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Section "B"

Sub: Advanced Engineering Surveying

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fourth Semester

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Q NO#01 part (a) :→ Two tangents meet at a Chainage of (I.D) ft with the deflection angle of $14°13'23''$. Degree of curve is $5°$.

1) :→ Chainage at the beginning and end of the curve
2) :→ length of long chord.
3) :→ Mid ordinate and External distance.

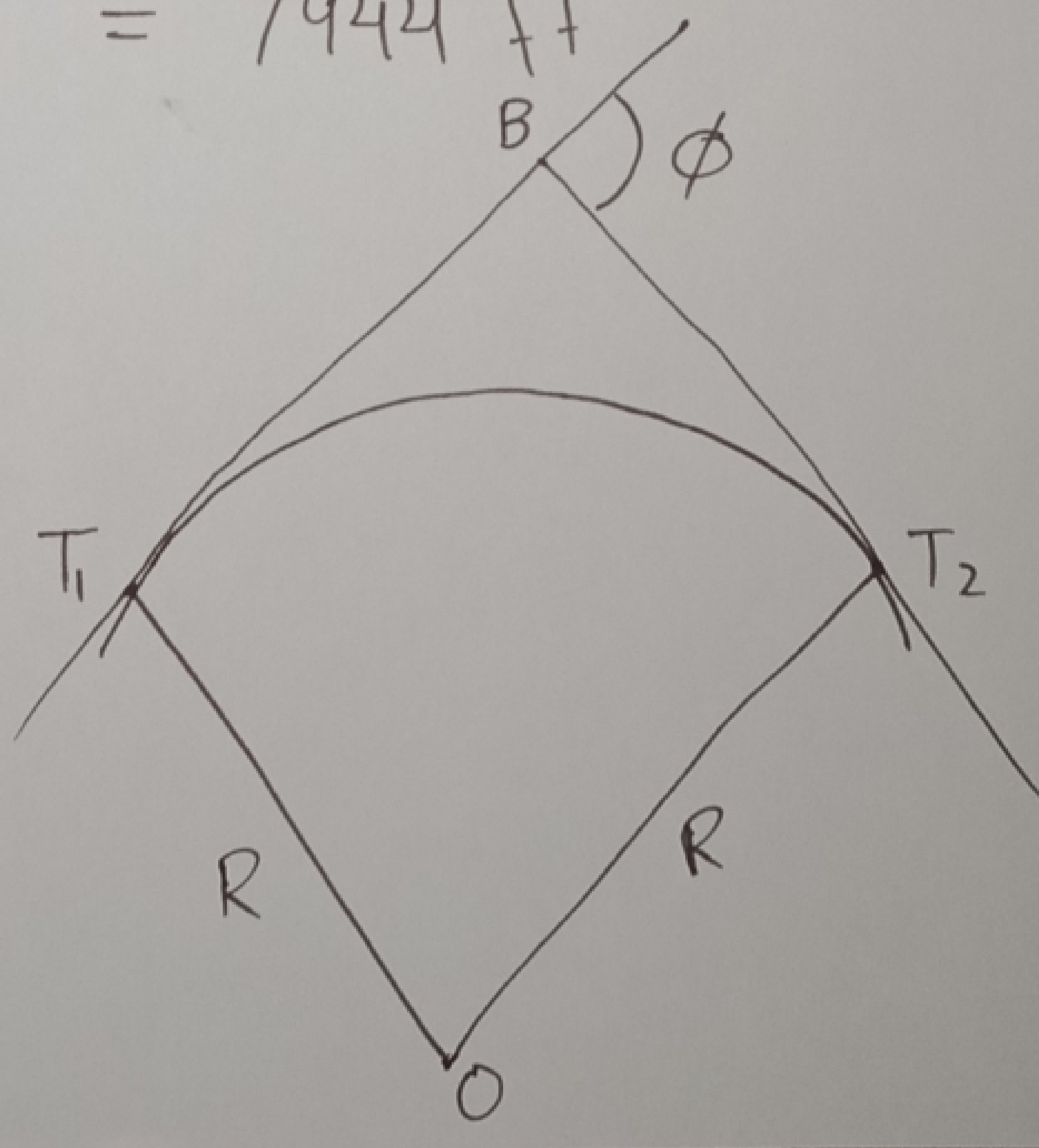
SOLUTION:

Given data :→

deflection angle $\phi = 14°13'23''$.

