

### 2.3.6 To Draw an Arc of Radius $R$ and Tangent to Given Two Circles (or Circular Arcs)

#### (a) Outside to the Given Circles

- Draw circles with  $O_1$  and  $O_2$  as their centers,  $R_1$  and  $R_2$  as their radii respectively. The relative positions of  $O_1$  and  $O_2$  are also given. (Figure 2.32(a))
- Draw arcs with  $O_1$  as center and  $R + R_1$  as radius and  $O_2$  as center and  $R + R_2$  as radius respectively. Intersection of these arcs gives the center  $O$  of the required arc. (Figure 2.32(b))
- Join  $O$  and  $O_1$  and  $O$  and  $O_2$  to get the point of tangencies  $A$  and  $B$  respectively. (Figure 2.32(c))
- Draw the required arc with  $O$  as center and  $OA$  ( $= OB = R$ ) as radius. (Figure 2.32(d))

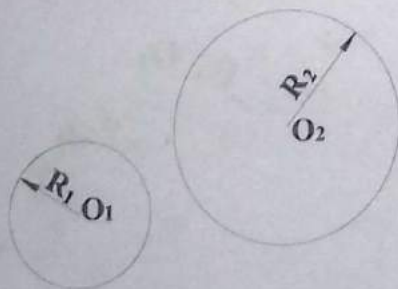


Figure 2.32(a)

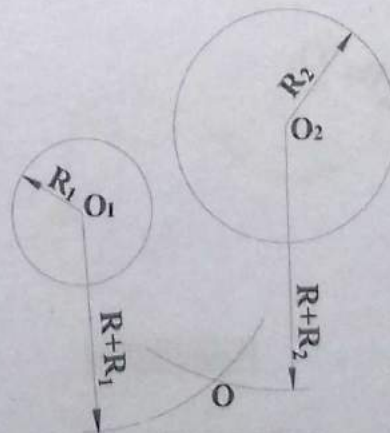


Figure 2.32(b)

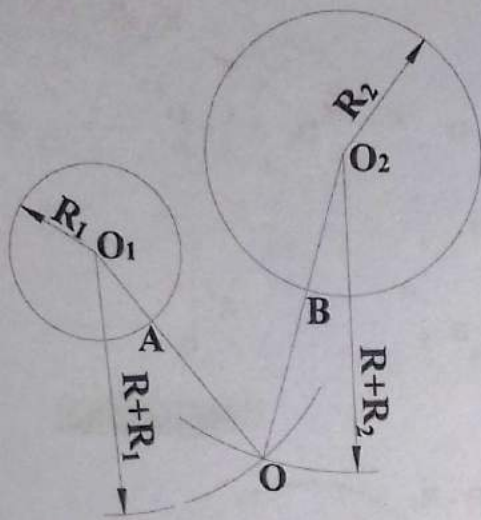


Figure 2.32(c)

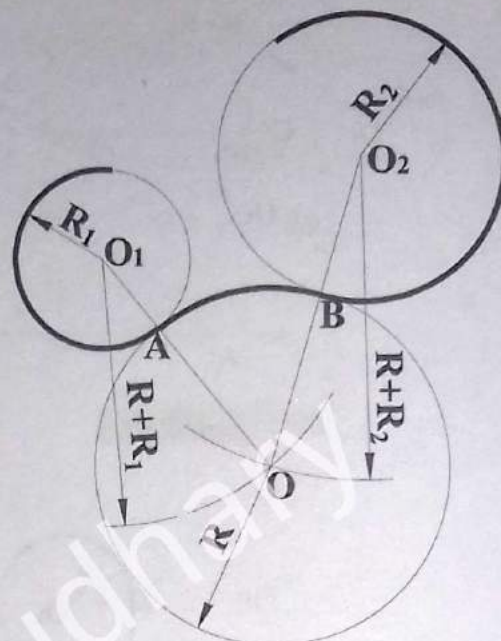


Figure 2.32(d)

**(b) Including the Given Circles**

- Draw circles with  $O_1$  and  $O_2$  as their centers,  $R_1$  and  $R_2$  as their radii respectively. The relative positions of  $O_1$  and  $O_2$  are also given. (Figure 2.33(a))
- Draw arcs with  $O_1$  as center and  $R - R_1$  as radius and  $O_2$  as center and  $R - R_2$  as radius respectively. Intersection of these arcs gives the center  $O$  of the required arc. (Figure 2.33(b))
- Join  $O$  and  $O_1$  and  $O$  and  $O_2$  and extend to get the point of tangencies  $A$  and  $B$  respectively. (Figure 2.33(c))
- Draw the required arc with  $O$  as center and  $OA$  ( $= OB = R$ ) as radius. (Figure 2.33(d))

