(9)

External Distance = FB = $R\left(\sec \frac{\theta}{2} - 1\right)$

$$FB = BF = 1145.916\left(\frac{1}{\cos \frac{\theta}{2}} - 1\right)$$

$\therefore \sec = \frac{1}{\cos}$

$$BF = 1145.916\left[\frac{1}{\cos \frac{14°13'23''}{2}} - 1\right]$$

$$BF = 1145.916\,(1.007 - 1)$$

$$BF = 8.02141\ ft$$

(b) Find the area from the data obtained from chain survey, as show in table below. The first is 7940 ÷ 1000, 7.94.

Chainage (m)	0	30	60	90	120	150
Offset (m)	7.940	7.940 + 3	7.940 + 4	7.940 + 2	7.940 − 4	7.940−3

Simpson's One Thir Rule:

$$\text{Area} = b/3(h_1 + h_7 + 4(h_2 + h_4 + h_6) + 2(h_3 + h_5)$$

⇒ In General Case

$$\text{Area} = b/3\ (X + 2O + 4E)$$

X = Sum of first and last offset

O = Sum of the remaining odd offset

E = Sum of Even offset.

As intercept is even number. So we will calculate area from 1st to 5th. And the area b/w 5th and 6th is calculated separately.

offset No.	OFFSET	SIMPSON'S MULTIPLY	PRODUCT
1	7.940	1	7.940
2	10.94	4	43.76
3	11.94	2	23.88
4	5.94	4	23.76
5	3.94	1	3.94

E = 103.28

$\Delta 11 = 8°23'53.95''$

$\Delta_{12} = 9°11'31.6''$

$\Delta_{13} = 9°11'31.6'' + 3°24'47.89'' = 12°36'19.49''$

Check $\Delta_{13} = \theta/2 = 20°40' = 10°20'0''$

Tangent Length, $BT_1 = BT_2 = R \tan \theta/2$

$$BT_1 = BT_2 = 721.81 \tan\left(\frac{20^\circ 40'}{2}\right)$$

$$BT_1 = BT_2 = 721.81\ (0.18233)$$

$$BT_1 = BT_2 = 131.60\ m$$

Length of Curve:

$$L = \frac{\pi R \theta}{180^\circ} = \frac{3.14\ (721.81)\ (20^\circ 40')}{180^\circ}$$

$$= 260.225$$

Chainage at B:

	7540m
Minus tangent length	- 131.60 m
Chainage of T_1	= 7408.4m
Plus L	= 260.225 m
Chainage of T_2	= 7668.6m

$$\delta_2 = \frac{1718.9 \times C_2}{60 \times R}$$

$$= \frac{1718.9 \times 20}{60 \times 721.81}$$

$$\delta_2 = 0^\circ 47' 37.65''$$

So $\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = \delta_{12} = \delta_{13}$

Now total deflection Angle for the Chords

$$\Delta_1 = \delta_1 = 0^\circ 27' 37.44''$$

$$\Delta_2 = \delta_1 + \delta_2 = \Delta_1 + \delta_2 = 0^\circ 27' 37.44'' + 0^\circ 47' 37.65''$$

$$= 1^\circ 15' 15.09''$$

$$\Delta_3 = \Delta_2 + \delta_3 = 1^\circ 15' 15.09'' + 0^\circ 47' 37.65''$$

$$= 2^\circ 2' 52.74''$$

$\Delta_4 = 2^\circ 50' 30.39''$

$\Delta_5 = 3^\circ 38' 8.05''$

$\Delta_6 = 4^\circ 25' 45.7''$

$\Delta_7 = 5^\circ 13' 23.35''$

$\Delta_8 = 6^\circ 1' 1''$

$\Delta_9 = 6^\circ 48' 38.65''$

$\Delta_{10} = 7^\circ 36' 16.3''$

For No. of Chords:

$$= 7660 - 7420$$
$$= 240$$

Now divide by peg interval we get;

$$= \frac{240}{20} = 12 \text{ no. of chords}$$

And $C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10} = C_{11} =$

$$C_{12} = C_{13}$$

By Deflection Angle

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

$$\delta_1 = \frac{1718.9 \times C_1}{60 \times R} \text{ Degree}$$

$$\delta_1 = \frac{1718.9 \times 11.6}{60 \times 721.81} = 0^\circ 27' 37.44''$$

$$\delta_{24} = \frac{1718.9 \times C_{14}}{60 \times 721.81}$$

$$= \frac{1718.9 \times 8.6}{60 \times 721.81} \Rightarrow 3^\circ 24' 47.89''$$

Initial Cord :

7380 7400 7408.4 7420 7440

Initial cord = 7420 − 7408.4 (T_1)

Initial cord = 11.6 m (cg)

Final Cord:

7640 7660 7668.6 7680 7700

Final Cord = 7668.6 (T_2) − 7660

Final Cord = 8.6m(Cs)

Area $(h_1 - h_5) = \frac{30}{3}(103.28) = 1032.8 m^2$

Area $(h_5 - h_6) = \frac{30}{2}(3.97 + 4.94) = 133.65$

Total Area = $1032.8 + 133.65$

Total Area = $1166.45 m^2$

QUESTION No. 2:

A circular curve of radius $(7940 - 200)$ m deflecting right through $20°40'$ is to be set out b/w two straights having chainage of the point of intersection as $(7940 - 400)$m.