Degree of the Curve $= 5°$

Chainage of Intersection point Assume ID in feet so $= 7944$ ft

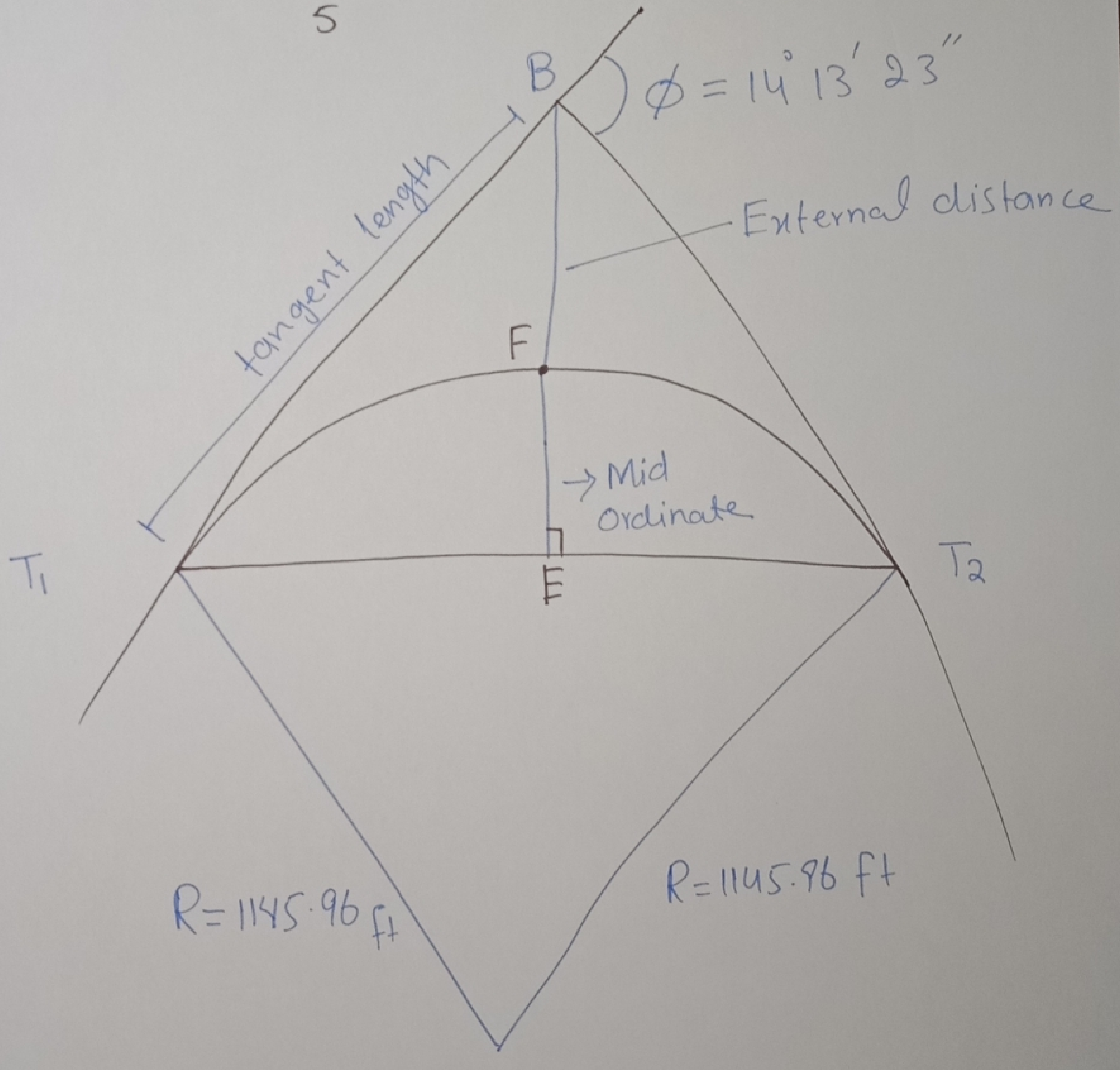


Now First of all we find the Radius of the curve from degree of the curve.

