

Ferris State University
Surveying Engineering
Surveying Computation - SURE 215
PROBLEM NUMBER 1
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Line/Line Intersection Problem

Write your answers in the spaces provided

Given Data:

Case 1

| <u>POINT NO.</u> | <u>NORTHING</u> | <u>EASTING</u> |
|------------------|-----------------|----------------|
| 1 | 4774.328 | 5917.368 |
| 2 | 4717.307 | 5697.844 |

Azimuth From 1 To 3 = 197 26 15.9

Azimuth From 2 To 3 = 151 38 52.4

Northing of point 3 = _____, Easting of point 3 = _____

Case 2

| <u>POINT NO.</u> | <u>NORTHING</u> | <u>EASTING</u> |
|------------------|-----------------|----------------|
| 1 | 4861.203 | 5000.031 |

Azimuth From 1 To 2 = 153 20 25.8

Distance From 1 To 2 = 607.640

Azimuth From 1 To 3 = 174 57 13.7

Distance From 2 To 3 = 328.251

NOTE: This Problem May Have Two Solutions

Solution 1: Northing of point 3 = _____, Easting of point 3 = _____

Solution 2 (if any): Northing of point 3 = _____, Easting of point 3 = _____

Case 3

| <u>POINT NO.</u> | <u>NORTHING</u> | <u>EASTING</u> |
|------------------|-----------------|----------------|
| 1 | 4772.976 | 5874.287 |
| 2 | 4827.020 | 5492.888 |

As You Look From Point 1 To Point 2, Point 3 Is At A Distance Of 782.307 To The Left

As you Look From Point 2 To Point 1, Point 3 Is At A Distance Of 480.263 To The Right

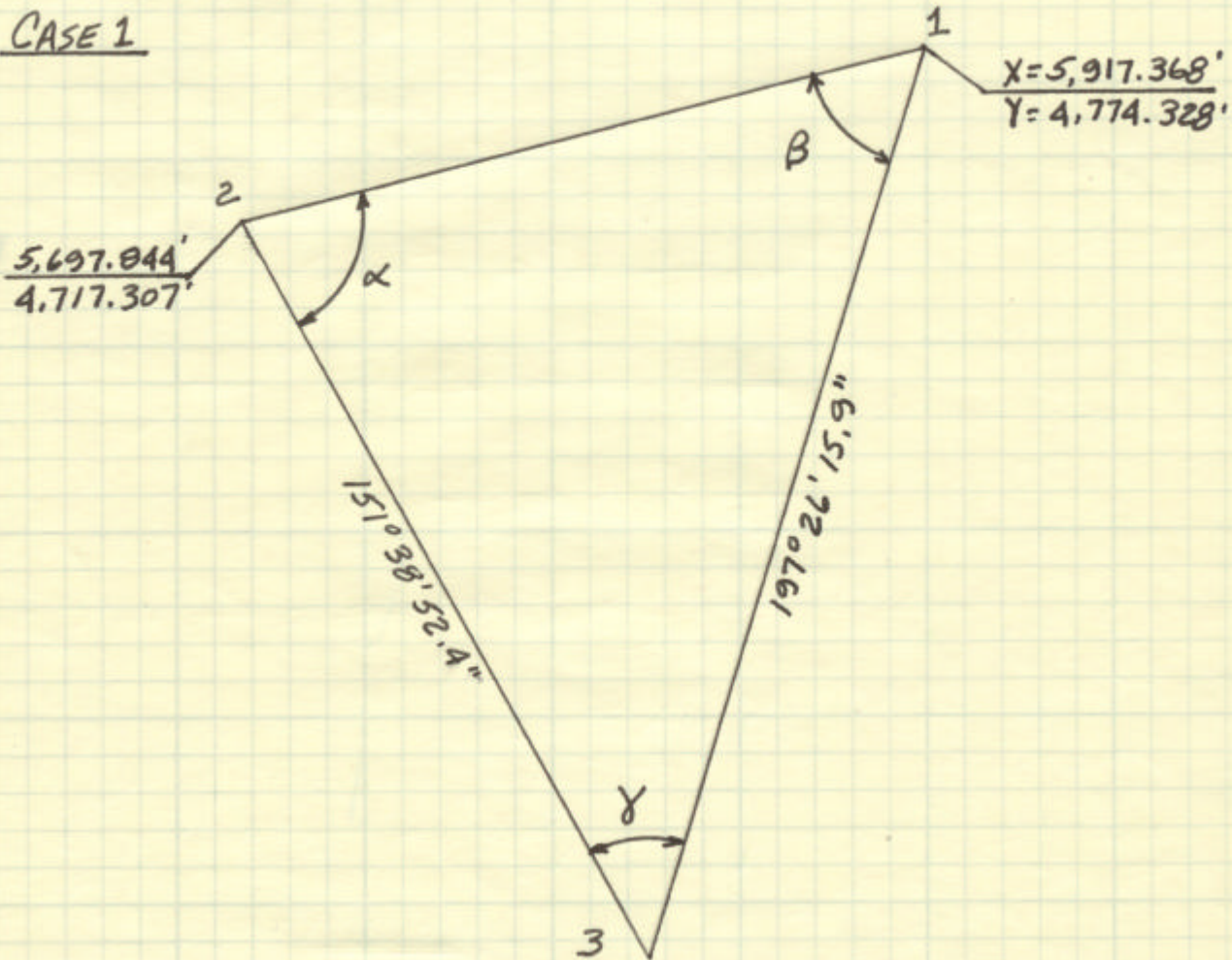
Northing of point 3 = _____, Easting of point 3 = _____

