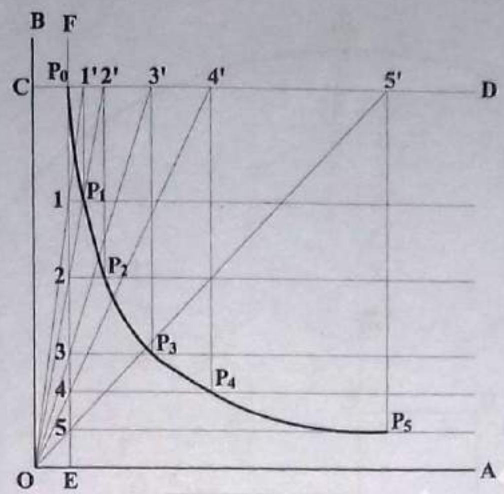

Figure 2.53(g)

2.5 Construction of Standard Curves

2.5.1 Construction of Involutes

The curve traced by a fixed point on a stretched cord when it is unwounded from a circle or a polygon is called an involute. Involute of a circle is used as the profile of gear teeth. Cams are often designed to the involute shape to ensure the rolling contact between the roller and the follower at constant speed.

(a) Involute of a Square

- Draw the given square ABCD. *(Figure 2.54(a))*
- Extend sides of the square as shown. *(Figure 2.54(b))*
- With A as center and AB as radius draw an arc intersecting the extended DA at point A'. With D as center and DA' as radius, draw an arc which intersects the extended CD at point D'. With C as center and CD' as radius, draw an arc which intersects the extended BC at point C'. With B as center and BC' as radius, draw an arc which intersects the extended AB at point B'. *(Figure 2.54(c))*

When one turn of the cord is taken out from the square, the length of the cord (BB') will be equal to perimeter of the square.

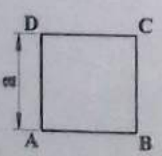

Figure 2.54(a)

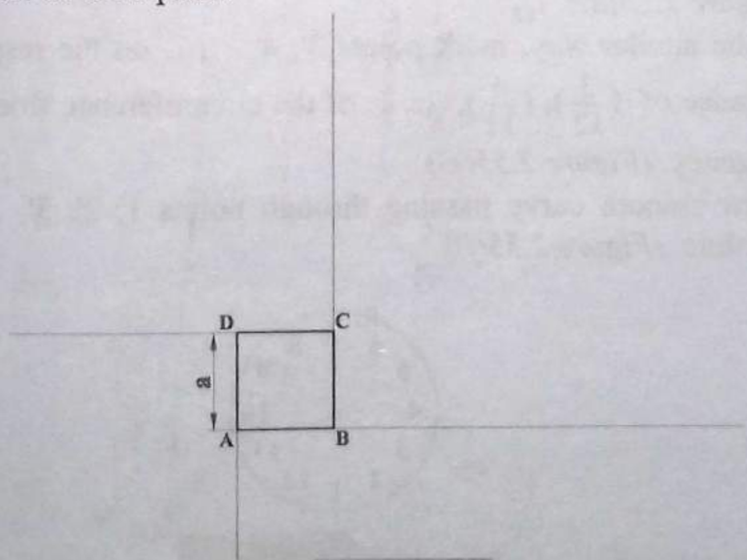

Figure 2.54(b)