$$\text{Degree} = 5^\circ$$

$$R = \frac{5729.8}{D}$$

$$R = \frac{5729.8}{5} = 1145.96 \text{ ft}$$



For tangent length

$T_1B = BT_2 = R \tan\frac{\phi}{2}$

$T_1B = BT_2 = 1145.96 \tan\frac{14^\circ 12' 23'}{2}$

$\boxed{T_1B = BT_2 = 142.8 \text{ ft}} \rightarrow$ tangent length.

Now we find length of the Curve

$$L = \frac{\pi R \phi}{180^\circ} = \frac{(3.14)(1145.96)(14^\circ 13' 23'')}{180}$$

$$\boxed{L = 284.32 \text{ ft}}$$

Chainage of Intersection point = 7944 ft

Minus tangent length = −142.8 ft

Chainage of T_1 = 7801.2 ft

Add the Length of Curve = +284.32 ft

Chainage of T_2 = 8085.52 ft

For length of the Chord:

we have formula :→

Length of the chord $= 2R\sin\frac{\phi}{2}$

So

Length of Chord $= 2(1145.96)\sin\left(\frac{14^\circ 13' 23''}{2}\right)$

$$\boxed{l = 283.74 \text{ ft}}$$

Mid Ordinate

$EF = R - R\cos\frac{\phi}{2}$

$$\boxed{EF = R\left(1 - \cos\frac{\phi}{2}\right)}$$

So $R = 1145.96$

$\phi = 14^\circ 13' 23''$

$EF = 1145.96\left(1 - \cos\left(\frac{14^\circ 13' 23''}{2}\right)\right)$

$$\boxed{EF = 8.81 \text{ ft}}$$

External distance

$FB = R\left(\sec\frac{\phi}{2} - 1\right)$

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

$= 1145.96\left(\frac{1}{\cos\frac{14^\circ 13' 23''}{2}} - 1\right)$

$$\boxed{FB = 8.88 \text{ ft}}$$

Q NO # 01 part (b):→ Find the area from the data obtained from chain-survey, as shown in table below, by using simpson's One third Rule. The first offset is your ID ÷ 1000 m.

SOLUTION:→

Chainage(m)	0	30	60	90	120	150
offset (m)	7.944	7.944+3	7.944+4	7.944-2	7.944-4	7.944-3

So

Chainage (m)	0	30	60	90	120	150
offsets(m)	7.944	10.944	11.944	5.944	3.944	4.944

We have formula:→

$$\text{Area} = \frac{b}{3}(X + 2O + 4E)$$

Where X = Sum of first and Last offset

O = Sum of The Remaining ODD offsets.

E = Sum of the even offset.

There are six Number of offsets. According to the Simpson's Rule we assume odd Number of offset.

offset No	offset	(b) Simpson's Multiplier	Product
1	7.944	1	7.944
2	10.944	4	43.776
3	11.944	2	23.888
4	5.944	4	23.776
5	3.944	1	3.944

$\Sigma = 103.328$

$$\text{Area } (h_1 - h_5) = \frac{30}{3} * 103.328$$

$$= 1033.28 \, m^2$$

Now we find The Remaining Area

$$\text{Area } (h_5 - h_6) = \left(\frac{h_5 + h_6}{2}\right) b$$

$$\text{So} \Rightarrow \left(\frac{3.944 + 4.944}{2}\right) * 30$$

$$\Rightarrow 133.32 \, m^2$$

$$\text{Total Area} = 133.32 + 1033.28$$

$$\boxed{= 1166.6 \, m^2}$$

QNO#02 A circuler curve of Radius (ID-200)m deflecting Right through $20^\circ 40'$ is to be act out between two straight having chainage of the point of intersection as (ID-400)m. Calculate all Necessary Data for setting out the curve using deflection angle Method with peg interval 20m.

