Q No (1) Part (a).

Two tangents meets at chainage of 7894 ft with deflection angle of 14°13'23", Degree of Curve is 5°.

Given Data:.

Chainage of intersection = 7894 ft.

Deflection angle = 14°13'23" = 14.22°

Degree of Curve = 5°.

Required:-

(i) Chainage at beginning and end of Curve = ?

(ii) Length of long chord = ?

(iii) Mid ordinate and External distance = ?

Solution:-

First we will find radius.

$$\text{Degree}\cdot\text{Radius} = \frac{18000}{\pi}$$

$$\text{Radius} = \frac{5729.578}{\text{Degree}}$$

Radius = 1145.916 ft.

Now tangent length.

$BT_1 = BT_2 = R \tan\left(\frac{\Phi}{2}\right)$

$= 1145.916 \tan\left(\frac{14.22}{2}\right)$

$= 142.963$ ft

Length of Curve

$L = R\pi \frac{\phi}{180} = \frac{1145.916 \times 3.14 \times 14.22}{180}$

$L = 284.456$ ft.

Now for chainage at T_1 and T_2.

Chainage of PI = 7894 ft

(begining)
Chainage of T_1 = 7894 − ~~284.456~~ 142.963

~~= 7609.544 ft~~ = 7751.037 ft

(End)
Chainage of T_2 = ~~7609.544~~ 7751.037 + length of Curve

~~= 7609.544 +~~

= 7751.037 + 284.456

Chainage of T_2 = 8035.493 ft.

Length of Cord $= 2R \sin\frac{\phi}{2}$

$= 2(1145.916)\sin\left(\frac{14.22}{2}\right)$

Length of chord $= 283.725$ ft.

Mid ordinates:

$EF = R\left(1 - \cos\left(\frac{\phi}{2}\right)\right)$

$= 1145.916\left(1 - \cos\frac{14.22}{2}\right)$

$= 8.8155$ ft

Now External distance

$BF = R\left(\frac{1}{\cos\left(\frac{\phi}{2}\right)} - 1\right)$.

$BF = 1145.916\left(\frac{1}{\cos\left(\frac{14.22}{2}\right)} - 1\right)$.

$BF = 8.8799$ ft.

Q No (1) Part (b)

Find Area from data obtained from Chain Survey as shown in table below, using Simpson one third rule.

Chainage (m)	0	30	60	90	120	150
Offset (m)	7.894	10.894	11.894	5.894	3.894	4.894

Solution

As we know by Simpson rule

$$Area = \frac{h}{3}\left(h_1 + h_n + 4(h_2 + h_4 + h_6 + \dots) + 2(h_3 + h_5 + \dots)\right)$$

But it is only used with odd numbers of offsets and even number of intercepts.

taken interval of 30m.

Now

$$Area(h_1 \text{ to } h_5) = \frac{30}{3}\left(7.894 + 10.894 + 4(5.894) + 2(11.894 + 3.894)\right)$$

$$Area(h_1 \text{ to } h_5) = \frac{30}{3}(18.788 + 23.576 + 31.576)$$

$$Area(h_1 \text{ to } h_5) = 739.4\ m^2$$

$$Area(h_5 \text{ to } h_6) = \frac{30}{3}(3.894 + 4.894) = \frac{30}{3}(8.788)$$

$$Area(h_5 \text{ to } h_6) = 87.88\ m^2$$

~~Total area~~

Total area = 739.4 + 87.88

Total area = 827.32 m^2

Q(8) No.

A Circular Curve of radius $(7894-7194 = 700m)$ deflecting through $20°40'$ is to be set out between two straights have point of Intersection $(7894-6794 = 1100m)$. Calculate all data necessary for setting out Curve using deflection angle method, with Peg interval of 20m.

Given Data:-

(R) Radius = 700m.

(Δ) Deflection Angle = $20°40' = 20.67$.

Chainage of PI = 1100m

Peg interval = 20m.

Required:-

Setting out Simple Curve by deflection method.

