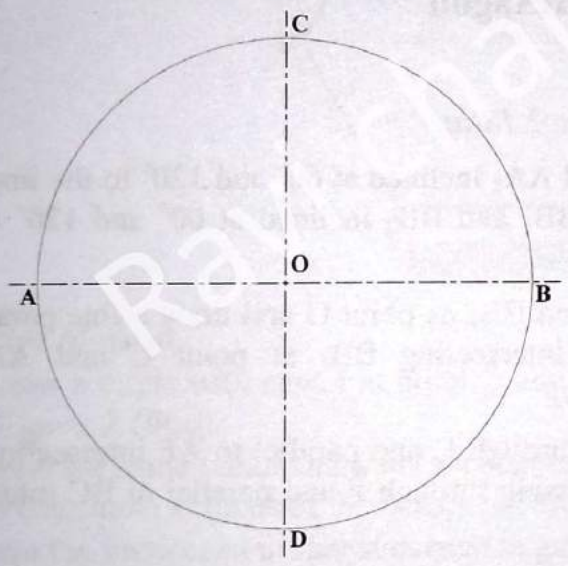


Figure 2.17(a)

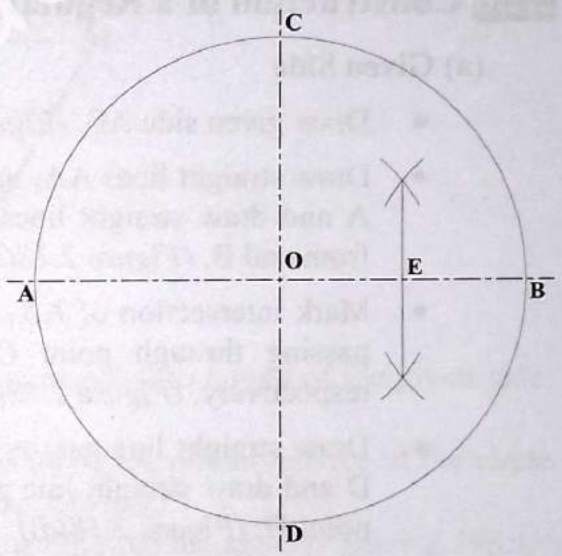


Figure 2.17(b)

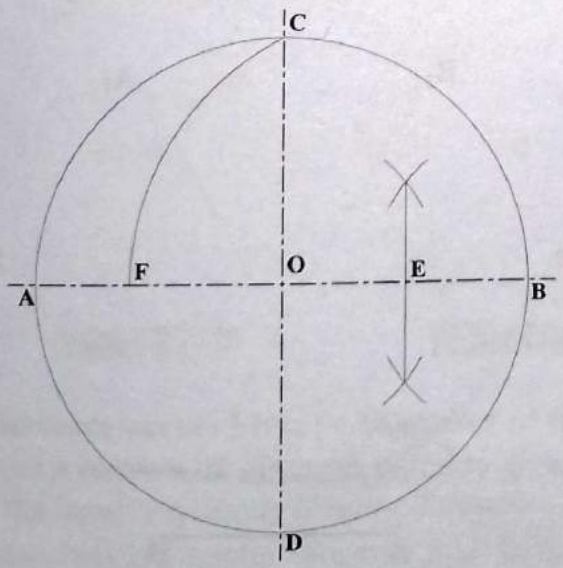


Figure 2.17(c)