SOLUTION :→

Given Data:→

Radius ⇒ I.D - 200 = 7944 - 200 = 7744m
it is too large again we subtract 7000m from This so

$$7744 - 7000 \Rightarrow 744m$$

$$\boxed{R = 744m}$$

Chainage of Intersection point
$$\Rightarrow 7944 - 400 = 7544m$$

$$\text{Peg interval} = 20m$$

length of the curve $= L = \dfrac{\pi R \phi}{180}$

Deflection Angle $= \phi = 20^\circ 40'$

$$L = \frac{(3.14)(744)(20^\circ 40')}{180^\circ}$$

$$L = 268.225\,m$$

So

Chainage of Intersection point = 7544m

Tangent length ⇒

$$T_1B = T_2B = R\tan\frac{\phi}{2} = 744\tan\frac{20^\circ 40'}{2}$$

$$T_1B = T_2B = 135.65\,m$$

Chainage of intersection point = 7544m

Minus tangent length = -135.65m

Chainage of T_1 = 7408.35m

Plus length of Curve = + 268.225m

Chainage of T_2 = 7676.575m

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length of first chord

$$C_1 = 7420 - 7408.35 = 11.65\,m$$

$$\boxed{C_1 = 11.65}$$

$$\text{No of chords} = \frac{\text{length of curve} - C_1}{\text{Interval}}$$

$$\text{No of Chords} = \frac{268.225 - 11.65}{20}$$

No of chords = 12.828

we can say 12 chords of 20m.

$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10} = C_{11} = C_{12} = C_{13} = 20$

$C_2 - C_{13} \Rightarrow 20m$

$C_{14} = 7676.575 - 7660 = 16.575m$

Defleclion Angle :→

$$\delta_1 = \frac{1718.9 * C_1}{60 * R} = \frac{1718.9 * 11.65}{60 * 744}$$

$$\delta_1 = 0^\circ 26' 54.93''$$

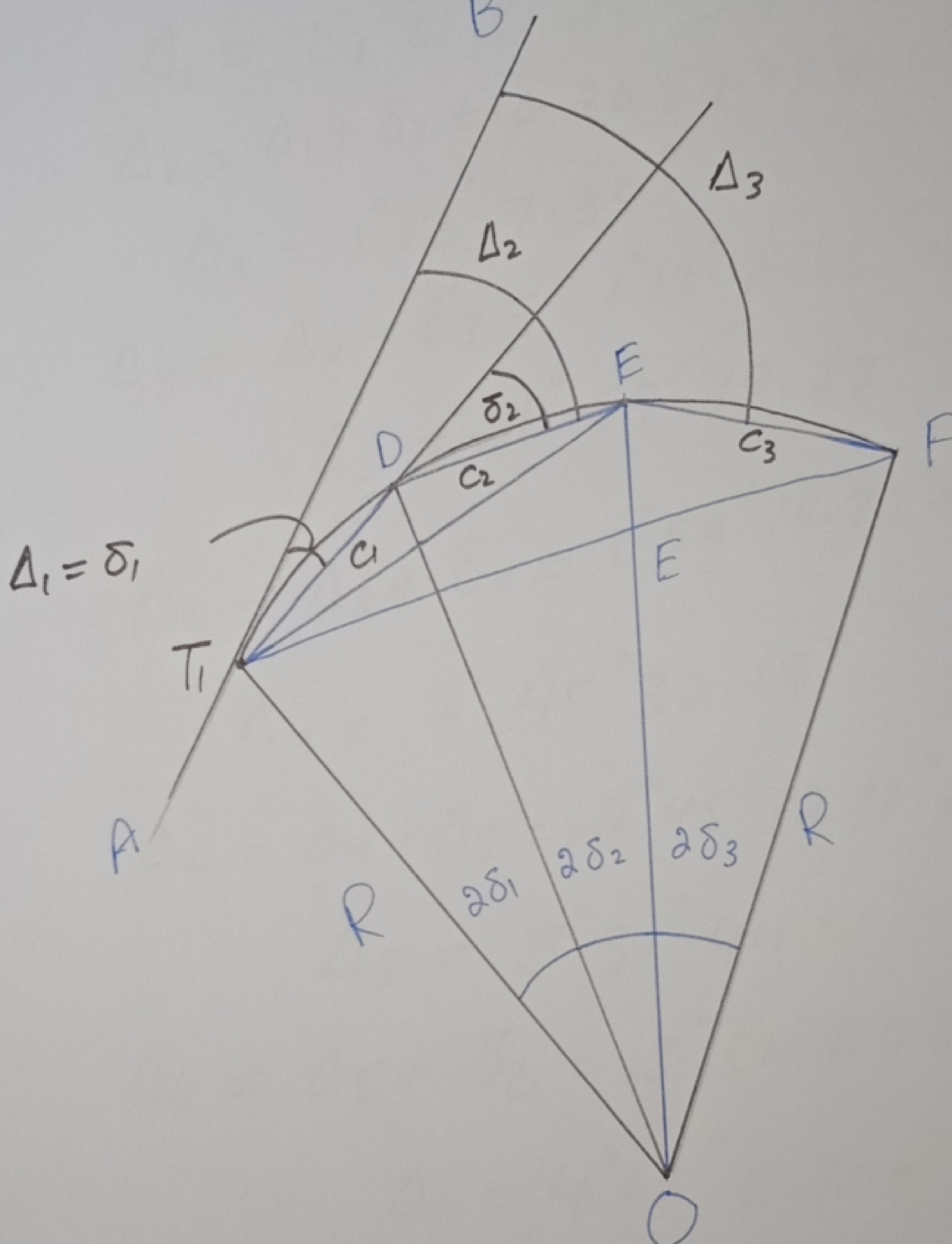
$$\delta_2 = \frac{1718.9 * C_2}{60 * R} = \frac{1718.9 * 20}{60 * 744}$$