Scanned by CamScanner

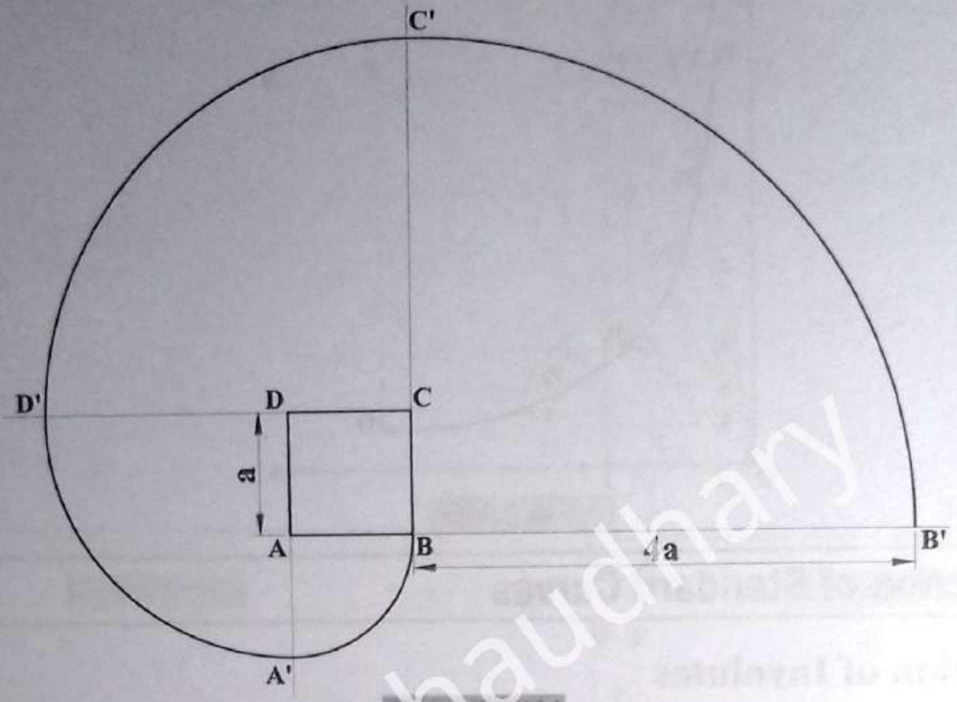

Figure 2.54(c)

(b) Involute of a Circle

- Draw the given circle and divide the circle into any number of equal parts, say 12. *(Figure 2.55(a))*
- Draw tangent lines from each point on the circumference of the circle in direction as shown. *(Figure 2.55(b))*
- Mark point 1' on the tangent line passing through point 1 such that the distance between 1 and 1' is equal to the circumference of the given circle. Divide 11' into the same number of equal parts as that of the circle. *(Figure 2.55(c))*
- Mark point 2' on the tangent line passing through point 2 such that 22' is equal to $(\frac{1}{12})$ of the circumference, i.e., 11'. Again, mark point 3' on the tangent line passing through point 3 such that 33' is equal to $(\frac{2}{12})$ of the circumference'. *(Figure 2.55(d))*
- In the similar way, mark points 3', 4', …… on the respective tangent lines at a distance of $(\frac{3}{12})$, $(\frac{4}{12})$, …… of the circumference from the respective points of tangency. *(Figure 2.55(e))*
- Draw smooth curve passing through points 1, 2', 3', …… to get the required involute. *(Figure 2.55(f))*

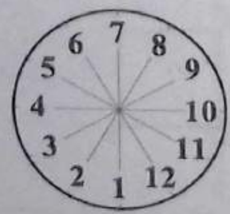

Figure 2.55(a)

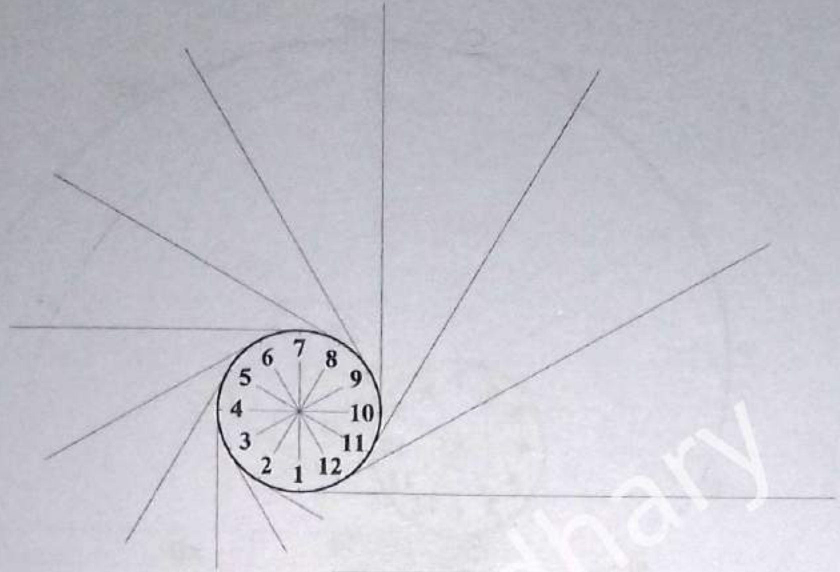

Figure 2.55(b)