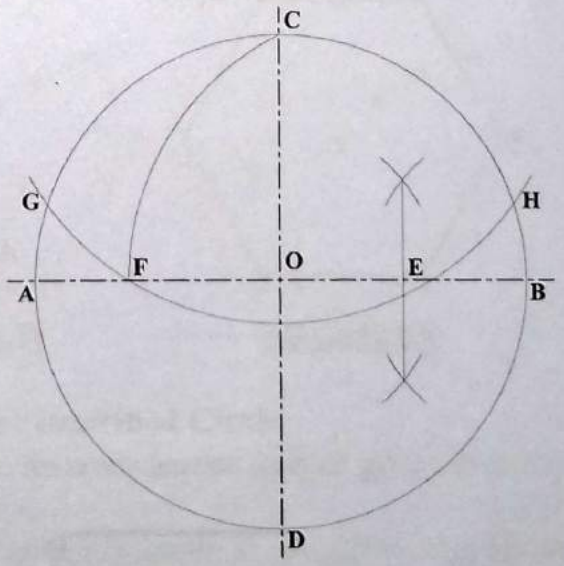


Figure 2.17(d)

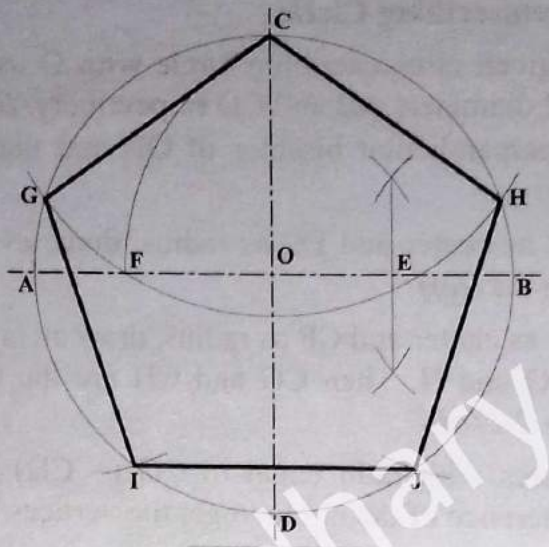


Figure 2.17(e)

## 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))*

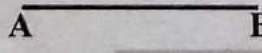


Figure 2.18(a)

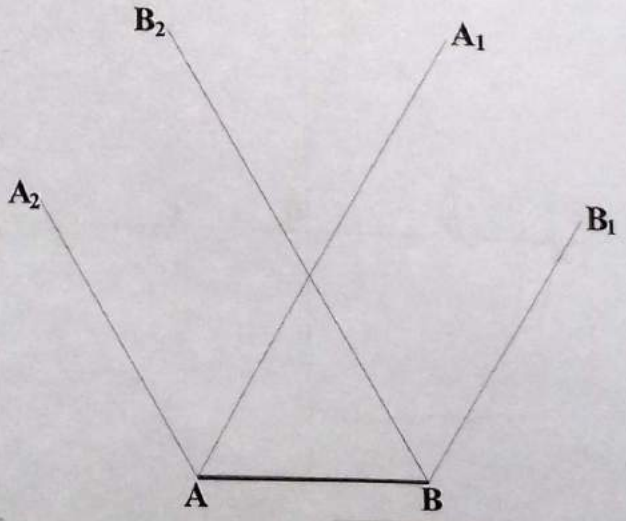


Figure 2.18(b)

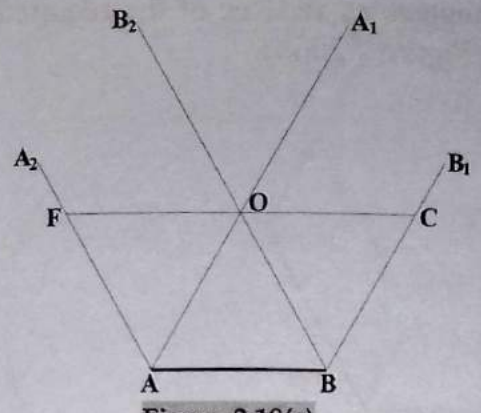


Figure 2.18(c)