$$\delta_2 = 0^\circ 46' 12.42''$$

$$\delta_2 — \delta_{13} = 0^\circ 46' 12.42''$$

$$\delta_{14} = \frac{1718.9 * C_{14}}{60 * R} = \frac{1718.9 * 16.575}{60 * 744}$$

$$\delta_{14} = 0^\circ 38' 17.64''$$


B
Δ_3
Δ_2
E
δ_2
D
c_3
F
c_2
$\Delta_1 = \delta_1$
c_1
E
T_1
A
R
$2\delta_1$
$2\delta_2$
$2\delta_3$
R
O

Total deflection (tangential) angle for the Chords are:

$$\Delta_1 = \delta_1 = 0^\circ 26' 54.93''$$

$$\Delta_2 = \Delta_1 + \delta_2 = 0^\circ 26' 54.93'' + 0^\circ 46' 12.42''$$

$$\Delta_2 = 1^\circ 13' 7.35''$$

$$\Delta_3 = \Delta_2 + \delta_3 = 1^\circ 13' 7.35'' + 0^\circ 46' 12.42''$$

$$\Delta_3 = 1^\circ 59' 19.77''$$

$$\Delta_4 = \Delta_3 + \delta_4 = 1^\circ 59' 19.77'' + 0^\circ 46' 12.42''$$

$$\Delta_4 = 2^\circ 45' 32.19''$$

$$\Delta_5 = \Delta_4 + \delta_5 = 2^\circ 45' 32.19'' + 0^\circ 46' 12.42''$$

$$\Delta_5 = 3^\circ 31' 44.61''$$

$$\Delta_6 = \Delta_5 + \delta_6 = 3^\circ 31' 44.61'' + 0^\circ 46' 12.42''$$

$$\Delta_6 = 4^\circ 17'' 57.03''$$

$$\Delta_7 = \Delta_6 + \delta_7 = 4^\circ 17'' 57.03'' + 0^\circ 46' 12.42''$$

$$\Delta_7 = 5^\circ 4' 9.45''$$

$$\Delta_8 = \Delta_7 + \delta_8 = 5^\circ 4' 9.45'' + 0^\circ 46' 12.42''$$

$$\Delta_8 = 5^\circ 50' 21.87''$$

$$\overset{12}{=}$$

$$\Delta_9 = \Delta_8 + \delta_9 = 5^\circ 50' 21.87'' + 0^\circ 46' 12.42''$$

$$\Delta_9 = 6^\circ 36' 34.29''$$

$$\Delta_{10} = \Delta_9 + \delta_{10} = 6^\circ 36' 34.29'' + 0^\circ 46' 12.42''$$

