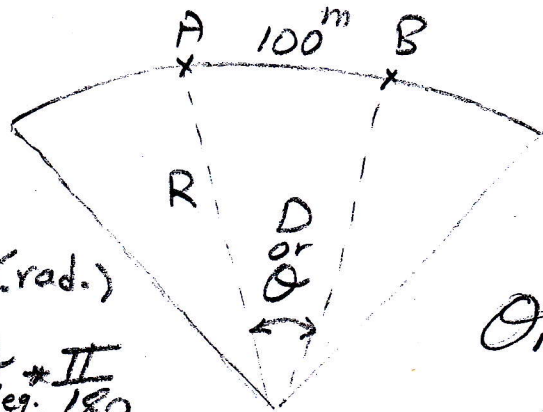


# Degree of curve

Two definition of degree of curve :

1. Arc definition ( $\theta$  or  $D$ ) : is an angle subtended at the center of the curve by an arc  $100^m$  Long.



Arc length  $A \rightarrow B = 100^m$

Arc length  $A \rightarrow B = R * \theta$  (rad.)

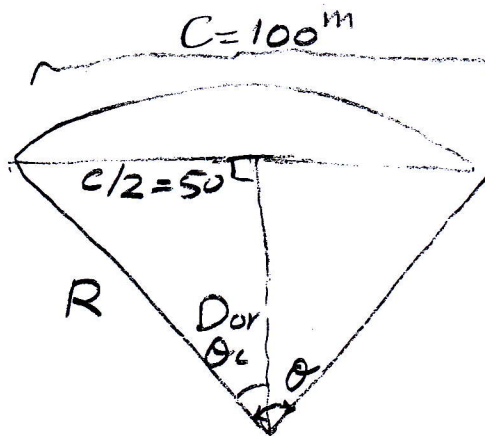
∴ Arc length  $A \rightarrow B = R * \theta_{deg} * \frac{\pi}{180}$

$\theta_{rad} = \theta_{deg} * \frac{\pi}{180}$

∴  $R = \frac{\text{Arc length } A \rightarrow B * 180^\circ}{\theta_{deg} * \pi}$

$R = \frac{100 * 180^\circ}{\theta_{deg} * \pi} \approx \frac{5730}{\theta_{deg}}$

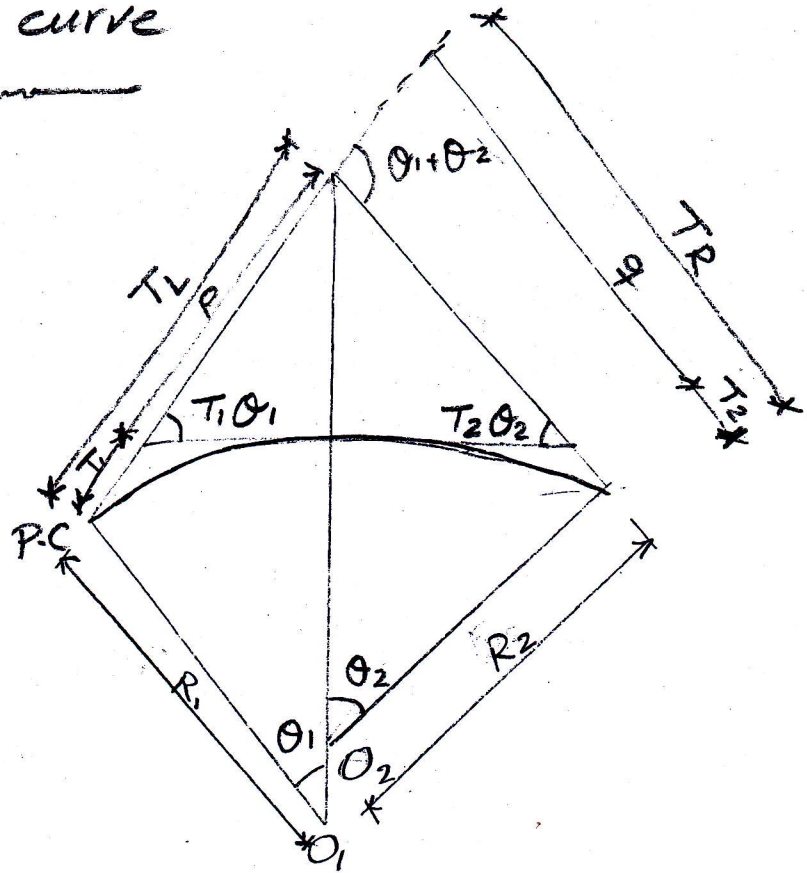
2. Chord definition ( $\theta_c$  or  $D_c$ ) : is an angle subtended at the center of the curve by chord having a length of  $100^m$ .



