

(1)

Example/ The table illustrates the field measurements for closed traverse J, K, L, M. if the coordinates of points J and M were (3000, 3000) and (3780.32, 2670.18), respectively and $\angle A_2 A_3 = 188^\circ 31' 52''$. Compute:

1. The correct coordinates, bearing and lengths for the traverse.
2. Closing error and relative accuracy of traverse.

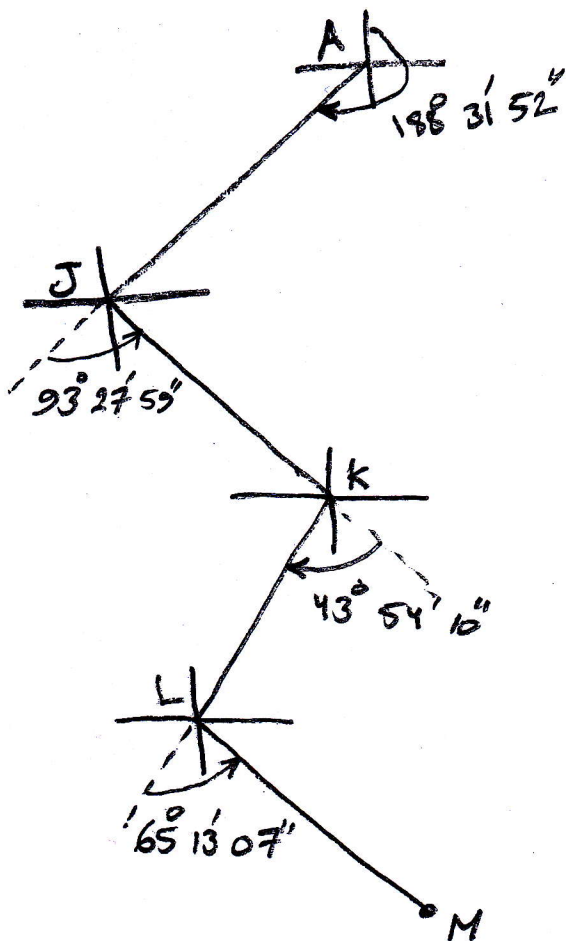
Point	line	Length	deflection angle
A			
	AJ		
J			$93^\circ 27' 59''$ L
	JK	346.95	
K			$43^\circ 54' 10''$ R
	KL	449.76	
L			$65^\circ 13' 07''$ L
	LM	144.82	
M			



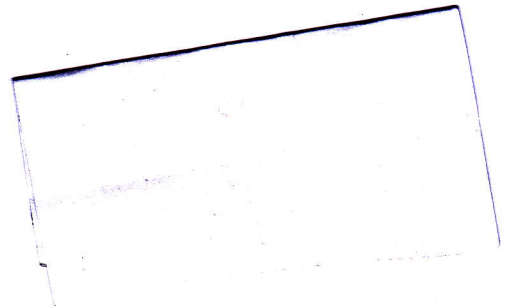
Sol.

(2)

Calculate azimuth of each side from deflection angle



$$\begin{aligned} Az AJ &= 188^{\circ} 31' 52'' \\ Az JK &= 188^{\circ} 31' 52'' - 93^{\circ} 27' 59'' = 95^{\circ} 03' 53'' \\ Az KL &= 95^{\circ} 03' 53'' + 43^{\circ} 54' 10'' = 138^{\circ} 58' 03'' \\ Az LM &= 138^{\circ} 58' 03'' - 65^{\circ} 13' 07'' = 73^{\circ} 44' 56'' \end{aligned}$$



Point	side	length	Azimuth	Dep.	Lat.	coordinate
J						($3000^x, 3000^y$)
	JK	346.95	$95^\circ 03' 53''$	+345.6	-30.63	
K						3345.6 2969.37
	KL	449.76	$138^\circ 58' 03''$	+295.26	-339.27	
L						3640.86 2630.1
	LM	144.82	$73^\circ 44' 56''$	+139.03	+46.53	
M						3779.89 2670.63

$$\Sigma = 941.53$$

$$\text{Dep.} = L \sin \theta \begin{cases} \rightarrow 346.95 \sin 95^\circ 03' 53'' = +345.60 \text{ (E)} \\ \rightarrow 449.76 \sin 138^\circ 58' 03'' = +295.26 \text{ (E)} \\ \rightarrow 144.82 \sin 73^\circ 44' 56'' = +139.03 \text{ (E)} \end{cases}$$

$$\text{Lat.} = L \cos \theta \begin{cases} \rightarrow 346.95 \cos 95^\circ 03' 53'' = -30.63 \text{ (S)} \\ \rightarrow 449.76 \cos 138^\circ 58' 03'' = -339.27 \text{ (S)} \\ \rightarrow 144.82 \cos 73^\circ 44' 56'' = +46.53 \text{ (N)} \end{cases}$$

$$\begin{aligned} X_K &= 3000 + 345.6 = 3345.6 & Y_K &= 3000 + (-30.63) = 2969.37 \\ X_L &= 3345.6 + 295.26 = 3640.86 & Y_L &= 2969.37 + (-339.27) = 2630.1 \\ X_M &= 3640.86 + 139.03 = 3779.89 & Y_M &= 2630.1 + 46.53 = 2670.63 \end{aligned}$$