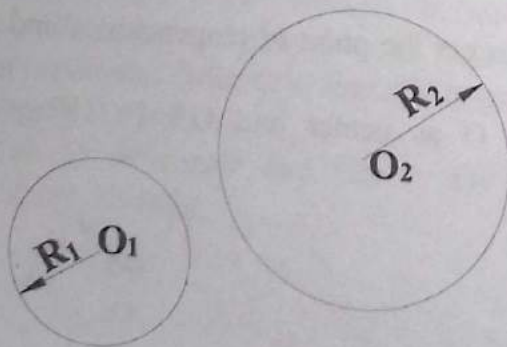


Figure 2.33(a)

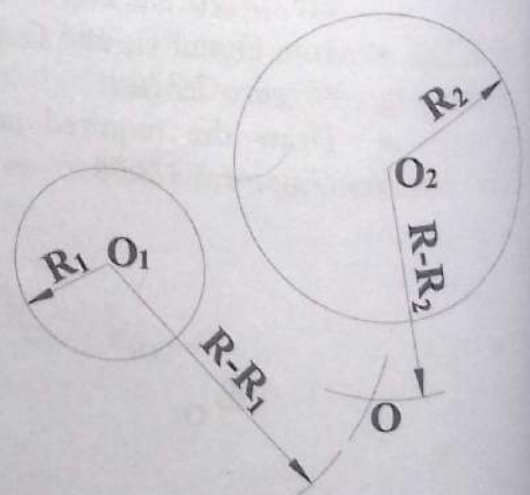


Figure 2.33(b)



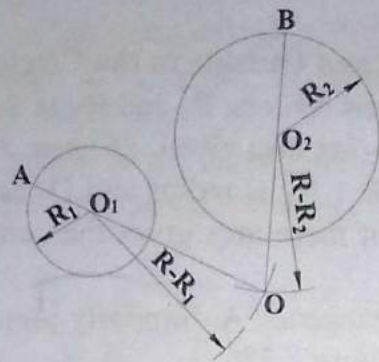


Figure 2.33(c)

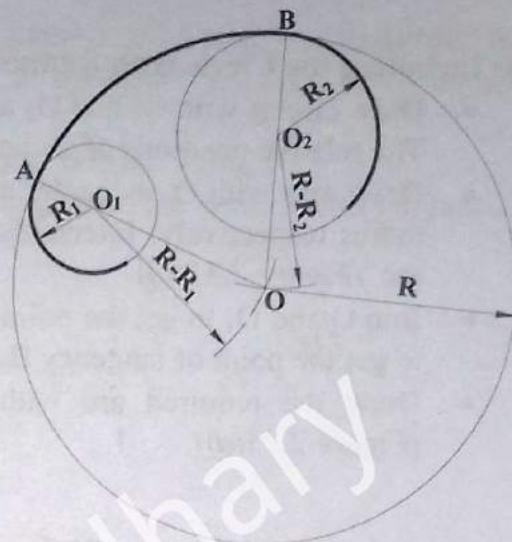


Figure 2.33(d)

**(c) Including the Circle with Radius  $R_1$  and Outside to the Circle with Radius  $R_2$**

- Draw circles with  $O_1$  and  $O_2$  as their centers,  $R_1$  and  $R_2$  as their radii respectively. The relative positions of  $O_1$  and  $O_2$  are also given. (Figure 2.34(a))
- Draw arcs with  $O_1$  as center and  $R - R_1$  as radius and  $O_2$  as center and  $R + R_2$  as radius respectively. Intersection of these arcs gives the center  $O$  of the required arc. (Figure 2.34(b))
- Join  $O$  and  $O_1$  and extend to get the point of tangency  $A$ . Similarly join  $O$  and  $O_2$  to get the point of tangency  $B$ . (Figure 2.34(c))
- Draw the required arc with  $O$  as center and  $OA (= OB = R)$  as radius. (Figure 2.34(d))

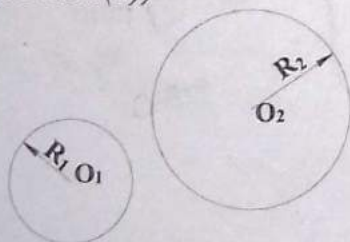


Figure 2.34(a)