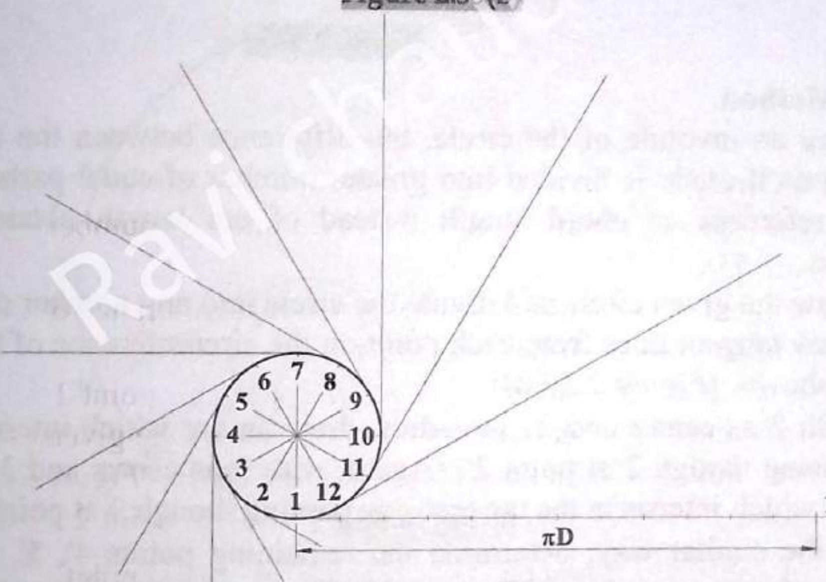

Figure 2.55(c)

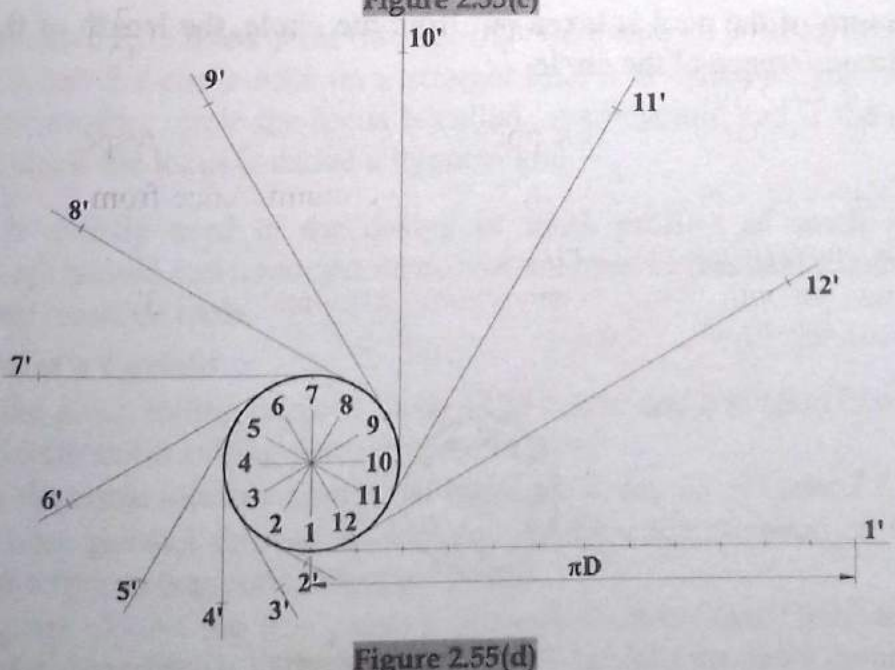

Figure 2.55(d)