Solution:-

First length of tangent.

$$\text{length of tangent} = R \tan\left(\frac{\Delta}{2}\right)$$

$$= 1100 \tan\left(\frac{20.67}{2}\right)$$

$$\text{length of tangent} = 127.65\ m$$

$$\text{chainage of } T_1 = 1100 - 127.65$$

$$\text{Chainage of } T_1 = 972.35\ m$$

Length of Ist chord $= C_1 = 990 - 972.35$

$C_1 = 17.65$

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

length of Curve $= \frac{700 \times 20.67 \times 3.14}{180}$

length of Curve $= 252.40$

Chainage of T_2 = Chainage of $T_1 + L$

$= 972.35 + 252.40$

Chainage to T_2 $= 1224.75$ m

Number of Chords $= \frac{L - C_1}{20} = \frac{252.40 - 17.65}{20}$

Number of chords $= 11.73 = 12$ chords.

$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10} = C_{11} = 20$m.

$C_{12} = 1224.75 - 1210 = 14.75$m.

Now total deflection angles for chords.

$\delta_1 = 1765 \times C_1 = \dfrac{1765 \times C_1}{60 \times 700} = 0°44'30.19''$

$\delta_2 = \dfrac{1765 \times 20}{60 \times 700} = 0°50'25.71''$.

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

$\delta_{12} = \dfrac{1765 \times 14.75}{60 \times 700} = 0°37'11.46''$

~~Tangential angles.~~

$\Delta_1 = \delta_1 = 0°44'30.19''$.

$\Delta_2 = \delta_1 + \delta_2 = 0°44'30.19'' + 0°50'25.71'' = 1°34'55.9''$

$\Delta_3 = 2°25'21.61''$

$\Delta_4 = 3°15'47.32''$

$\Delta_5 = 4°6'13.03''$

$\Delta_6 = 4°56'38.74''$

$\Delta_7 = 5°47'4.45''$

$\Delta_8 = 6°37'30.16''$

$\Delta_9 = 7°27'55.87''$

$\Delta_{10} = 8°18'21.58''$

$\Delta_{11} = 9°8'47.29''$

$\Delta_{12} = 9°8'47.29'' + 0°37'11.46''$

$\Delta_{12} = 9°45'58.75''$

Q No (3)!

Two tangents AB and BC are intersected by a line KM. The angles AKM and KMC are 130° and 140° respectively. The radius of Ist arc is 7594m and 2nd arc is 7694m. Find the chainage of tangents Points and Point of Compound Curve given that chainage of intersection point is 7494m.

Given Data:

$\angle AKM = 130^\circ$

$\angle KMC = 140^\circ$

$R_S = 7594m$

$R_L = 7694m$

chainage of PI = 7494m.

Required

chainage of Tangents = ?

Solution:

We know that

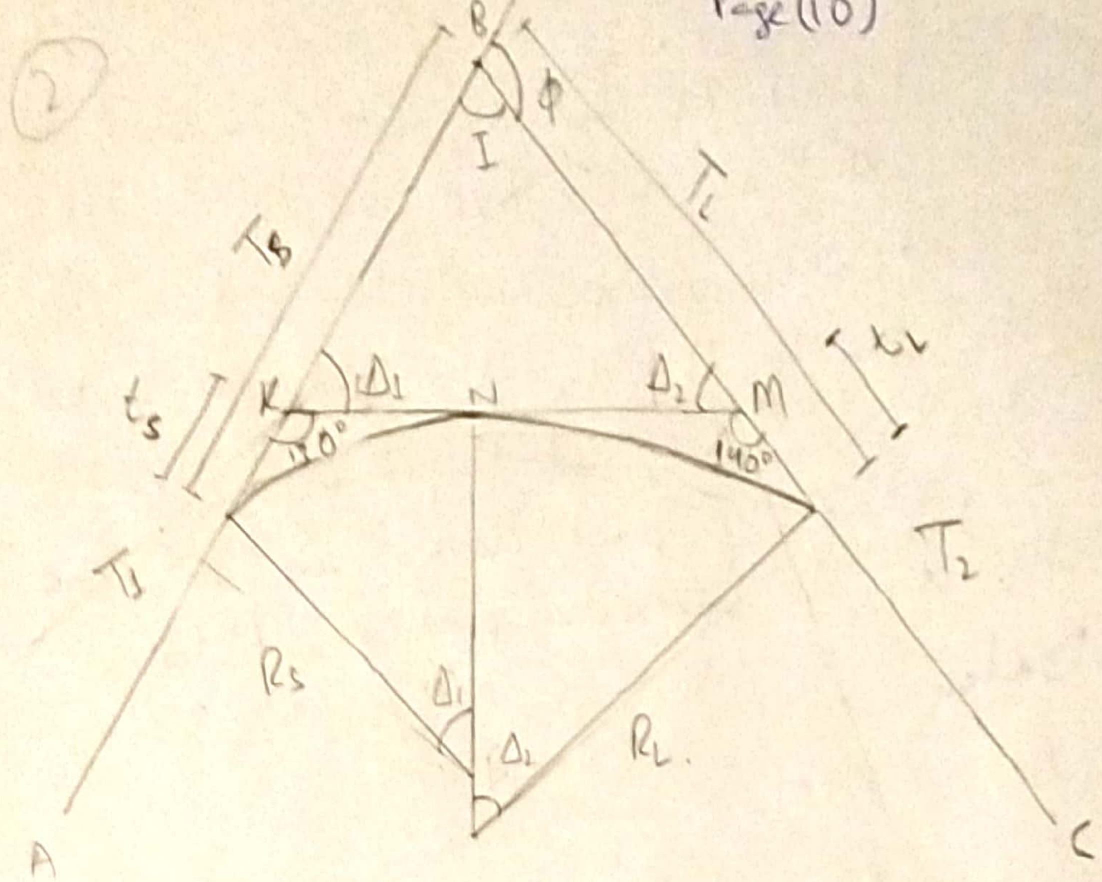
$\Delta_1 = 180^\circ - 130^\circ = 50^\circ$

$\Delta_2 = 180^\circ - 140^\circ = 40^\circ$

Now $\phi = 50 + 40 = 90^\circ$.

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

(2)



Now

$$t_s = KN = R_s \tan\left(\frac{\Delta_1}{2}\right)$$

$$t_s = 7594 \tan\left(\frac{50}{2}\right)$$

$$t_s = 3451.14\,m$$

$$t_L = MN = R_L \tan\left(\frac{\Delta_2}{2}\right)$$

$$t_L = 7694 \tan\left(\frac{40}{2}\right)$$

$$t_L = 2800.38\ m$$

$$KM = KN + MN = 3451.14 + 2800.38 = 6251.52\ m$$

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Now

From ΔBKM

$$\frac{BK}{\sin\Delta_2} = \frac{BM}{\sin\Delta_1} = \frac{KM}{\sin I}$$

$$\frac{BK}{\sin\Delta_2} = \frac{KM}{\sin I} \Rightarrow \frac{BK}{\sin 40^\circ} = \frac{6251.52}{\sin 90^\circ}$$

$BK = 4018.48m.$

$$\frac{BM}{\sin\Delta_1} = \frac{KM}{\sin I} \Rightarrow \frac{BM}{\sin 50^\circ} = \frac{6251.52}{\sin 90^\circ}$$

$BM = 4788.94m$

$T_s = BK + t_s = 4018.48 + 3451.14$

$T_s = 7469.62m.$

$T_L = BM + t_L = 478894 + 3451.14$

$T_L = 8240.08m.$

Now length of Curve.

$$L_s = \frac{\pi R_1 \Delta_1}{180} = \frac{3.14 \times 7594 \times 50}{180}$$

$$L_s = 6627.015\,m$$

$$L_L = \frac{\pi R_2 \Delta_2}{180} = \frac{3.14 \times 7694 \times 40}{180}$$

$$L_L = 5371.42\,m$$

Change of $T_1 = 7494 - 7469.62$

$= 24.38m + L.$

$= 24.38 + 6627.015$

Change of $T_1 =$ ~~6651~~ $6651.395m$

Change of $T_2 = 6651.395m + 5371.42$

$= 12022.815\,m.$