Compute:

The Coordinates Of The Points Of Intersection In Each Of The Above Three Cases

LINE-LINE INTERSECTION

CASE 1



$$D_{12} = [(X_2 - X_1)^2 + (Y_2 - Y_1)^2]^{1/2} = 226.8087'$$

$$Az_{12} = \tan^{-1} \left[\frac{X_2 - X_1}{Y_2 - Y_1} \right] = 255^\circ 26' 21.4''$$

$$\alpha = Az_{23} - Az_{21} = 76^\circ 12' 31.0''$$

$$\beta = Az_{12} - Az_{13} = 58^\circ 00' 05.5''$$

$$\gamma = 180^\circ - (\alpha + \beta) = 45^\circ 47' 23.5''$$

$$D_{13} = \frac{D_{12}}{\sin \gamma} \sin \alpha = 307.3015'$$

$$X_3 = X_1 + D_{13} \sin Az_{13} = \underline{5,825.279'}$$

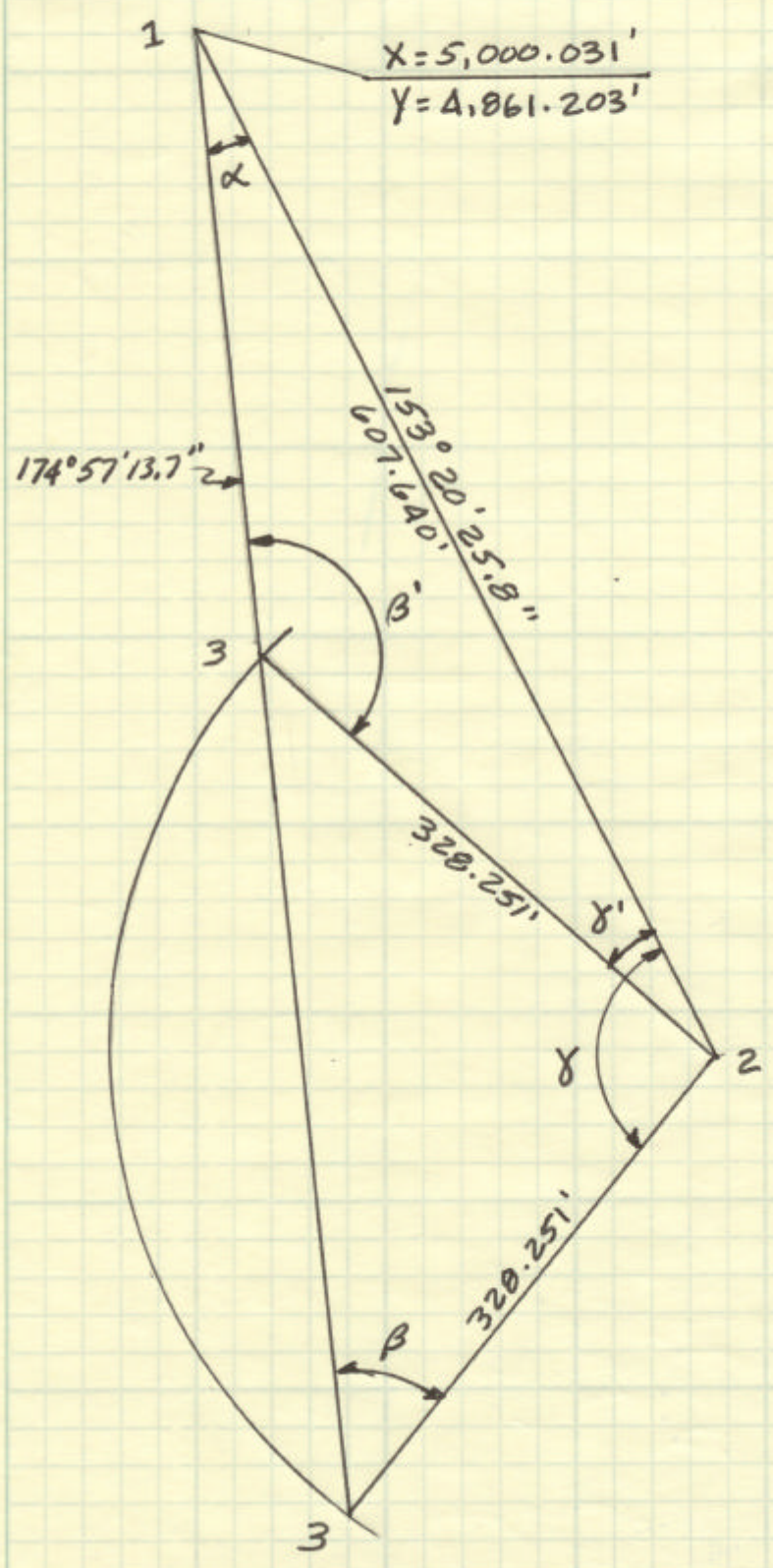
$$Y_3 = Y_1 + D_{13} \cos Az_{13} = \underline{4,481.149'}$$

$$D_{23} = \frac{D_{12}}{\sin \gamma} \sin \beta = 268.3473'$$

$$X_3 = X_2 + D_{23} \sin A_{223} = \underline{5,825.279'} \quad \checkmark$$

$$Y_3 = Y_2 + D_{23} \cos A_{223} = \underline{4,401.149'} \quad \checkmark$$