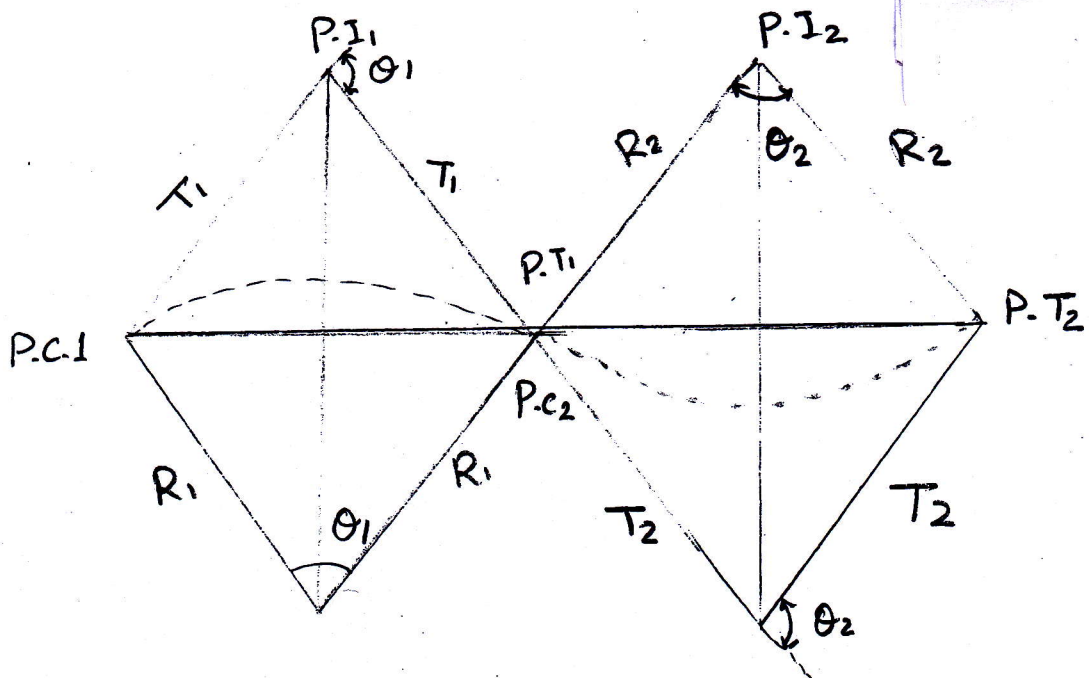
$\sin \theta_c = \frac{50}{R}$

# Compound circular curve

(4)