Calculate all the data necessary for setting out the curve using deflection angle method, with Peg interval being 20m.

Given Data:

$$\text{Radius} = \frac{7940}{11} = 721.81 \text{ m}$$

$$\theta = 20°40'$$

Chainage at B = $7940 - 400 = 7540$ m

Length of Curve:

$$\text{Length of Curve} = L = \frac{\pi R\theta}{180^\circ}$$

$$L = \frac{\pi(1145.916)(14^\circ 13' 23'')}{180^\circ}$$

$$L = 284.31\text{ft}$$

Chainage of point of intersection = 7+94.0

Minus tangent length = -2+90.37

Chainage of T1 =

Mid Ordinate:

$$\text{Mid Ordinate} = EF = R\left(1-\cos\theta/2\right)$$

$$EF = R\left[1-\cos\left(\frac{14^\circ 13' 23''}{2}\right)\right]$$

$$EF = 1145.916\left(1-0.992\right)$$

$$EF = 9.167\text{ft}.$$

$$R = \frac{5729.58}{D} \text{ ft}$$

$$R = \frac{5729.58}{5^\circ}$$

$$R = 1145.916 \text{ feet.}$$

Tangent length: $BT_1 = BT_2 = R \tan \theta/2$

$$BT_1 = BT_2 = 1145.916 \tan 14^\circ 13' 23''$$

$$B_{T_1} = BT_2 = 1145.916 (0.2534)$$

$$BT_1 = BT_2 = 290.37 \text{ feet}$$

Length of the Chord:

Length of chord - $l = 2R \sin(\theta/2)$

$$l = 2R \sin \theta/2$$

$$l = 2(1145.916) \sin\left(\frac{14^\circ 13' 23''}{2}\right)$$

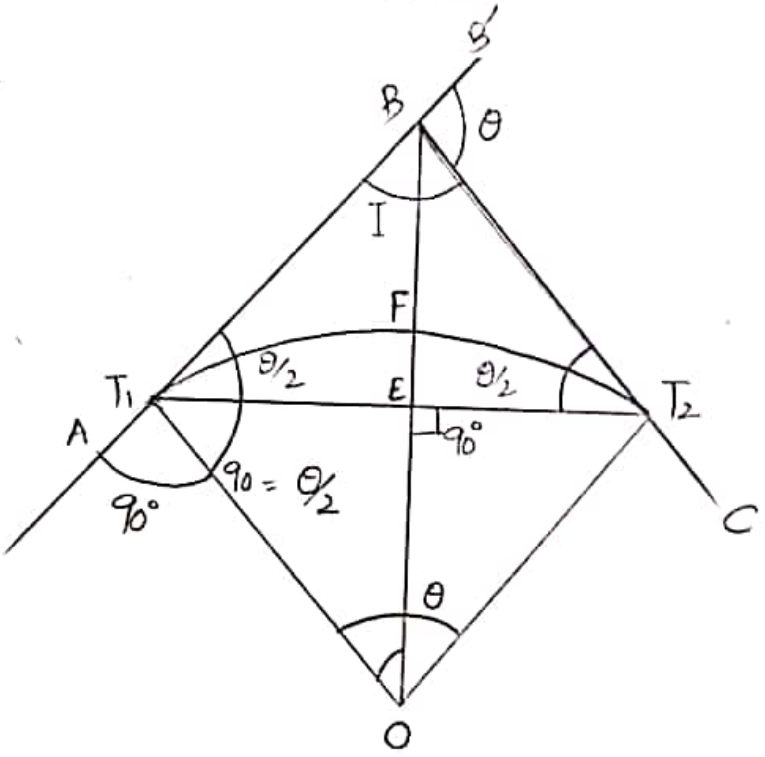
$$l = 2(1145.916)\ (0.123)$$

$$l = 281.89 \text{ ft}$$

Question No. 1:

(a) Two tangents meet at a chainage of 7+94.0 with deflection angle of 14°13'23". Degree of curve is 5°.

1. T_1, T_2
2. Length of Chord
3. Mid Ordinate and External Distance



Arc Definition:

Let R = Radius of curve
D = Degree of curve

Then $\frac{D}{360} = \frac{100}{2\pi R}$

Question No. 2:

A circular curve of radius (7940 - 200) m deflecting right through 20°40′ is to be set out b/w two straights having chainage of the point of intersection as (7940 - 400) m.

Calculate all the data necessary for setting out the curve using deflection angle method, with Peg interval being 20m.

Given Data:

$$\text{Radius} = \frac{7940}{11} = 721.81 \text{ m}$$

$$\theta = 20°40'$$

Chainage at B = 7940 - 400 = 7540 m.

Tangent Length, $BT_1 = BT_2 = R \tan \theta/2$

$$BT_1 = BT_2 = 721.81 \tan\left(\frac{20^\circ 40'}{2}\right)$$

$$BT_1 = BT_2 = 721.81\ (0.18233)$$

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Length of Curve:

$$L = \frac{\pi R\theta}{180^\circ} = \frac{3.14\ (721.81)\ (20^\circ 40')}{180^\circ}$$

$$= 260.225$$

Chainage at B:

7540m

Minus tangent length = -131.60 m

Chainage of T_1 = 7408.4m

Plus L = 260.225 m

Chainage of T_2 = 7668.6m