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I.D # 7712

Sec : A

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Question: 01

Solution:

As we know that

$R = 300m$

$\Delta = 60^\circ$

(a) Arc definition:

As we have from Arc definition

$S = 30m$

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

So

$$300 = \frac{300 \times 180}{Da\,\pi}$$

$$300 = \frac{300 \times 180}{Da \times 3.14}$$

$$Da = \frac{300 \times 180}{300 \times 3.14}$$

$$\boxed{Da = 57.32}$$

(b) Chord definition:

From chord definition we have

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

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

$$\sin \frac{Dc}{2} = \frac{30}{2 \times 300}$$

$$\frac{Dc}{2} = \sin^{-1}(0.05)$$

$$Dc = 2 \times 2.86$$

$$\boxed{Dc = 5.73}$$

(i) **Length of The Curve:**

As we know from length of curve

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

$$L = 300 \times 60 \times \frac{\pi}{180}$$

$$= 300 \times 60 \times \frac{3.14}{180}$$

$$\boxed{L = 314 \text{ m}}$$

(ii) **Tangent length:**

As we have from tangent length

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

$$T = 300 \times 0.577$$

$$\boxed{T = 173.1 \text{ m}}$$

(iii) **Length of long chord:**

As we know from length of long chord

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

$$= 2 \times 300 \times \sin\frac{60}{2}$$

$$= 2 \times 300 \times 0.5$$

$$\boxed{L = 300 \text{ m}}$$

(iv) Mid-ordinate:

As we know that from mid-ordinate

$$M = R\left[1 - \cos\frac{\Delta}{2}\right]$$

$$= 300\left[1 - \cos\frac{60}{2}\right]$$

$$\boxed{M = 40.19\,m}$$

(v) Apex-distance:

As we know from Apex distance

$$E = R\left[\sec\frac{\Delta}{2} - 1\right]$$

$$= 300\left[\sec\frac{60}{2} - 1\right]$$

$$\boxed{E = 46.41\,m}$$

Question: 02

Solution:

As we know that

$R = 200m$

$\Delta = 45^0$

Length of Tangent $= 200 \tan 45/2 = 82.84m$

Chainage of $T_1 = 1839.2 - 82.84 = 1756.36m$

Length of Curve $= R \times 45 \times \pi/180 = 157.08m$

Chainage of forward tangent $T_2 = 1913.44m.$

OFF sets from chords:

As we know that

Length of first sub-chord = 13.64 m = C_1

Length of normal chord = 30 m = C_2

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

Chainage of forward tangent = 1913.44 m

= 63 chains + 23.44 m

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

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

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

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

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

$$\boxed{O_6 = 3.13\text{m}}$$

Question: 03:

Solution:

As we know that

$R = 17.5 \times 20$

$= 350 m$

$\Delta = 32°40'$

$= 32.667°$

Now $\frac{\Delta}{2} = 16°20'$

Tangent Length $T = R \tan \Delta/2$

$= 350 \times \tan 16°20'$

$= 102.57 m$

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

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

Chainage of T_1 = Chainge of P.I − T

$= (51 + 9.35) - 102.57$

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

$\Rightarrow 926.78 m = 46 + 6.78$

Chainage of T_2 = Chainage of $T_1 + l$

$= 926.78 + 199.55$

$= 1126.33 m$

$= 56 + 6.33.$

Also

Length of first sub-chord $c_7 = (46+20) - (46+6.78)$

$= 13.22\,m$

Length of last sub-chord $= c_l = (56+6.33) - (56+0)$

$= 6.33\,m$

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

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

Co-ordinates of T_1 and T_2

Bearing of $IT_1 = \alpha = 180^\circ +$ bearing of T_1I

$= 180^\circ + 78^\circ 36' 30''$

$= 258^\circ 36' 30''$

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

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

$= 258^\circ 36' 30'' - (180^\circ - 32^\circ 40')$

$= 111^\circ 16' 30''$

Co-ordinates of T_1

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

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

$= E\,958.00\,m$

Northing of $T_1 = NT_1 =$ Northing of $I + T\cos\alpha$

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

$= N\,1024.78\,m$

Now

Co-ordinates of T_2

Easting of $T_2 = ET_2 =$ Easting of $1 + T\sin B$

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

$= E\ 1154.13m$

Northing of $T_2 = NT_2 =$ Northing of $1 + T\cos B$

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

$= N\ 1007.812m$

Tangential Angles

$\delta = 1718.9\ c/R$ minutes

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

$\delta_1 = 64.925'$

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

$= 98.223'$

$\delta_{11} = 1718\ \frac{6.33}{350}$

$\delta_{11} = 31.088'$

Now

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

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

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

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

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

[illegible]

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

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

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

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

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

Apply Check

So $\Delta_{11} = \frac{\Delta}{2} = 16^\circ 20'$ [okay]