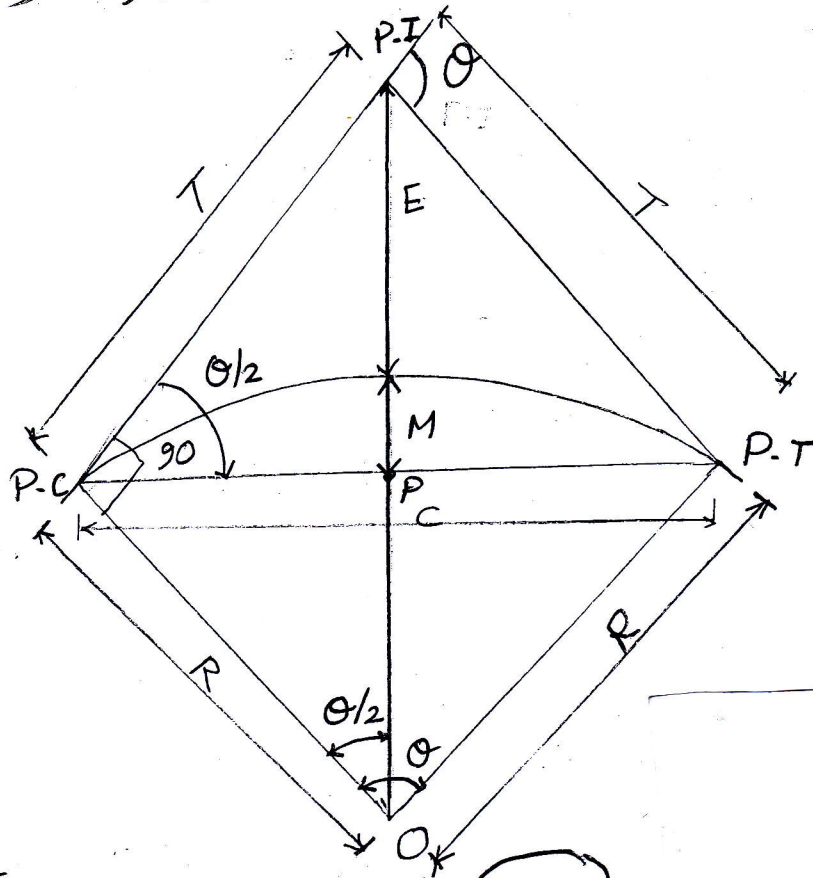


# Reverse circular curve

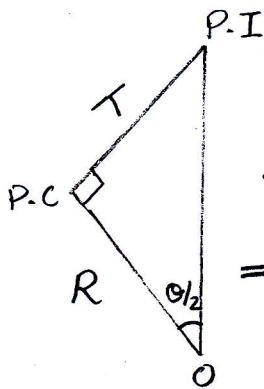


To compute  $T, C, L, E, M$

(5)



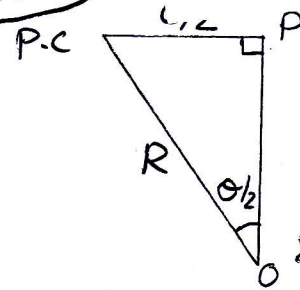
1. T



$$\tan \frac{\theta}{2} = \frac{T}{R}$$

$$\Rightarrow T = R \tan \frac{\theta}{2}$$

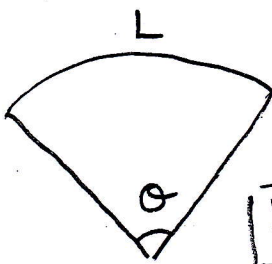
2. C



$$\sin \frac{\theta}{2} = \frac{C/2}{R}$$

$$C = 2R \sin \frac{\theta}{2}$$

3. L



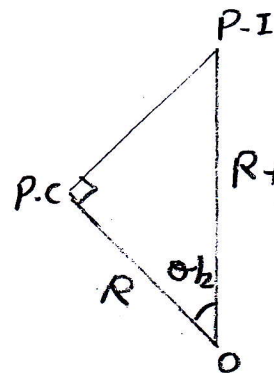
$$\frac{L}{\theta} = \frac{2\pi R}{360}$$