$$\Delta_{10} = 7^\circ 22' 46.71''$$

$$\Delta_{11} = \Delta_{10} + \delta_{10} = 7^\circ 22' 46.71'' + 0^\circ 46' 12.42''$$

$$\Delta_{11} = 8^\circ 8' 59.13''$$

$$\Delta_{12} = \Delta_{11} + \delta_{12} = 8^\circ 8' 59.13'' + 0^\circ 46' 12.42''$$

$$\Delta_{12} = 8^\circ 55' 11.55''$$

$$\Delta_{13} = \Delta_{12} + \delta_{13} = 8^\circ 55' 11.55'' + 0^\circ 46' 12.42''$$

$$\Delta_{13} = 9^\circ 41' 23.97''$$

$$\Delta_{14} = \Delta_{13} + \delta_{14} = 9^\circ 41' 23.97'' + 0^\circ 38' 17.64''$$

$$\Delta_{14} = 10^\circ 19' 41.61''$$

Check $\frac{\phi}{2} \Rightarrow \frac{20^\circ 40'}{2} = 10^\circ 20'$.

So $10^\circ 20' \approx 10^\circ 19' 41.61''$

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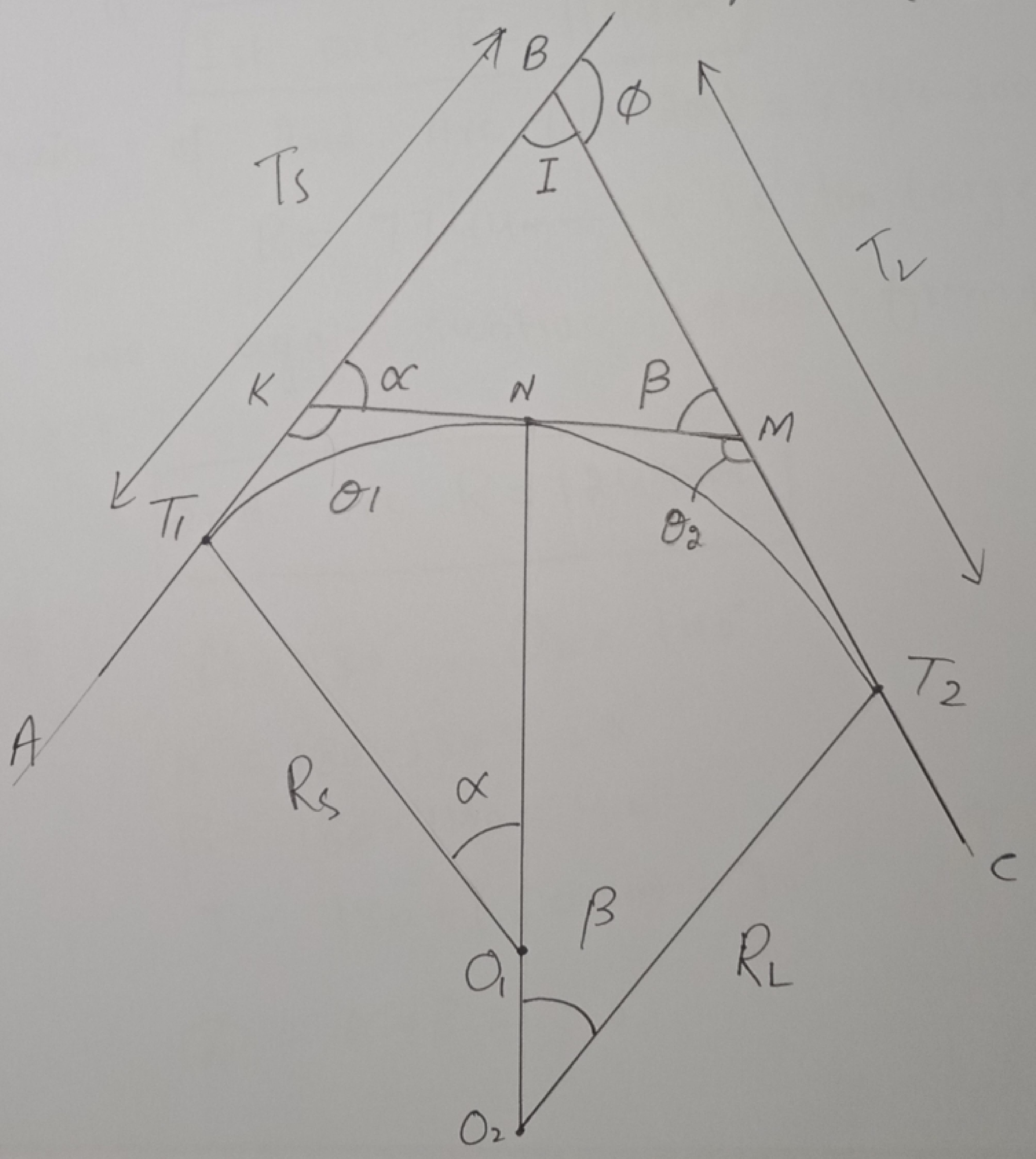
QNO#03 : Two tangents AB & BC are intersected by a line KM. The angle of AKM and KMC are 130° & 140° Respectively. The Radius of 1st arc is (1D-300) and 2nd arc is (1D-200)m. Find the chainage of tangent point and the point of compound curve given that the chainage of intersection point (1D-400)m.