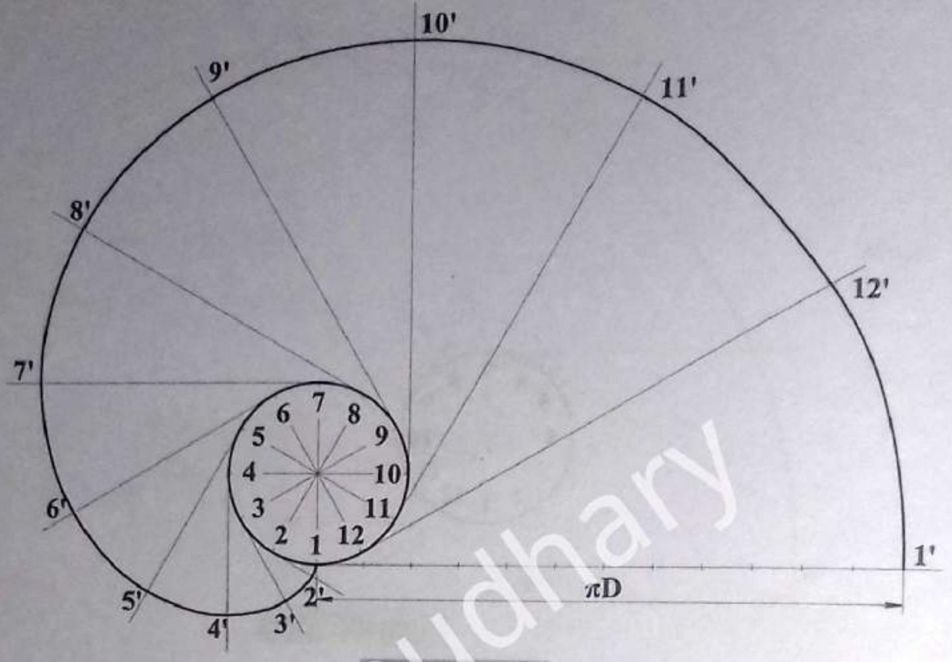

Figure 2.55(e)

Alternative Method

While drawing an involute of the circle, the difference between the arc length and chord length decreases if circle is divided into greater number of equal parts and involute can be drawn with reference to chord length instead of arc length obtained by dividing the circumference.

- Draw the given circle and divide the circle into any number of equal parts, say 12. Draw tangent lines from each point on the circumference of the circle in direction as shown. *(Figure 2.56(a))*
- With 2 as center and 21 as radius, draw an arc which intersects the tangent line passing though 2 at point 2'. (Again, with 3 as center and 32' as radius, draw an arc which intersects the tangent line passing though 3 at point 3'. *(Figure 2.56(b))*
- In the similar way, determine the remaining points 4', 5', 6', …………, 12' to complete the involute. *(Figure 2.56(c))*

When one turn of the cord is taken out from the circle, the length of the cord (11') will be equal to circumference of the circle.

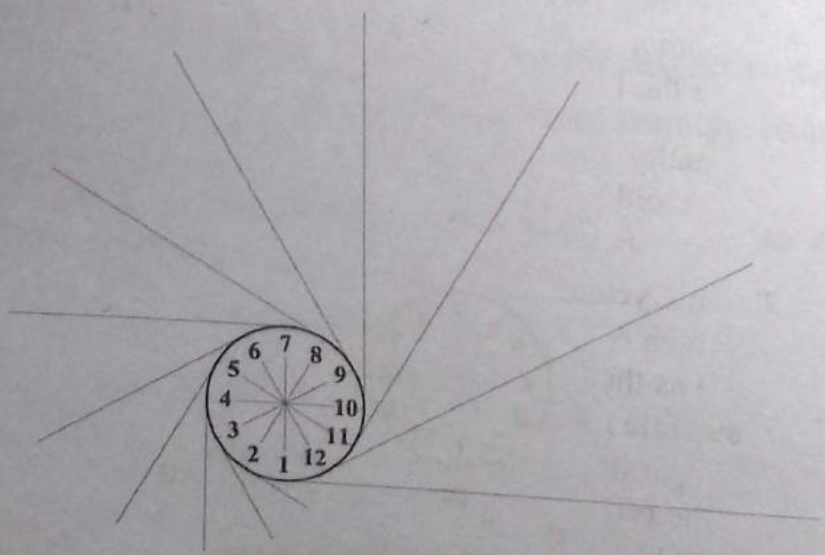

Figure 2.56(a)

