Name: Nadir Aziz
ID : 7547
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Submitted To: Engr. Abdul Farhan.

Q1a Two tangent meet at a chainage of 7547ft with the ∠ deflection angle of ~~14°13'23"~~, 14°13'23". Degree of curve 5°. Calculate i) Chainage at the beganing and end of the curve.
(ii) Length of long chord.
(iii) Mid ordinate & External distance.

Salution.

Tangent meet at chainage = 7547ft
Deflection angle = 14°13'23".
Degree of Curve = 5°

Solution

$D = 5°$

$R = 5729.58/D$

$= \frac{5729.58}{5°} = 1145.91 ft.$

Tangent length $= BT_1 = BT_2 = R \tan(\frac{\phi}{2})$

$BT_1 = BT_2 = 1145.91 \times \tan\left(\frac{14°13'23''}{2}\right)$

$BT_1 = BT_2 = 142.96 ft$

Length of curve $= L = \frac{\pi R \phi}{180}$

$L = \frac{\pi \times 1145.91 \times 14°13'23''}{180}$

$L = 284.45 ft$

Chainage of intersection point = 7547
Minus tangent length = 142.96ft
Chainage of T_1 = 7404.04ft
Plus L = 284.45ft
Chainage of T_2 = 7688.49ft.

length of chard = $l = 2R\sin(\Phi/2)$
$= 2 \times 1145.91 \times \sin\left(\frac{14^\circ 13' 23''}{2}\right)$
$= 283.72ft$

Mid ordinate $= R(1-\cos(\Phi/2))$
$= 1145.91\left(1-\cos\left(\frac{14^\circ 13' 23''}{2}\right)\right)$
$= 8.81ft$

External Distance $= R(\sec(\Phi/2)-1)$

$= 1145.91\left(\sec\left(\frac{14^\circ 13' 23''}{2}\right)-1\right)$

$= 8.88ft.$

Q1B Find the area from the data obtained from chain survey as shown in table below - - - - .

Chainage(m)	0	30	60	90	120	150
offset (m)	7.547	10.547	11.547	5.547	3.547	4.347

offset = 6
intercept = 5
interval = 30

offset No	offset	Simpson Multiplier	Product.
1	7.547	1	7.547
2	10.547	4	42.188
3	11.547	2	23.094
4	5.547	4	22.184
5	3.547	1	3.547
			Σ = 98.564

Area $(h_1 - h_5) = 30/3 \times 98.564 = 985.64$

Area $(h_5 - h_0) = 30/2 (3.547 + 4.547)$

$= 121.41$

Total area = 98.564 + 121.41 = 1107.05 m

Q2 A circular curve of radius (ID = 7250)m deflecting right through 20°41' is to be act out b/w two straight having Chainage of the Point of intersection as (ID = 4600)m
Calculate all the data necessary for Setting out the curve using deflection angle methode, with peg interval being 20m.

Q2. Solution. Given data.

Circular radius = 7547 - 7250
= 284 m

Deflection angle = 20°40'

Point of intersection
7547 - 5000 = 2547

Interval = 20m.

Solution

$R = 284 \times 2 = 568m$

$BT_1 = BT_2 = R \tan \phi/2$

$BT_1 = BT_2 = 568 \tan \frac{20°40'}{2}$

$BT_1 = BT_2 = 103.56m$

Length of curve $L = \frac{\pi R \phi}{180}$

$= \frac{\pi \times 568 \times 20°40'}{180}$

$= 204.87m$

Chainage of point of intersection = 2547m
Minus tangent = -103.56
Chainage of T_1 = 2443.44
Plus L = + 204.87
Chainage of T_2 = 2648.31m
Length of curve of 1st chord = C_1 =
$C_1 = 2460 - 2443.44$
= 16.56 m

$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10} =$
$2648.40 - 2630$
= 18.40m

By deflection methode.

$$\delta_1 = \frac{1718.9 \times C_1}{60R} \text{ (degree)}$$

$$\delta_1 = \frac{1718.9 \times 16.56}{60 \times 568}$$

$$\boxed{\delta_1 = 0^\circ 50' 6.86''}$$

$$\delta_2 = \frac{1718.9 \times 30}{60 \times 568} \Rightarrow \boxed{1^\circ 0' 31.48''}$$

$$\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10}$$

$$\delta_{11} = \frac{1718.9 \times 18.40}{60 \times 568} \Rightarrow \boxed{\delta_{11} = 0^\circ 55' 40.96''}$$

Total deflection (tangential) angle for the chords is,

$\Delta_1 = \delta_1 = 0^\circ 50' 6.86''$

$\Delta_2 = \delta_1 + \delta_2 = 0^\circ 50' 6.86'' + 1^\circ 0' 31.48''$

$\Delta_2 = 1^\circ 50' 38.34''$

$\Delta_3 = 2^\circ 51' 9.82''$

$\Delta_4 = 3^\circ 51' 41.3''$

$\Delta_5 = 4^\circ 52' 12.78''$

$\Delta_6 = 5^\circ 52' 44.26''$

$\Delta_7 = 6^\circ 53' 15.74''$

$\Delta_8 = 7^\circ 53' 47.22''$

$\Delta_9 = 8^\circ 54' 18.7''$

$\Delta_{10} = 9^\circ 54' 50.18''$

$\Delta_{11} = 10^\circ 50' 31.34''$

Check $\Phi/2 = \frac{20^\circ 40'}{2}$

$\Rightarrow 10^\circ 20'$

Q3 Two tangents AB & BC are intersecting by KM.

Solution

* Given Data.

$\Delta AKM = 130^\circ$

$\Delta KMC = 140^\circ$

1st arc radius = 7547-300 = 7947 m

2nd arc radius = 7547-300 = 7347 m

Chainage of intersection point = 7547-400 = 7147 m

* Required.

Tangents Points = ?

Compound Curvature = ?

* Solution.

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

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

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

$I = 180 - \phi = 180 - 90^\circ = 90^\circ$

$KT_1 = KN = R_1 \tan(\alpha/2)$

$7947 \tan(50^\circ/2)$

$KT_1 = KN = 3379.33$ m

$MN = MT_2 = R_2 \tan(\beta/2)$

$= 7347 \tan(40/2)$

$MN = MT_2 = 2674.08$ m

$KM = MT_2 + KT_1 = 3379.33 + 2674.08$

$KM = 6053.41$ m

Now

$$\frac{BK}{MK \sin\beta} = \frac{1}{\sin I}$$

$BK = \frac{MK \sin\beta}{\sin I} = \frac{6053.41 \times \sin 40^\circ}{\sin 90} = 3891.05m$

$BM = \frac{MK \sin\alpha}{\sin I} = \frac{6053.41 \times \sin 50^\circ}{\sin 90} = 4637.18m$

$T_L = KT_1 + BK = 3379.33 + 3891.05 = 7270.38m$

$T_S = MT_2 + BM = 2674.08 + 4637.18 = 7311.26m$

$L_L = \frac{\pi R_L \alpha}{180} = \frac{\pi \times 7247 \times 50}{180} = 6324.20m$

$L_S = \frac{\pi R_S \beta}{180} = \frac{\pi \times 7347 \times 40}{180} = 5129.17m$

Chainage of intersection point
= 7147m

Chainage of intersection point $-T_L = -7270.38m$
Chainage of $T_1 = -123.38m$
Plus $L = +6324.26m$
$= 6200.88m$

Chainage of Compound curvature (M)
Plus $L_S = 5129.17m$
Chainage of $T_2 = 11330.05m$