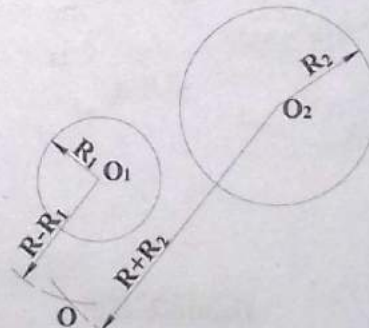


Figure 2.34(b)

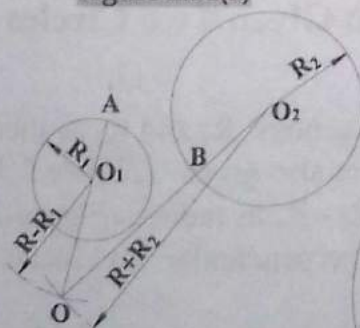


Figure 2.34(c)

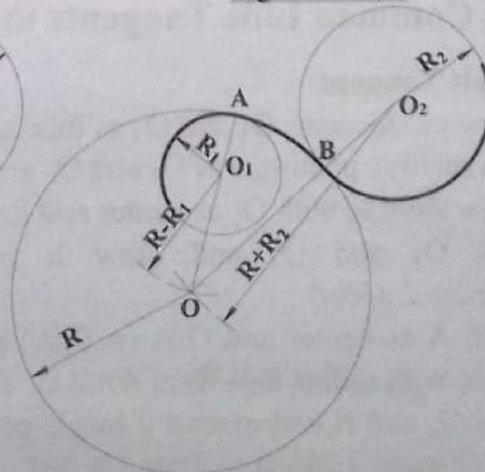


Figure 2.34(d)

(d) Including the Circle with Radius  $R_2$  and Outside to the Circle with Radius  $R_1$

- Draw circles with  $O_1$  and  $O_2$  as their centers,  $R_1$  and  $R_2$  as their radii respectively. The relative positions of  $O_1$  and  $O_2$  are also given. (Figure 2.35(a))
- Draw arcs with  $O_1$  as center and  $R + R_1$  as radius and  $O_2$  as center and  $R - R_2$  as radius respectively. Intersection of these arcs gives the center  $O$  of the required arc. (Figure 2.35(b))
- Join  $O$  and  $O_1$  to get the point of tangency  $A$ . Similarly join  $O$  and  $O_2$  and extend to get the point of tangency  $B$ . (Figure 2.35(c))
- Draw the required arc with  $O$  as center and  $OA (= OB = R)$  as radius. (Figure 2.35(d))

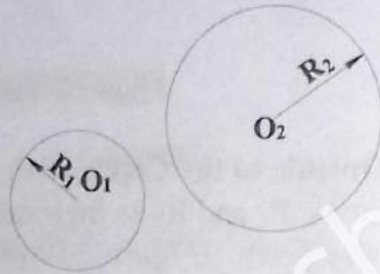


Figure 2.35(a)

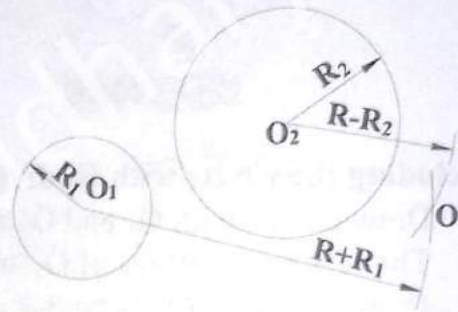


Figure 2.35(b)

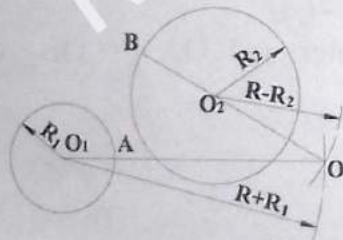


Figure 2.35(c)

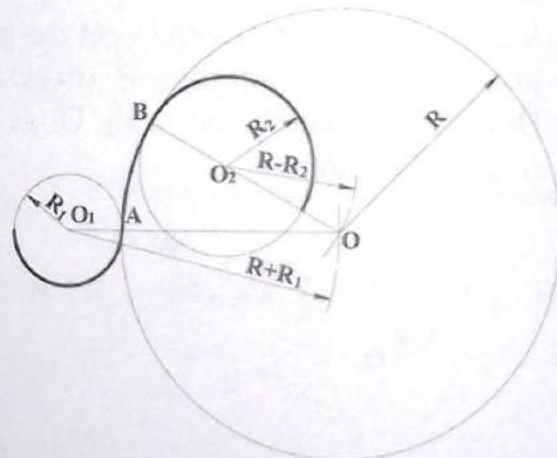


Figure 2.35(d)