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Q:No=01

Solution

$R = 300m$

$\Delta = 60^\circ$

(a) Arc definition:

$S = 30m$

$$R = \frac{S}{D_a} \times \frac{180}{\pi}$$

$$\therefore \quad 300 = \frac{30 \times 180}{D_a \pi}$$

$$\boxed{D_a = 5.730} \text{ Ans}$$

(b) Chord definition:

$$R \sin \frac{D_c}{2} = \frac{S}{2}$$

$$300 \sin \frac{D_c}{2} = \frac{30}{2}$$

$$\boxed{D_C = 5.732} \text{ Ans}$$

(i) Length of the Curve:

$$\ell = R\Delta \frac{\pi}{180} = 300 \times 60 \times \frac{\pi}{180} = 314.16m$$

$$\boxed{\ell = 314.16m} \text{ Ans}$$

(ii) Tangent length:

$$T = R \tan \frac{\Delta}{2} = 300 \tan \frac{60}{2} = 173.21m$$

$\boxed{T = 173.21m}$ Ans

(iii) Length of long chord:

$$L = 2R \sin \frac{\Delta}{2} = 2 \times 300 \times \sin \frac{60}{2} = 300m$$

$\boxed{L = 300m}$ Ans

(iv) Mid-ordinate

$$M = R\left(1 - \cos \frac{\Delta}{2}\right) = 300\left(1 - \cos \frac{60}{2}\right) = 40.19m$$

$\boxed{M = 40.19m}$ Ans

(v) Apex distance:

$$E = R\left(\sec \frac{\Delta}{2} - 1\right) = 300\left(\sec \frac{60}{2} - 1\right) = 46.41m$$

$\boxed{E = 46.41m}$ Ans

Q=No=02

Given data:

$R = 200m$

$\Delta = 45°$

Solution:

$\therefore$ Length of tangent $= 200 \tan \frac{45}{2} = 82.84m$

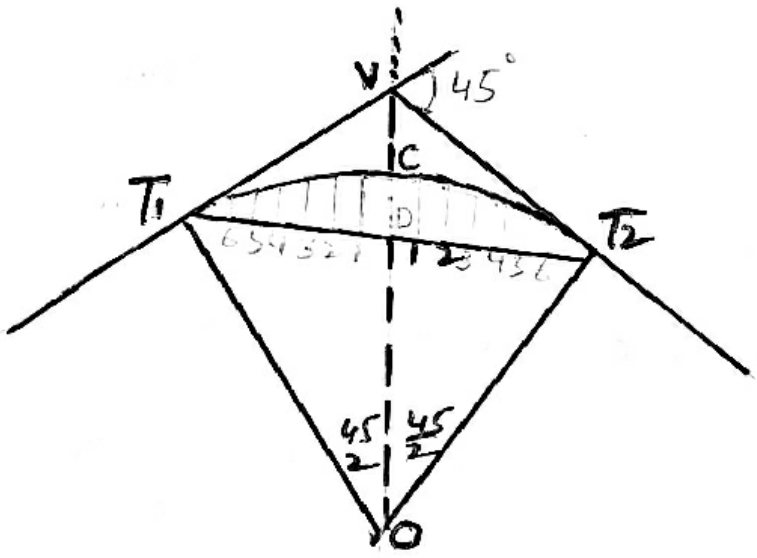
$\therefore$ chainage of $T_1 = 1839.2 - 82.84 = 1756.36m$

Length of Curve $= R \times 45 \times \frac{\pi}{180} = 157.08m$

chainage of forward tangent T_2

$= 1756.36 + 157.08 = 1913.44m$

By offset from long chord:



Distance of $DT = L_2 = R \sin \frac{\Delta}{2} = 200 \sin \frac{45}{2}$

(P-T-O)

