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Section = B

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QNO1:- Solution:-

$$R = 300mm \quad \Delta = 60^\circ$$

ⓐ=> Arc definition

$$S = 30m.$$

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

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

ⓑ=> Chord definition

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

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

=> $$D_c = 5.732$$

(i) Length of curve:

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

(ii) Tangent length:

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

(iii) Length of long chord:-

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

(iv) Mid-ordinate:

$$M = R\left(1-\cos\frac{\Delta}{2}\right) = 300\left(1-\cos\frac{60}{2}\right) = 40{\cdot}19\,m$$

(v) Apex distance:

$$E = R\left(\sec\frac{\Delta}{2}-1\right) = 300\left(\sec\frac{60}{2}-1\right) = 46{\cdot}41\,m.$$

QNO#2:-

Solution:-

$R = 200m \quad \Delta = 45°$

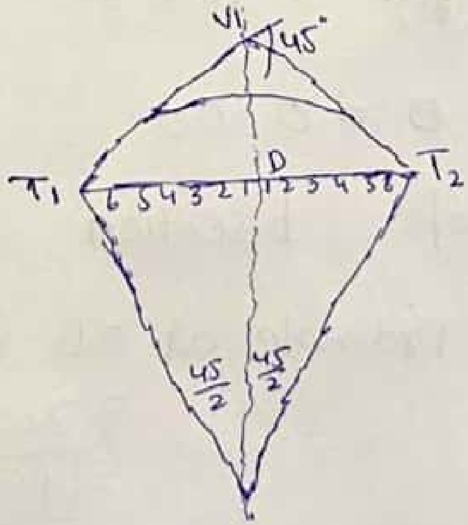
∴ Length of tangent $= 200 \tan \frac{45}{2} = \boxed{82.84m}$

∴ Chainage of T_1 $= 1839.2 - 82.84$
$\boxed{= 1756.36m}$

length of curve $= R \times 45 \times \pi/180$
$\boxed{= 157.08 m}$

Chainage of forward tangent T_e
$= 1756.36 + 157.08 - 1913.99m$

ⓐ By off sets from Angthord



Distance of $DT = l/2 = R \sin \frac{\Delta}{2} = 200 \sin 45/2$
$= \boxed{76.54}$

Measuring 'x' from D
$y = \sqrt{R^2 - x^2} - \sqrt{R^2 - (l/2)^2}$

At $x = 0$

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

$$= \boxed{15.220}$$

$$O_1 = \sqrt{(200)^2 - (20)^2} - 184.78 = 14.97m$$

$$O_2 = \sqrt{(200)^2 - (10)^2} - 184.78 = 14.27m$$

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

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

$$O5 = \sqrt{(200)^2 - (50)^2} - 184.78 = 8.87m$$

$$O6 = \sqrt{(200)^2 - (60)^2} - 184.78 = 6.09m$$

$$O7 = \sqrt{(200)^3 - (70)^2} - 184.78 = 2.57m$$

AT T_1 O = 0.00

h) Method of bisection

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

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

$$= \boxed{15.22}$$

Ordinate at

$$D_1 = R (1 - \cos \frac{\Delta}{4}) = 200 (1 - \cos \frac{45}{4})$$

$$= \boxed{3.84m}$$

Ordinate at

$$D_2 = R (1 - \cos \frac{\Delta}{8}) = 200 (1 - \cos \frac{45}{8})$$

$$= \boxed{0.96m}$$

(C) offsets from tangents:

$$O_x = \sqrt{R^2 - x^2} - R$$

chainage of T_1 = 56.36m

for 30m chain it is at = 58 chains + 16.36m

$x_1 = 30 - 16.36 = 13.64\,m$

$x_2 = 43.64\,m$

$x_3 = 73.64\,m$

and last is at x_4 = Tangent length = 82.84m

$$O_1 = \sqrt{(200)^2 + (13.64)^2} - 200 = 0.46m$$

$$O_2 = \sqrt{(200)^2 + (4364)^2} - 200 = 4.71m$$

$$O_3 = \sqrt{(200)^2 + (7364)^2} - 200 = 13.13m$$

$$O_4 = \sqrt{(200)^2 + (8284)^2} - 200 = 16.48m$$

(D) offsets from chord produced length of first sub-chord $= 13.64 = C_1$

length of normal chord $= 30 = C_2$

~~Sing~~ Since length chain is 157.08m ($C_3 = C_4 = C_5 = 30$

Chainage of forward tangent - 1913.44m
= 63 chains + 23.44m

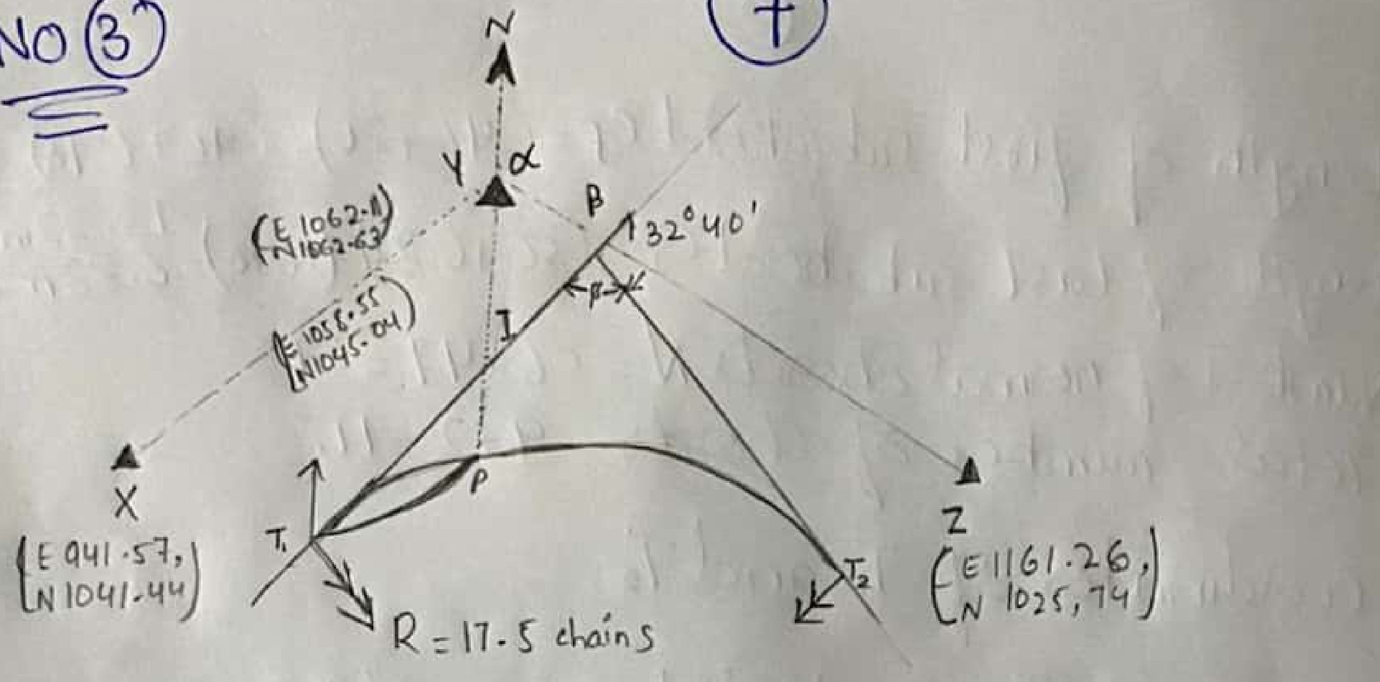
$$O_1 = \frac{C_1^2}{2R} = \frac{13.64^2}{2 \times 200} = 0.47$$

$$O_2 = \cancel{C_2}\frac{(2(C_1+C_2)}{2R} = \frac{30(30+13.64)}{2 \times 200} = 327$$

$$O_4 = \frac{C_n(C_{n-1}+C_a)}{2R} = \frac{23.44(23.44+30)-1}{2 \times 300}$$

$$= \boxed{3.13m}$$

QNO 3



Solution: $R = 17.5 \times 20 = 350m$

$\Delta = 32°40' = 32.667°$

$\frac{\Delta}{2} = 16°20'$

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

$= 350 \times \tan 16°20' = 102.57m$

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

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

Chainage of T_1 = Chainage of P.I. − T

$= (51 + 9.3.5) - 102.57$

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

$= 926.78m = 46 + 6.78$

Chainage of T_2 = Chainage of T_1 + I

$= 926.78 + 199.55 = 1126.33m$

$= 56 + 6.33.$

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 $= 9+2 = 11.$

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_1

Easting of $T_1 = E_{T1} =$ Easting of $I + T \sin \alpha$

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

$= E\ 958.00m$

Nothing of $T_1 = N_{T1} =$ Nothing of $I + T \cos \alpha$

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

$= N\ 1024.78\ m.$

Coordinates of T_2

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

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

$= E\ 1154.13\,m$

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

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

$= N\ 1007.812\,m$

Tangential angles

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

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

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

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

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

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

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

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

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

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

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

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

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

$\Delta_{11} = \Delta_{10} + \delta_{11} = 948.932' + 98.223' = 980.020'$
$= 16°20'00''$

Check: $\Delta_{11} = \frac{\Delta}{2} = 16°21'$