SOLUTION :→

$\angle AKM = 130^\circ$

$\angle KMC = 140^\circ$

Radius of First arc $(ID - 300) = 7944 - 300$

$\Rightarrow 7644m$ it is too large

again we subtract 6500 from This valu

we get

$\boxed{1st\ arc\ R = 1144m}$

Radius of 2nd Arc $(ID - 200) = 7944 - 200$

$R = 7744m$ — it is too large

So we agais subtract 6500 from this

weget

$\boxed{2nd\ Arc\ R = 1244m}$

&

$\theta_1 = 130^\circ$, $\theta_2 = 140^\circ$

$\alpha = 180 - 130 = 50^\circ$

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

$I = 180 - (50 + 40) = 90^\circ$

$\phi = \alpha + \beta = 90^\circ$

Tangent length of small Radius of Curve

$T_1K = KN = R \tan\frac{\alpha}{2} = 1144 \tan\frac{50}{2} = 533.45\,m$

$$\boxed{T_1K = KN = 533.45\,m}$$

Tangent length of large Radius of Curve

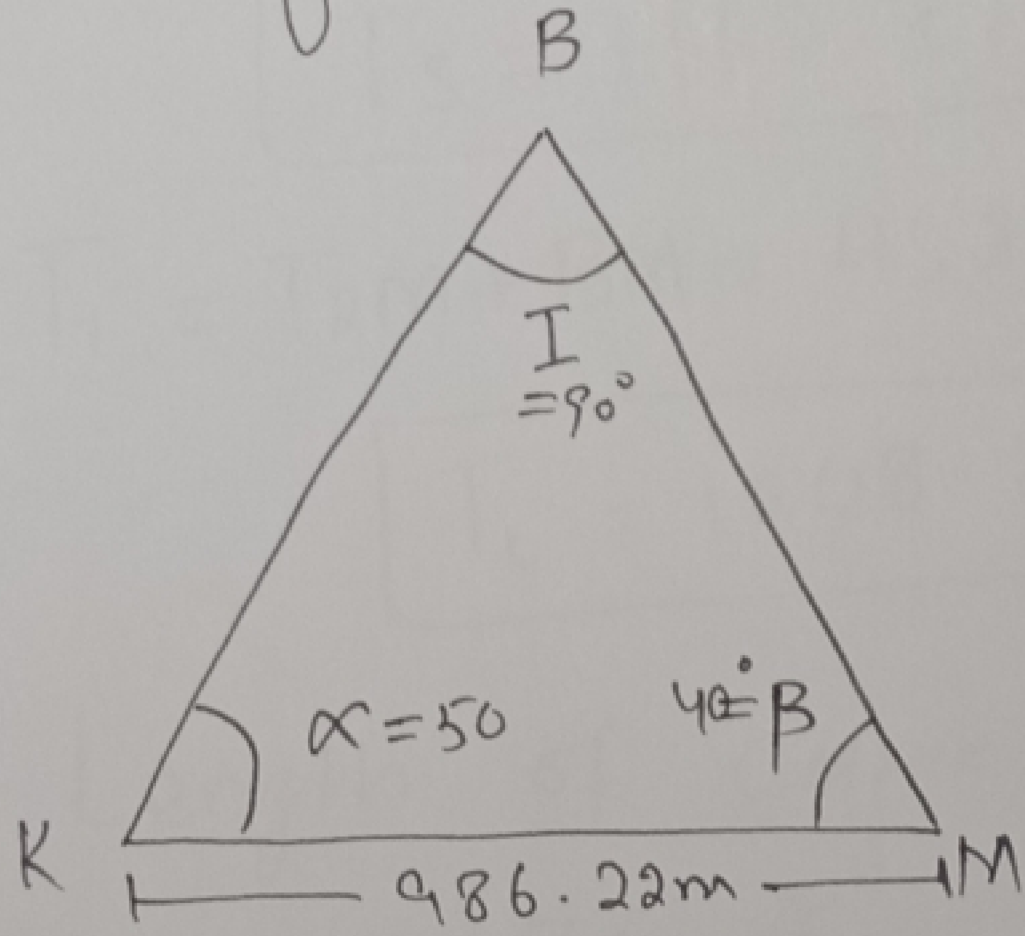
$T_2M = MN = R \tan\frac{\beta}{2} = 1244 \tan\frac{40}{2} = 452.77\,m$

$$\boxed{T_2M = MN = 452.77\,m}$$

So $KM = MT_2 + NK = 452.77 + 533.45$

$$\boxed{KM = 986.22\,m}$$

Now from the Triangle



Now we can find BK and BM By Sine Rule:→

$$\frac{BK}{\sin\beta} = \frac{MK}{\sin I}$$

