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MAJOR MID ASSIGNMENT

INSTRUCTOR:
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Question No 1:

Sol:

$R = 300m$

$\Delta = 60°$

So

(A) Arc Definition:

$s = 30m$

$R = \frac{s}{D_a} \times 180/\pi$

$300 = \frac{30 \times 180}{D_a \pi}$ or $D_a = 5.730$

(B) Chord Definition:

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

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

$\therefore \quad D_c = 5.732.$

(i) Length of the curve:

$l = R\Delta \frac{\pi}{180}$

$= 30 \times 60 \times \pi/180 \quad = 314.16m$

(ii) Tangent length:

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

$$= 300 \tan \frac{60}{2} = 173.21\,m$$

(iii) Length of long chord:

$$L = 2R \sin \frac{\Delta}{2}$$

$$= 2 \times 300 \times \sin \frac{60}{2} = 300\,m.$$

(iv) Mid-ordinate:

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

$$= 300\left(1 - \cos \frac{60}{2}\right)$$

$$= 40.19\,m.$$

(v) Apex Distance:

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

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

Question No 2:

Sol:

$R = 200\,m$

$\Delta = 45°$

Chainage = 1839.2m.

$\therefore$ 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

$= 1756.36 + 157.08 = 1913.44m$

(A) By offsets from long chord:

Distance of DT $= \frac{L}{2} = R \sin \frac{\Delta}{2}$

$= 200 \sin \frac{45}{2}$

$= 76.54$

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Measuring 'x' from 'D'

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

$x = 0$

At

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

$= 200 - 184.78$

$= 15.22m$

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

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

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

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

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

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

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

At T_1 $O = 0.00$

(B) Method of Bisection:

Central ordinate at $D = R\left(1 - \cos\frac{\Delta}{2}\right)$

$= 200\left(1 - \cos\frac{45}{2}\right)$

$= 15.22$

Ordinate at $D_1 = R\left(1-\cos\frac{\Delta}{4}\right)$

$= 200\left(1-\cos\frac{45}{4}\right)$

$= \cancel{38}.\ 3.84\,m$

Ordinate at $D_2 = R\left(1-\cos\frac{\Delta}{8}\right)$

$= 200\left(1-\cos\frac{45}{8}\right)$

$= 0.96\,m$

(c): Offsets from Chord.