$$L = \frac{\pi R \theta}{180}$$

$$\text{OR } L = R \theta \frac{\pi}{180}$$

$$L = \frac{R \theta \text{deg} \times \pi}{180}$$

4. E

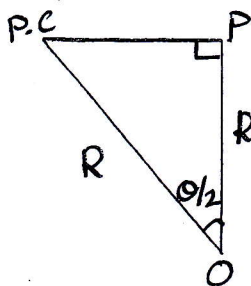


$$\cos \frac{\theta}{2} = \frac{R}{R+E}$$

$$R \cos \frac{\theta}{2} + E \cos \frac{\theta}{2} = R$$

$$E = R \left( \frac{L}{R \cos \frac{\theta}{2}} - 1 \right)$$

$$E = R \left( \sec \frac{\theta}{2} - 1 \right)$$



$$\cos \frac{\theta}{2} = \frac{R-M}{R}$$

$$R \cos \frac{\theta}{2} = R-M$$

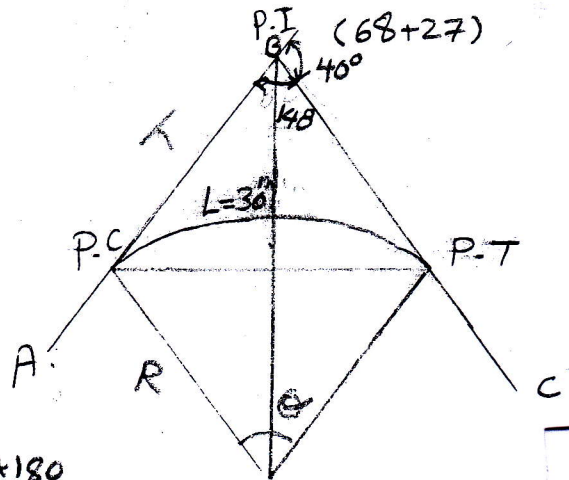
$$M = R - R \cos \frac{\theta}{2}$$

$$M = R \left( 1 - \cos \frac{\theta}{2} \right)$$

6

station P.C = station P.I - T  
 station P.T = station P.C + L

Example 1) The lines AB and BC intersected at station (68+27) with intersection angle  $140^\circ$  to connect these lines by simple circular curve. The degree of curve is  $5^\circ$  according to the arc definition. Find the radius of curve and distance of the tangent points (P.C, P.T) if the length of arc was 30m at this degree of curve, and 1 station equal to  $100^m$ .



$$\theta = 180^\circ - 140^\circ = 40^\circ$$

Sol.

$$\text{og } L = \frac{\pi R \theta}{180} \Rightarrow R = \frac{L \times 180}{\pi \theta}$$

$$R = \frac{30 \times 180}{\pi \times 5} = 343.77 \text{ m}$$

$$T = R \tan \frac{\theta}{2} = 343.77 \tan 20^\circ = 125.12 \text{ m}$$

$$L = \frac{\pi R \theta}{180} = \frac{\pi \times 343.77 \times 40^\circ}{180} = 240 \text{ m}$$

$$\begin{aligned} \text{sta. P.C} &= \text{sta. P.I} - T \\ &= (68+27) - (1 + 25.12) = 67+1.88 \end{aligned}$$

$$\begin{aligned} \text{sta. P.T} &= \text{sta. P.C} + L \\ &= (67+1.88) + (2+40) = 69+41.88 \end{aligned}$$

Example 2) The table below illustrated the straights information: (7)

line	W.C.B	length(m)
AI	$20^\circ$	450.30
IB	$70^\circ$	275.00

if the radius of the curve joining the straights is 300 m. Compute the tangent points (P.C and P.T).

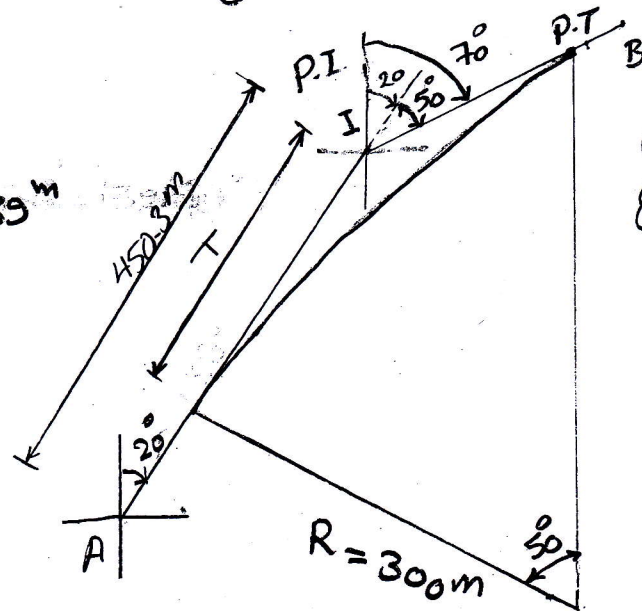
Sol.