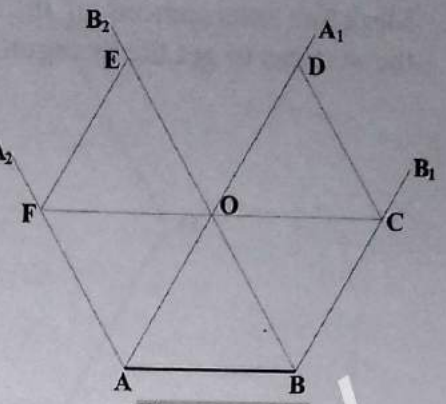


Figure 2.18(d)

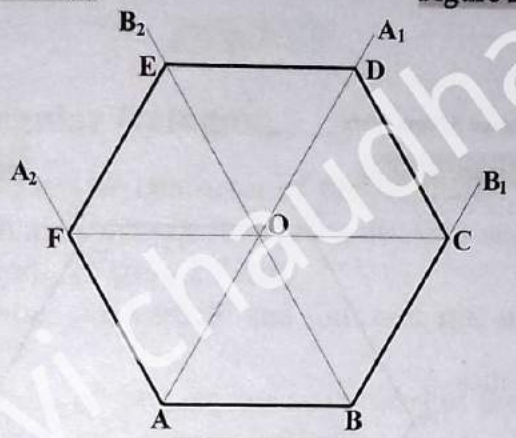


Figure 2.18(e)



**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))*

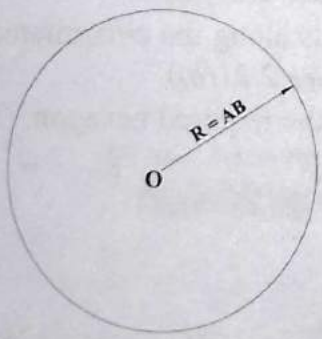


Figure 2.19(a)

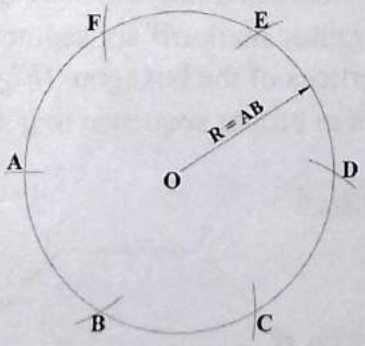


Figure 2.19(b)

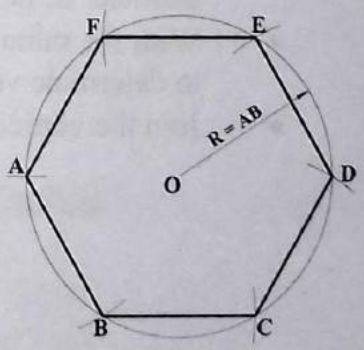


Figure 2.19(c)

**(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 $60^0$ 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))*

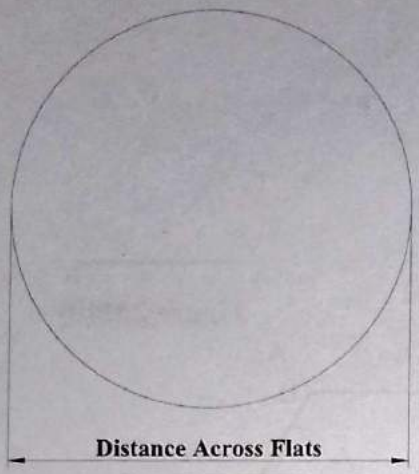


Figure 2.20(a)

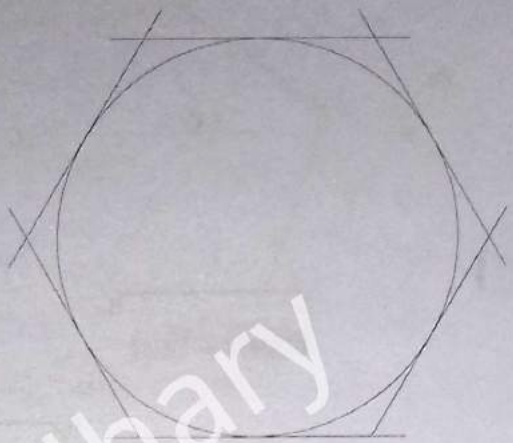

Figure 2.20(b)