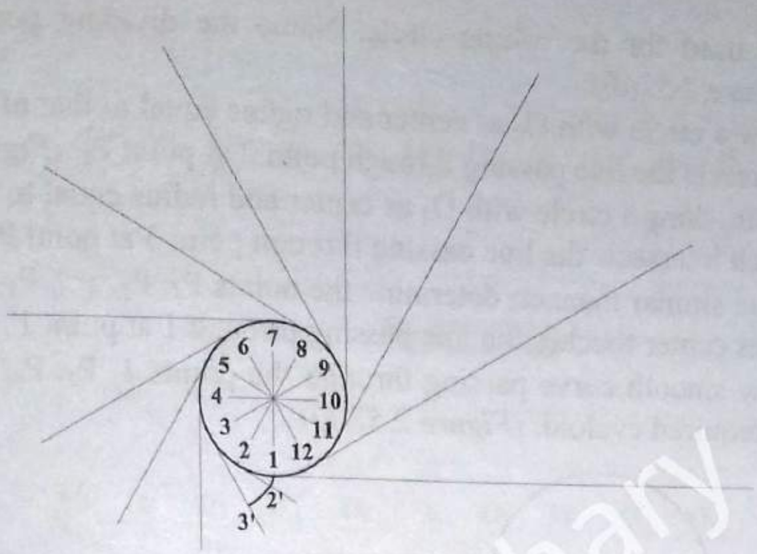

Figure 2.56(b)

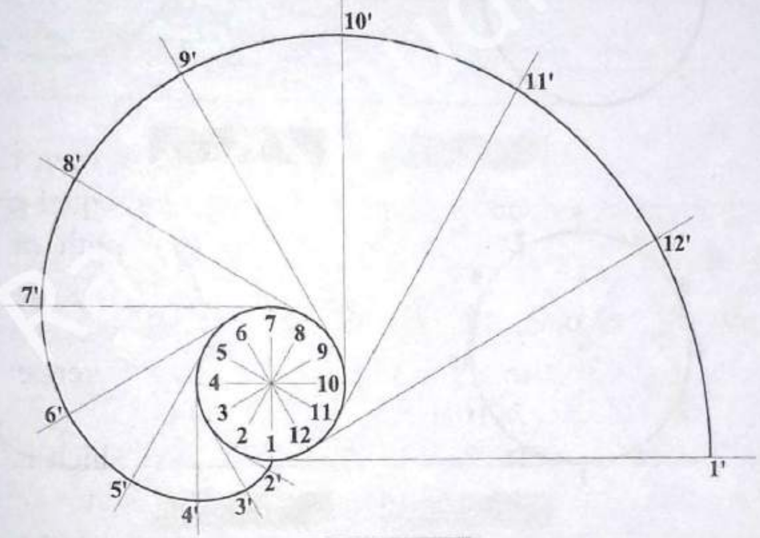

Figure 2.56(c)

2.5.2 Construction of Cycloids

The plane curves generated by a fixed point on a rolling circle when it rolls on different surfaces are called cycloids. When the circle rolls on a straight line, it is called a cycloid. If the circle rolls on the outside of another circle the locus is called an epicycloid and if the circle rolls on the inside of another circle the locus is called a hypocycloid.

The cycloid curve is usually used in the design of tooth profiles of small gears used in instruments whereas epicycloid and hypocycloid curves are used in mechanisms for cutting gear teeth and metal cutting machine tools.

(a) Construction of a Cycloid

- Draw the given rolling circle with O_1 as its center and a tangent line at the bottom of the circle as the rolling path. *(Figure 2.57(a))*
- Divide the circle into any number of equal parts, say 12. *(Figure 2.57(b))*
- Draw lines passing through each point on the circumference of the circle and parallel to the rolling path. *(Figure 2.57(c))*
- Mark point O_1' on the line passing through O_1 such that O_1O_1' is equal to the circumference of the rolling circle. Divide O_1O_1' into the same number of parts as