CASE 2



22-141 50 SHEETS
 22-142 100 SHEETS
 22-144 200 SHEETS

CAMPAD

$$\alpha = Az_{13} - Az_{12} = 21^{\circ} 36' 47.9''$$

SOLUTION 1:

$$\beta = \sin^{-1} \left[\frac{\sin \alpha}{D_{23}} D_{12} \right] = 42^{\circ} 59' 18.6''$$

$$\gamma = 180^{\circ} - (\alpha + \beta) = 115^{\circ} 23' 53.5''$$

$$D_{13} = \frac{D_{23}}{\sin \alpha} \sin \gamma = 805.0300'$$

$$X_3 = X_1 + D_{13} \sin Az_{13} = \underline{\underline{5,070.841'}}$$

$$Y_3 = Y_1 + D_{13} \cos Az_{13} = \underline{\underline{4,059.293'}}$$

$$X_2 = X_1 + D_{12} \sin Az_{12} = 5,272.6714'$$

$$Y_2 = Y_1 + D_{12} \cos Az_{12} = 4,318.1620'$$

$$Az_{23} = Az_{21} - \gamma = 217^{\circ} 56' 32.3''$$

$$X_3 = X_2 + D_{23} \sin Az_{23} = \underline{\underline{5,070.841'}} \checkmark$$

$$Y_3 = Y_2 + D_{23} \cos Az_{23} = \underline{\underline{4,059.293'}} \checkmark$$