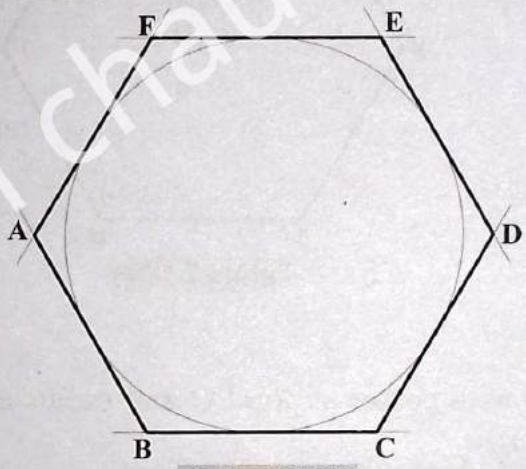


Figure 2.20(c)



**(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))*

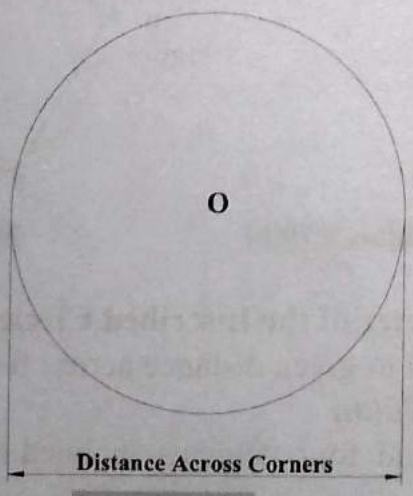


Figure 2.21(a)

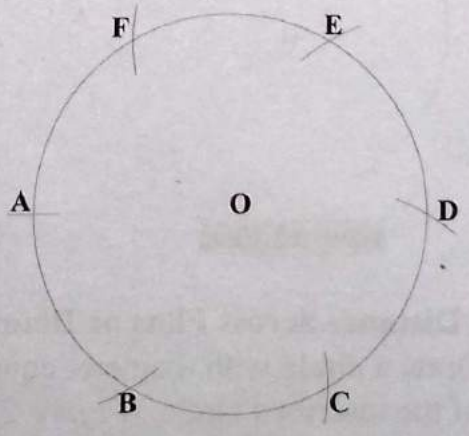


Figure 2.21(b)

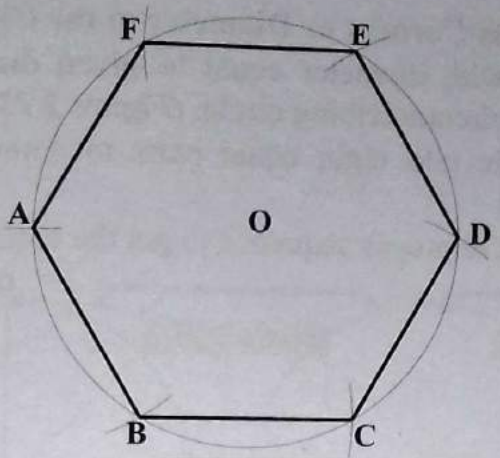


Figure 2.21(c)

## 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 $45^0$ 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))*

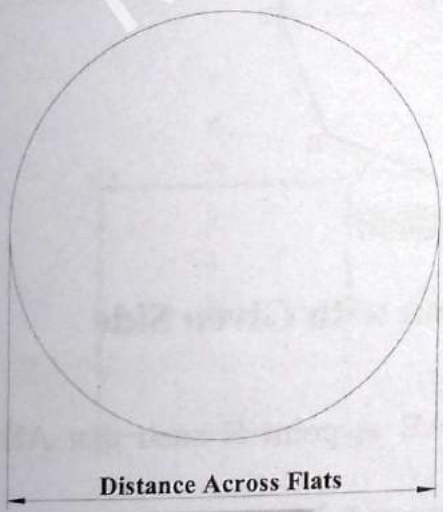


Figure 2.22(a)