$$T = R \tan \frac{\theta}{2} = 300 \tan 25^\circ = 139.89 \text{ m}$$

$$\begin{aligned} P.C &= P.I - T \\ &= 450.30 - 139.89 \\ &= 310.41 \text{ m} \end{aligned}$$

$$\begin{aligned} L &= \frac{\pi R \theta}{180} = \frac{\pi \times 300 \times 50}{180} \\ &= 261.80 \text{ m} \end{aligned}$$

$$\begin{aligned} P.T &= P.C + L \\ &= 310.41 + 261.80 = \underline{\underline{572.21 \text{ m}}} \end{aligned}$$

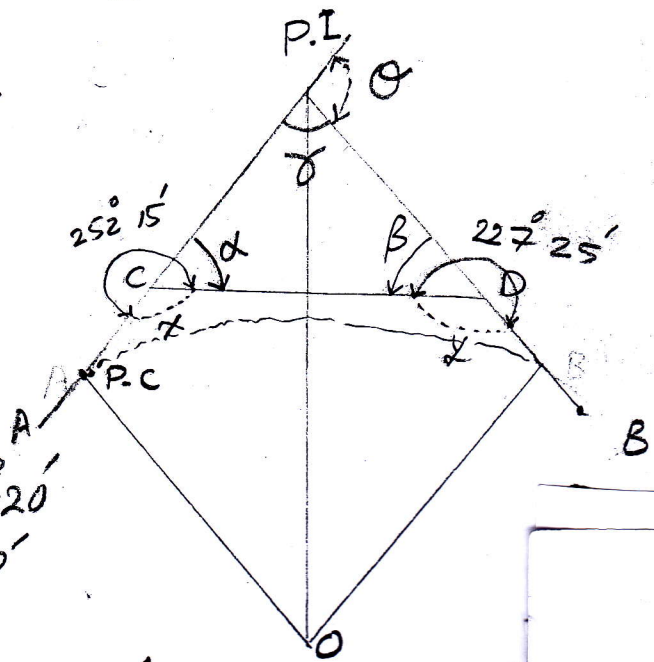


$$\begin{aligned} \theta &= \text{deflection angle} \\ \theta &= 70^\circ - 20^\circ \\ &= 50^\circ \end{aligned}$$

Example 3) If the exterior angles of traverse ACDB were as follows:

the angle ACD was  $252^{\circ} 15'$ , while the angle CDB was  $227^{\circ} 25'$ . The length of sides AC and CD were 559.28 m and 256.50 m, respectively. Compute the tangent point (P.C) if the straights are to be connected by a 300 m radius of curve. The figure below shows the traverse

$$\begin{aligned}
 x &= 360^{\circ} - 252^{\circ} 15' = 107^{\circ} 45' \\
 \alpha &= 180^{\circ} - 107^{\circ} 45' = 72^{\circ} 15' \\
 y &= 360^{\circ} - 227^{\circ} 25' = 132^{\circ} 35' \\
 \beta &= 180^{\circ} - 132^{\circ} 35' = 47^{\circ} 25' \\
 \delta &= 180^{\circ} - 47^{\circ} 25' - 72^{\circ} 15' = 60^{\circ} 20' \\
 \theta \text{ (deflection angle)} &= 180^{\circ} - 60^{\circ} 20' \\
 &= 119^{\circ} 40'
 \end{aligned}$$



$$\frac{l_{P.I \rightarrow C}}{\sin \beta} = \frac{l_{C \rightarrow D}}{\sin \delta} \Rightarrow \frac{l_{P.I \rightarrow C}}{\sin 47^{\circ} 25'} = \frac{256.50}{\sin 60^{\circ} 20'}$$

$$\Rightarrow l_{P.I \rightarrow C} = 217.349 \text{ m}$$

$$P.I = AC + l_{P.I \rightarrow C} = 559.280 + 217.349 = 776.629 \text{ m}$$

$$T = R \tan \frac{\theta}{2} = 300 \tan \frac{119^{\circ} 40'}{2} = 516.142 \text{ m}$$

$$P.C = P.I - T = 776.629 - 516.142 = 260.487 \text{ m}$$