Length of first sub-chord $= 13.64\,m = C_1$

Length of normal chord $= 30\,m = C_2$

Length of chain $157.08\,m$, $C_3 = C_4 = C_5 = 30\,m$

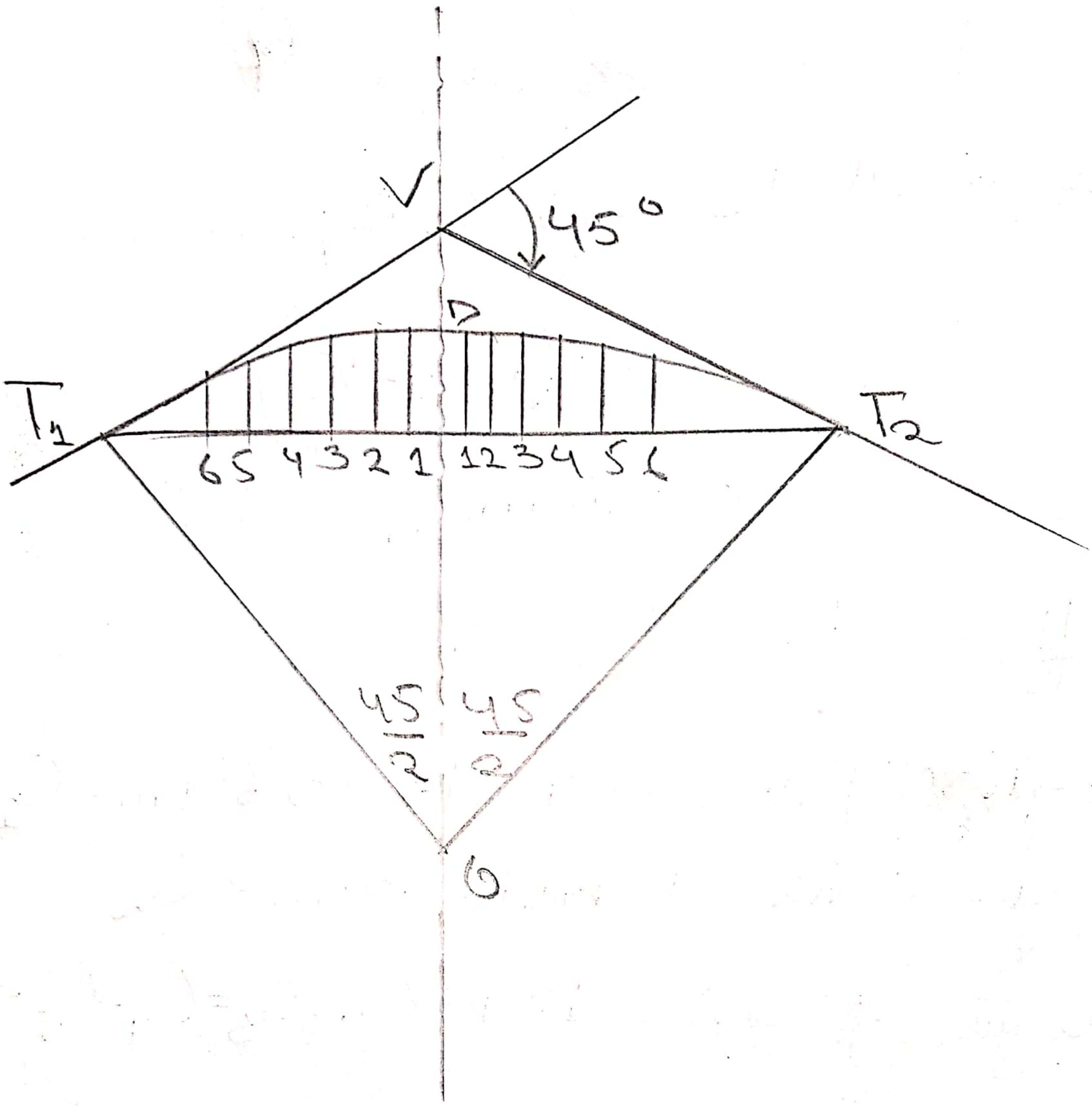
Length of last chord $= 23.44\,m = C_n = C_6$

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

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

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

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


V
45°
D
T1
T2
6 5 4 3 2 1 1 2 3 4 5 6
45/2 45/2
O

Question No 3:

Sol:

$R = 17.5 \times 20 = 350\,m$

$\Delta = 32°40' = 32.667°$

$\frac{\Delta}{2} = 16°20'$

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

$= 350 \times \tan 16°20' = 102.57\,m$

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

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

Chainagee of T_1 = Chainage of P.I − T

$= (51 + 9.35) - 102.57$

$= 926.78\,m = 46 + 6.78$

Chainage of T_2 = Chainage of $T_1 + l$

$= 926.78 + 199.55 = 1126.33\,m$

$= 56 + 6.33$.

Length of first sub-chord $= (46+20) - (46+6.78)$

$= 13.22\,m$

Length of last sub-chord $= C_2 = (56+6.33) - (56.0)$

$= 6.33\,m$

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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 $IT_1 = \alpha = 180° +$ bearing of $T_1 I$

$= 180° + 78°36'30''$

$= 258°36'30''$

Bearing of $IT_2 = \beta =$ Bearing of $IT_1 - \phi$

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

$= 258°36'30'' - (180° - 32°40')$

$= 111°16'30''$

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 $I + T \sin\beta$

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

$=$ N 1007.812m

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Tangential angles

$\delta = 1718.9 \frac{C}{R}$ minutes

$\delta_1 = 1718.9 \frac{13.22}{350} = 64.925'$

δ_2 to $\delta_{10} = 1718.9 \frac{20}{350} = 98.223'$

$\delta_{11} = 11718.9 \frac{6.33}{350} = 31.088'$

Deflection Angles:

$\Delta_1 = \delta_1 = 64.925' = 1°4'55''$

$\Delta_2 = \Delta_1 + \delta_2 = 64.925' + 98.223'$

$= 163.148' = 2°42'09''$

Curve Ranging:

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

$\Delta_4 = \Delta_3 + \delta_4 = 261.371' + 98.223' = 359.594' = 5°59'36''$

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

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

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

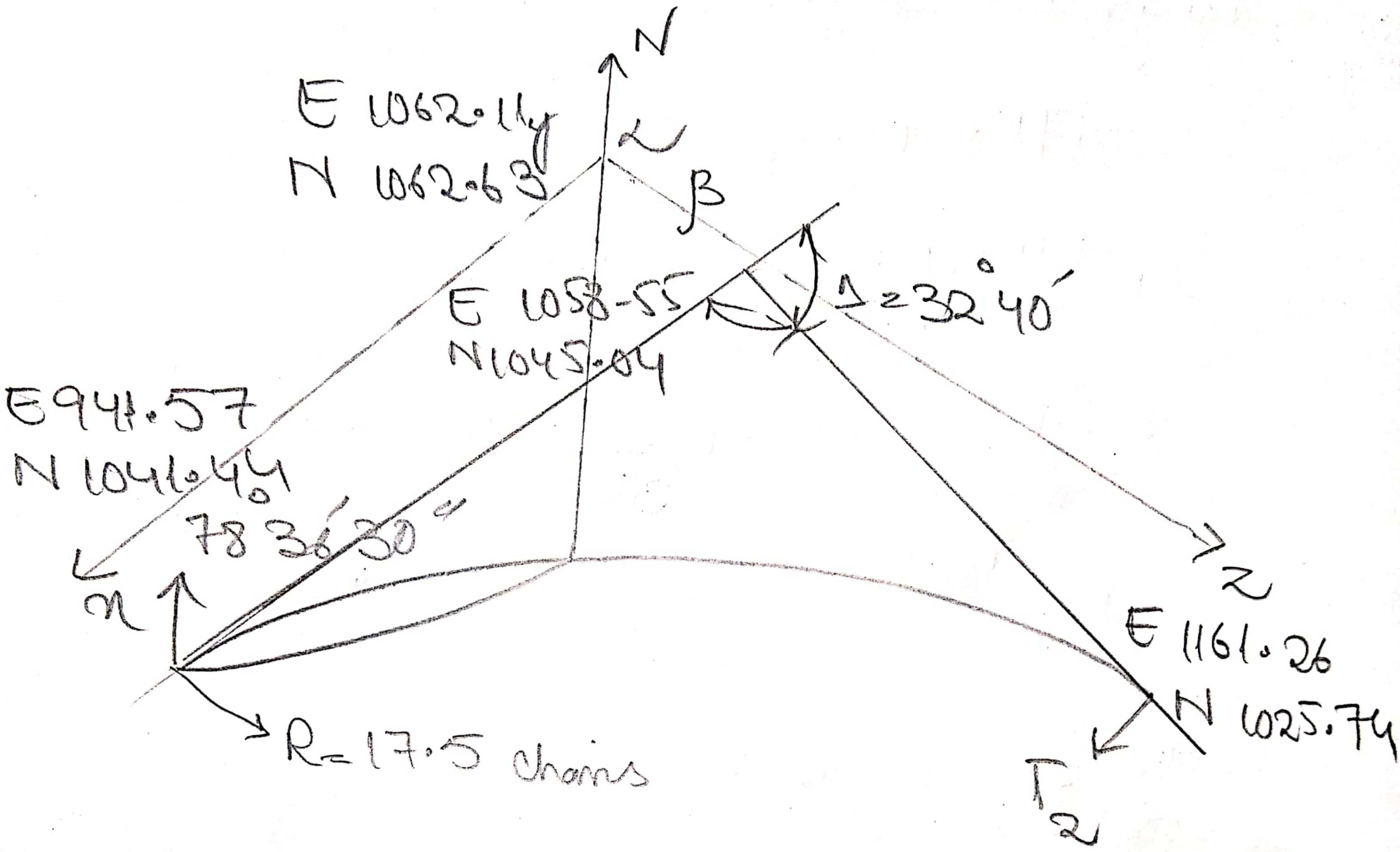
$\Delta_8 = \Delta_7 + \delta_8 = 654.263' + 98.223' = 752.486' = 12°32'29''$

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

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

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

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


N
E 1062.14
N 1062.63
α
β
E 1058.55
N1045.04
Δ=32°40′
E941.57
N 1041.44
78 36′ 30″
x
z
E 1161.26
N 1025.74
R=17.5 chains
T2