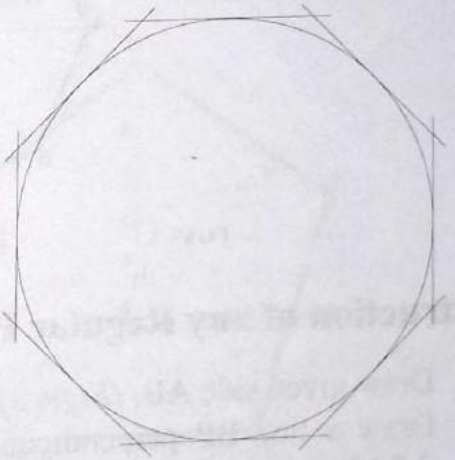

Figure 2.22(b)

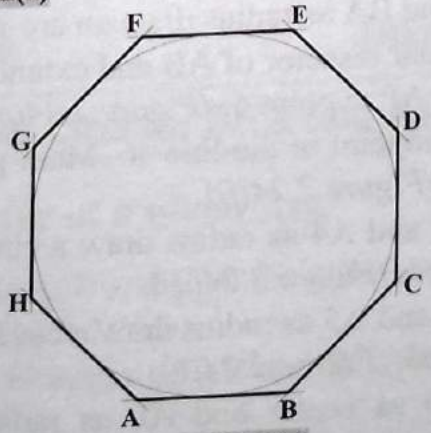


Figure 2.22(c)

**(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))*

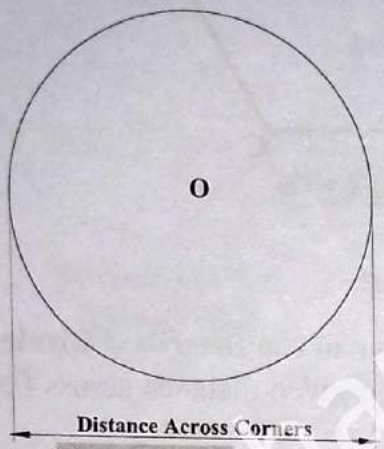

Figure 2.23(a)

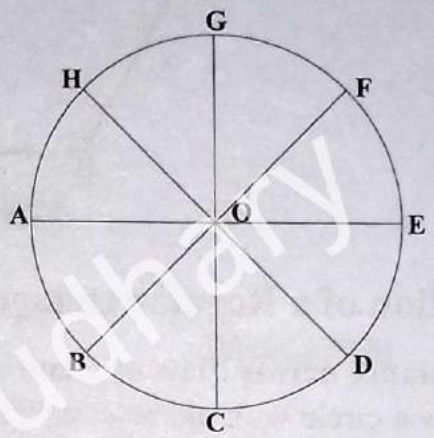

Figure 2.23(b)

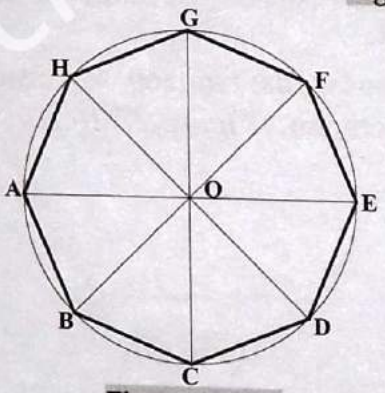

Figure 2.23(c)

## 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.

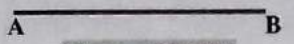


Figure 2.24(a)

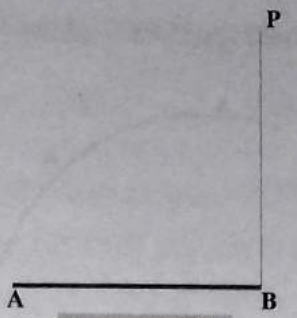


Figure 2.24(b)