Measuring 'x' from D

$$y = \sqrt{R^2 - x^2} \Rightarrow \sqrt{R^2 - (b/2)^2}$$

$x = 0$

$$O_0 = 200 - \sqrt{200^2 - 76.54^2} = 200 - 184.78$$

$$\boxed{O_0 = 15.22\text{m}}$$

$$O_1 = \sqrt{200^2 - 10^2} - 184.78 = 14.97\text{m}$$

$$O_2 = \sqrt{200^2 - 20^2} - 184.78 = \cancel{12.96\text{m}}\ 14.22\text{m}$$

$$O_3 = \sqrt{200^2 - 30^2} - 184.78 = 12.96\text{m}$$

$$O_4 = \sqrt{200^2 - 40^2} - 184.78 = 11.18\text{m}$$

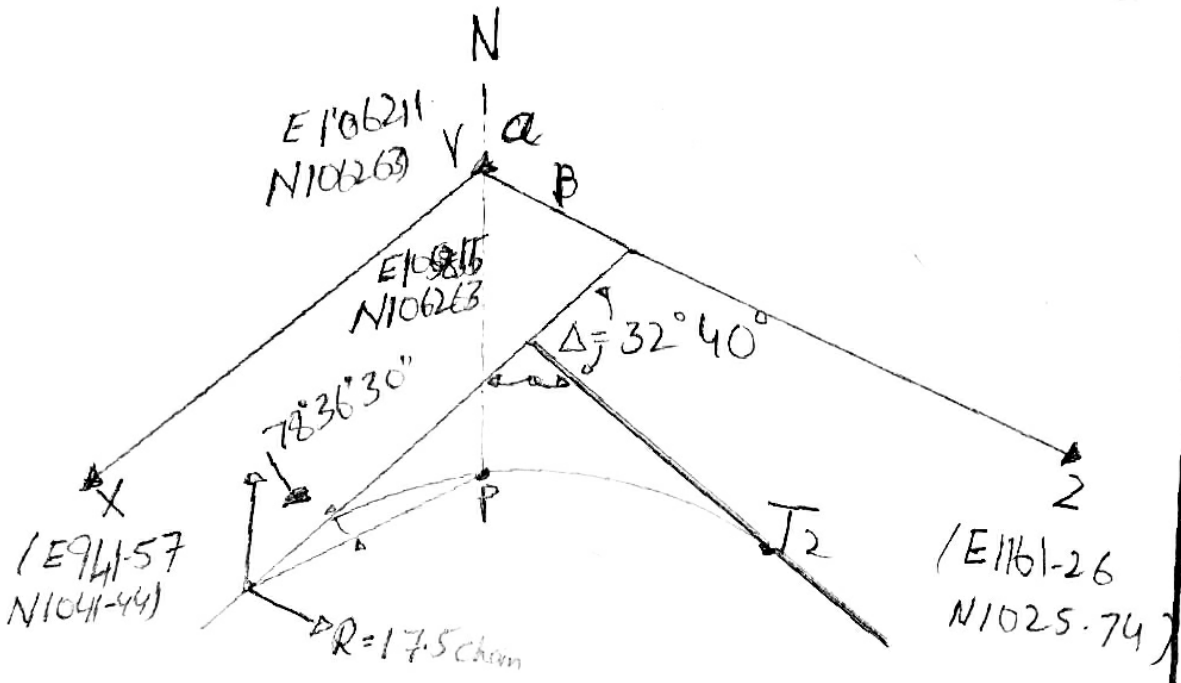
$$O_5 = \sqrt{200^2 - 50^2} - 184.78 = 8.87\text{m}$$

$$O_6 = \sqrt{200^2 - 60^2} - 184.78 = 6.01\text{m}$$

$$O_7 = \sqrt{200^2 - 70^2} - 184.78 = 2.57\text{m}$$

At $T_1, \theta = 0.00$

(P.T.O)


N
E1106211
N106263
V
a
B
E1106216
N106263
Δ = 32°40°
78°36'30"
X
P
Z
T2
(E941-57
N1041-44)
(E1161-26
N1025.74)
R=17.5 chain

Q = No: 03

Solution:

$$R = 17.5 \times 20 = 350\text{m}$$

$$\Delta = 32°40' = 32.667°$$

$$\frac{\Delta}{2} = 16°20'$$

Tangent length $T = R \tan \frac{\Delta}{2}$

$$= 350 \times \tan 16°20' = 102.57\text{m}$$

Length of Curve $l = \frac{\pi R \Delta}{180}$

$$= \frac{\pi \times 250 \times 32.667}{180} = 199.55\text{m}$$

Chainage of T_1 = chainage of P.I − T

$$= (51 + 9.35) - 102.57$$

$$= (51 \times 20 + 9.35) - 102.57$$

$$= 926.78\text{m} = 46 + 6.78$$

~~Cha~~ chainage of T_2 = chainage of $T_1 + l$

$$= 926.78 + 199.55 = 1126.33\text{m}$$

$$= 56 + 6.33$$

Length of first Sub-chord $C_f = (46+20)-(46+6.78) = 13.22m$

Length of last Sub-chord $C_l = (56+6.33)-(56+0) = 6.33m$

Number of normal chords = $N = 56 - 47 = 9$

Total number of chords $n = 9+2 = 11$

Coordinates of T_1 and T_2

Bearing of $IT_1 = \alpha = 180° + \text{bearing of } T_1I$

$= 180° + 78°36'30"$

$= 258°36'30"$

Bearing of $IT_2 = B = \text{Bearing of } IT_1 - \phi$

$= \text{Bearing of } IT_1 - (180° - \Delta)$

$= 258°36'30" - (180° - 32°40')$

$= 111°16'30"$

Coordinates of T_1

Easting of $T_1 = ET_1 = \text{Easting of } I + T\sin\alpha$

$= 1058.55 + 102.57 \times \sin 258°36'30"$

$E = 958.00m$

Northing of $T_1 = N_{T_1}$ = Northing of $I + T\cos\alpha$

$= 1045.04 + 102.57 \times \cos 258°36'30''$

$= N\ 1024.78m$

Coordinates of T_2

Easting of $T_2 = E_{T_2}$ = Easting of $I + T\sin\beta$

$= 1058.55 + 102.57 \times \sin 111°16'30''$

$= E\ 1154.13m$

Northing of $T_2 = N_{T_2}$ = Northing of $I + T\cos\beta$

$= 1045.04 + 102.57 \times \cos 111°16'30''$

$= N\ 1007.812m.$

Tangential angles:

$$\delta = 1718.9 \frac{c}{R} \text{ minutes}$$

$$\delta_1 = 1718.9 \frac{13.22}{350} = 64.825'$$

$$\delta_2 \text{ to } \delta_{10} = 1718.9 \frac{20}{350} = 98.223'$$

$$\delta_{11} = 1718.9 \frac{6.33}{350} = 31.088'$$

Deflection angles

$$\Delta_1 = \delta_1 = 64.925' = 1°04'55''$$

$$\Delta_2 = \Delta_1 + \delta_2 = 64.925' + 98.223' = 163.148' = 2°43'09''$$

Curve Ranging:

$$\Delta_3 = \Delta_2 + \delta_3 = 163.148' + 98.223' = 261.371' = 4°21'22''$$

$$\Delta_4 = \Delta_3 + \delta_4 = 261.371' + 98.223' = 359.594' = 5°5'36''$$

$$\Delta_5 = \Delta_4 + \delta_5 = 359.594' + 98.223' = 457.817' = 7°37'39''$$

$$\Delta_6 = \Delta_5 + \delta_6 = 457.817' + 98.223 = 556.040' = 9°16'02''$$

$$\Delta_7 = \Delta_6 + \delta_7 = 556.040' + 98.223 = 654.263' = 10°54'16''$$

$$\Delta_8 = \Delta_7 + \delta_8 = 654.263 + 98.223 = 752.486' = 12°32'29''$$

$$\Delta_9 = \Delta_8 + \delta_9 = 752.486' + 98.223' = 850.709' = 14°10'43''$$

$$\Delta_{10} = \Delta_9 + \delta_{10} = 850.709' + 98.223 = 948.932' = 15°48'56''$$

$$\Delta_{11} = \Delta_{10} + \delta_{11} = 948.932' + 31.088' = 980.020' = 16°20'00''$$

Check $\Delta_{11} = \frac{\Delta}{2} = 16°20'$ (Okay)

$C_4 = \sqrt{200^2 - 82.84^2} - 200 =$

(iii) offset from chord proclureed:

Length of first Sub-chord = 13.64m = C_1

Length of normal chord = 30m = C_2

Since length of chain is 157.08m, $C_3 = C_4 = C_5 = 30mm$

chainage of forward tangent = 1913.44m

= 63 chains + 23.44m

Length of last chord = 23.44m = $C_n = C_6$

$$O_1 = \frac{C_1^2}{2R} = \frac{13.64^2}{2 \times 200} = 0.47m$$

$$O_2 = \frac{C_2(C_1 + C_2)}{2R} = \frac{30(30 + 13.64)}{2 \times 200} = 3.27m$$

$$O_3 = \frac{C_2^2}{R} = \frac{30^2}{2 \times 200} = 4.5m = O_4 = O_5$$

$$O_6 = \frac{C_n(C_{n-1} + C_n)}{2R} = \frac{23.44(23.44 + 30)}{2 \times 200} = 3.13m$$

(iii) offset from chord produced:

Length of first Sub-chord = 13.64m = C_1

Length of normal chord = 30m = C_2

Since length of chain is 157.08m, $C_3 = C_4 = C_5 = 30$mm

chainage of forward tangent = 1913.44m

= 63 chains + 23.44m

Length of last chord = 23.44m = $C_n = C_6$

$$O_1 = \frac{C_1^2}{2R} = \frac{13.64^2}{2\times200} = 0.47m$$

$$O_2 = \frac{C_2(C_1+C_2)}{2R} = \frac{30(30+13.64)}{2\times200} = 3.27m$$

$$O_3 = \frac{C_2^2}{R} = \frac{30^2}{2\times200} = 4.5m = O_4 = O_5$$

$$O_6 = \frac{C_n(C_{n-1}+C_n)}{2R} = \frac{2344(23.44+30)}{2\times200} = 3.13m$$