$$\begin{aligned} \text{T.C for E} &= E_{\text{calc. last point}} - E_{\text{given for last point}} \\ &= 3779.89 - 3780.32 = -0.43 = R_x \end{aligned}$$

$$\begin{aligned} \text{T.C for N} &= N_{\text{calc. last point}} - N_{\text{given for last point}} \\ &= 2670.63 - 2670.18 = +0.45 = R_y \end{aligned}$$

$$\begin{aligned} \text{Closing error} &= \sqrt{R_x^2 + R_y^2} \\ &= \sqrt{(0.43)^2 + (0.45)^2} = 0.62 \end{aligned}$$

$$\text{Relative accuracy} = \frac{\text{Closing error}}{\text{total length of traverse}} = \frac{0.62}{941.53} \approx \frac{1}{1500}$$

(4)

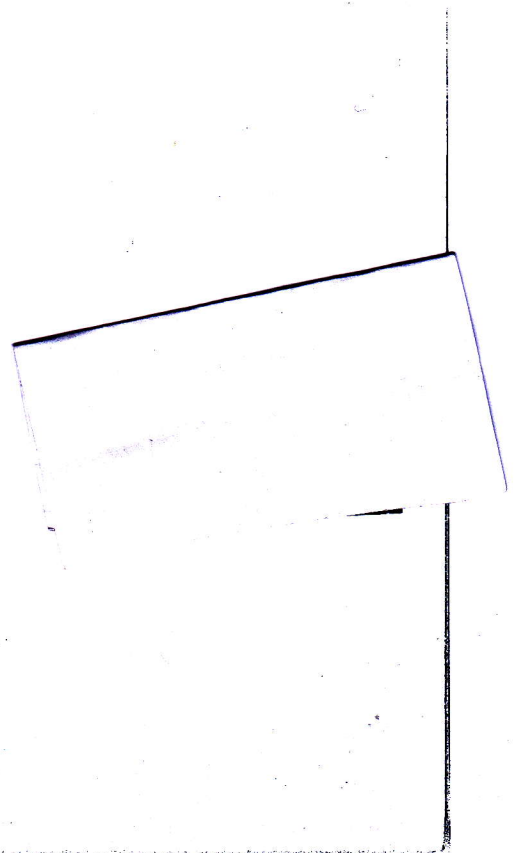
Calculation of correction for Departure and Latitude for each side

Departure :

$$\begin{aligned} JK &= \frac{+0.43}{941.53} * 345.6 = +0.16 \\ KL &= \frac{+0.43}{941.53} * 449.76 = +0.21 \\ LM &= \frac{+0.43}{941.53} * 144.82 = 0.07 \end{aligned} \quad \left. \vphantom{\begin{aligned} JK \\ KL \\ LM \end{aligned}} \right\} \Sigma = +0.43$$

Latitude

$$\begin{aligned} JK &= \frac{-0.45}{941.53} * 345.6 = -0.17 \\ KL &= \frac{-0.45}{941.53} * 449.76 = -0.21 \\ LM &= \frac{-0.45}{941.53} * 144.82 = -0.07 \end{aligned} \quad \left. \vphantom{\begin{aligned} JK \\ KL \\ LM \end{aligned}} \right\} \Sigma = -0.45$$



Point	side	Dep.	Lat.	Correction	Dep.	Lat.	Coordinate	Adj. Azimuth	Adj. Length
J		+345.6	-30.63	+0.16	-0.17	345.76	-30.8	95° 5' 26"	347.13
K	JK	+295.26	-339.27	+0.2	-0.21	295.46	-339.48	138° 57' 57"	450.05
L	KL	+139.03	+40.53	+0.07	-0.07	139.1	40.46	73° 46' 55"	144.86
M	LM					3780.32	2670.18		

$$JK = \theta = \tan^{-1} \frac{\text{Adj Dep.}}{\text{Adj Lat.}} = \tan^{-1} \frac{345.76}{-30.8} = -84^\circ 54' 35'' \rightarrow 180 - 84^\circ 54' 35'' = 95^\circ 5' 26''$$

$$KL = \tan^{-1} \frac{295.46}{-339.48} = -41^\circ 02' 02'' \rightarrow 180 - 41^\circ 02' 02'' = 138^\circ 57' 57''$$

$$LM = \tan^{-1} \frac{139.1}{40.46} = 73^\circ 46' 55''$$

$$\theta \text{ Dep.} = L \sin \theta \Rightarrow L_{\text{adj}} = \frac{\text{Dep. adjusted}}{\sin \theta}$$

$$L_{JK} = \frac{345.76}{\sin 84^\circ 54' 35''} = 347.13 \quad (\text{neglect negative sign})$$

$$L_{KL} = \frac{295.46}{\sin 41^\circ 02' 02''} = 450.05 \quad (\text{neglect negative sign})$$

$$L_{LM} = \frac{139.1}{\sin 73^\circ 46' 55''} = 144.86$$

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