$$BK = \frac{MK \sin\beta}{\sin I} = \frac{986.22 \sin 40^\circ}{\sin 90^\circ}$$

$$\boxed{BK = 633.929\,m}$$

$$\frac{BM}{\sin\alpha} = \frac{MK}{\sin I}$$

$$BM = \frac{MK \sin\alpha}{\sin I} = \frac{986.22 \sin 50}{\sin 90^\circ}$$

$$\boxed{BM = 755.48\,m}$$

$$T_s = T_1K + KB = 533.45 + 633.929$$

$$\boxed{T_s = 1167.379\,m}$$

$$T_{L_1} = T_2M + BM = 452.77 + 755.48$$

$$\boxed{T_L = 1208.25\,m}$$

& Length of curve of Small Radius :→

$$L_s = \frac{\pi R_s \alpha}{180^\circ} = \frac{(3.14)(1144)(50)}{180^\circ}$$

$$\boxed{L_s = 997.8\,m}$$

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& length of Curve of large Radius.

OR

2nd Arc Radius.

So $L_L = \frac{\pi R_L \beta}{180} = \frac{(3.14)(1244)(40)}{180}$

$$\boxed{L_L = 868.03\,m}$$

Now we can find chainage at different point of the curve.

→ Chainage of Intersection point (ID−400) m

So 7944 − 400 = 7544 m

→ Chainage of Intersection point = 7544 m

→ Minus Tangent length T_S = −1167.379 m

→ Chainage of T_1 = 6376.63 m

→ Plus Length L_S = + 977.8 m

→ Chainage at N point = 7354.43 m

→ Plus Length L_L = + 868.03 m

→ Chainage of T_2 = 8222.46 m

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