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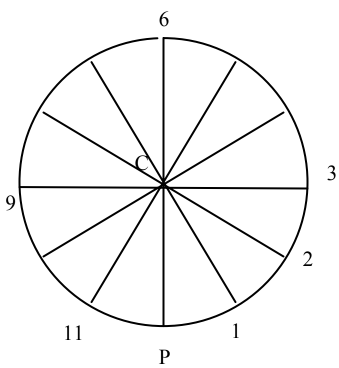
Q) **A** circle of 50 mm rolls on another circle of 150 mm and outside it. Name the curve. Trace the path of a point P on the circumference of the smaller circle. Also draw a tangent and normal to the curve at a point on the curve, 85 mm from the centre of the bigger circle.

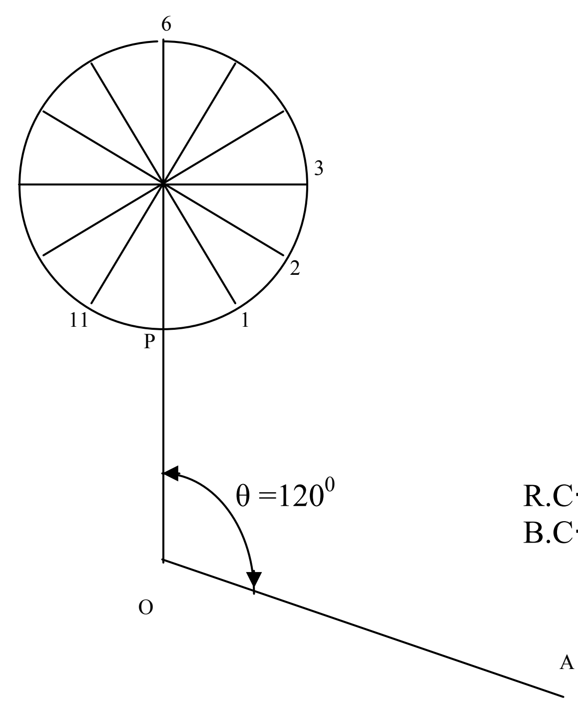
Ans) The **Curve** is an **epicyloid** as the **circle** rolls on outside of another circle.
The **angle** for one revolution will be equal to (360 * **d/D**).

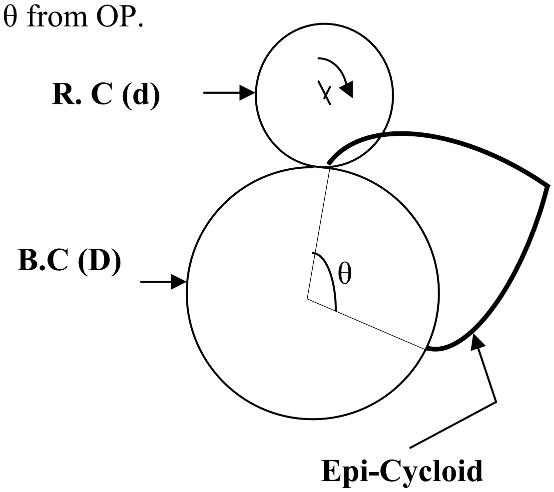
1) Draw a circle of 25 mm radius with centre C and **mark P as the bottom most point**. Divide the circle into 12 parts and label them as 1, 2, 3…12 after P.



2) **From P, mark O, centre of big circle (base circle) at PO=R=75 mm.**

3) Mark ∟POA = θ= 360*(d/D) and draw OA at θ from OP.





R.C→ ROLLING CIRCLE (GENERATING CIRCLE)
B.C→ BASE CIRCLE (DIRECTING CIRCLE)

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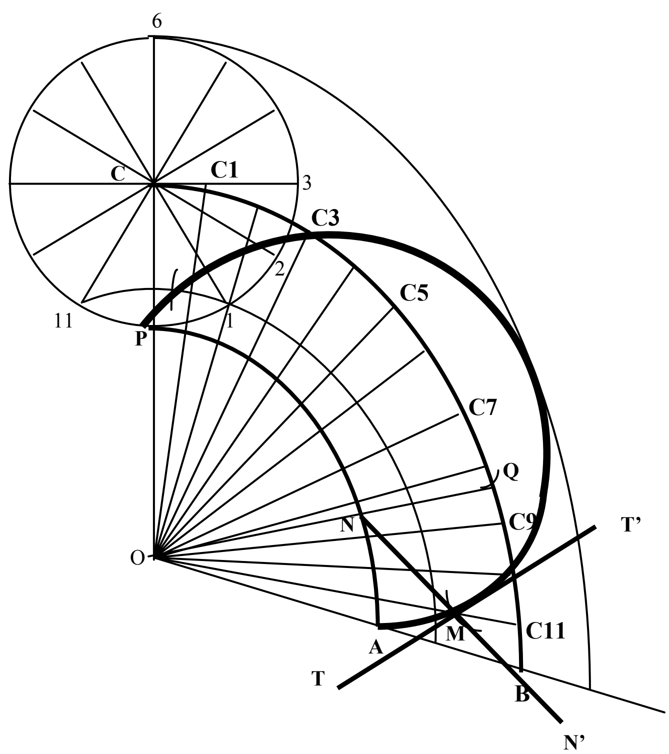
The above figure is the profile of the Epi Cycloid that is generated when the rolling circle of d rolls on a base circle of D.

4) With O as centre and OP radius, draw base circle up to A. PA is part of the base Circle.

5) With O as centre and OC radius, draw an arc through centre to get **Centre Arc CB**. On CB, the centers $C_1 \ldots C_{12}$ will lie.

6) To get the centers, divide ∟POA into 12 equal parts (here 120/12 = 10^0) and join O to each of these 10^0 to get C1, C2,…C12.



7) Now, similar to cycloids, with **C1 centre** and **radius CP (=25)**, cut arc on **1-11 arc** of **rolling circle** to get P1. Repeat with C2, C3, etc on 2-10, 3-9, etc to get the epicycloid.

<u>**Note**</u>: While dividing the θ into 12 parts, mark centers C1,C2,..C12 on centre arc **CB** passing through **C** only and **not** on the **arc passing through 3-9**.
Arc passing through 3-9 will be **separate** and is used for getting P3 and P9 while cutting arcs.

<u>*Tangent and Normal:*</u>

1) Mark M on the epicycloid at 85 mm from O by taking O as centre and radius 85.
2) With M as center, radius CP (=25), cut arc Q on CB.
3) Join QO, cutting base circle PA at N.
4) Join NM to get normal NN', and ⊥ to NN' draw the tangent TT'.