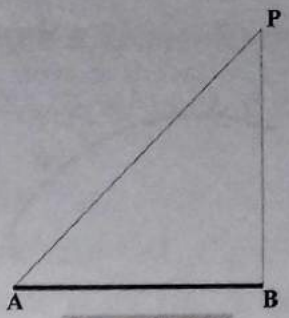


Figure 2.24(c)

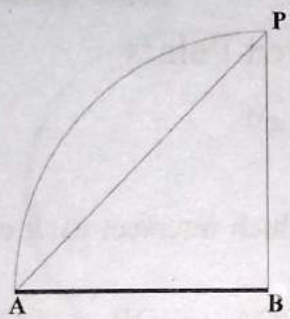


Figure 2.24(d)

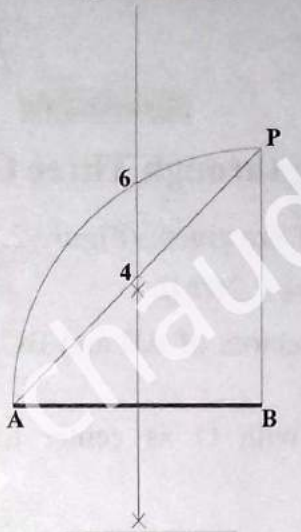


Figure 2.24(e)

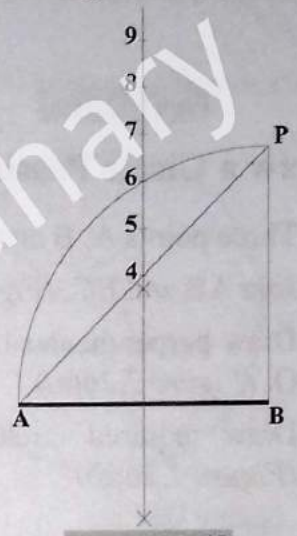


Figure 2.24(f)

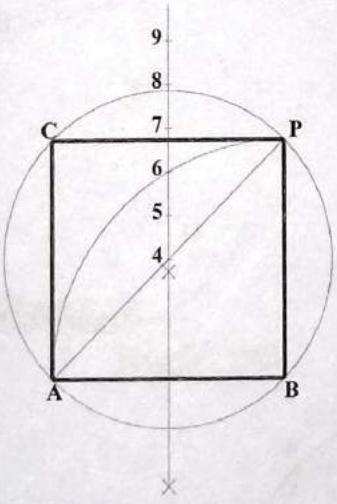


Figure 2.24(g)

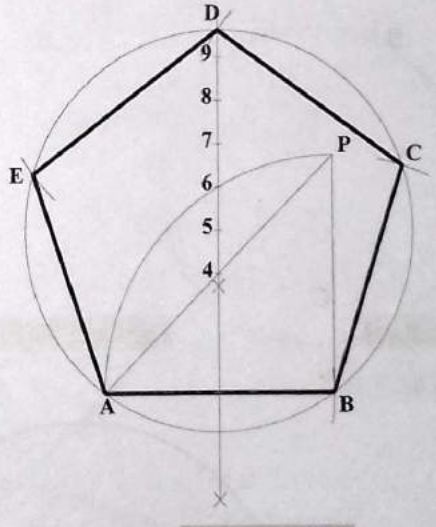


Figure 2.24(h)

## 2.3 Construction Involving Circular Arcs and Tangents

### 2.3.1 To Determine the Center of a given Arc

- Take any three points A, B and C on the given arc. *(Figure 2.25(a))*
- Join AB and BC. *(Figure 2.25(b))*
- Draw perpendicular bisectors of AB and BC, which intersect each other at point O. *(Figure 2.25(c))*
- Point O is the required center of the given arc.