SOLUTION 2:

$$\beta' = 180^{\circ} - \beta = 137^{\circ} 00' 41.4''$$

$$\gamma' = 180^{\circ} - (\alpha + \beta') = 21^{\circ} 22' 30.7''$$

$$D_{13} = \frac{D_{23}}{\sin \alpha} \sin \gamma' = 329.8051'$$

$$X_3 = X_1 + D_{13} \sin Az_{13} = \underline{\underline{5,028.600'}}$$

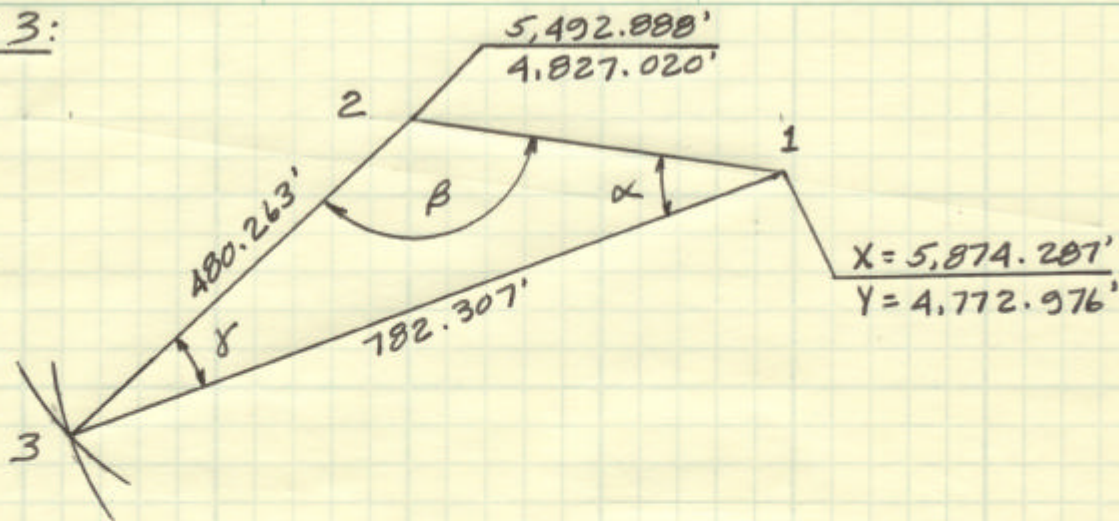
$$Y_3 = Y_1 + D_{13} \cos Az_{13} = \underline{\underline{4,537.657'}}$$

$$Az_{23} = Az_{21} - \gamma' = 311^{\circ} 57' 55.1''$$

$$X_3 = X_2 + D_{23} \sin Az_{23} = \underline{\underline{5,028.600'}} \checkmark$$

$$Y_3 = Y_2 + D_{23} \cos Az_{23} = \underline{\underline{4,537.657'}} \checkmark$$

CASE 3:



$$D_{12} = [(X_2 - X_1)^2 + (Y_2 - Y_1)^2]^{1/2} = 385.2090'$$

$$Az_{12} = \tan^{-1} \left[\frac{(X_2 - X_1)}{(Y_2 - Y_1)} \right] = 278^\circ 03' 54.3''$$

$$\alpha = \cos^{-1} \left[\frac{D_{13}^2 + D_{12}^2 - D_{23}^2}{2D_{12}D_{13}} \right] = 28^\circ 29' 08.6''$$

$$\beta = \cos^{-1} \left[\frac{D_{12}^2 + D_{23}^2 - D_{13}^2}{2D_{12}D_{23}} \right] = 129^\circ 01' 22.6''$$

$$Az_{23} = Az_{21} + \beta = 227^\circ 05' 16.9''$$

$$X_3 = X_2 + D_{23} \sin Az_{23} = \underline{5,141.143'}$$

$$Y_3 = Y_2 + D_{23} \cos Az_{23} = \underline{4,500.021'}$$

$$Az_{13} = Az_{12} - \alpha = 249^\circ 34' 45.7''$$

$$X_3 = X_1 + D_{13} \sin Az_{13} = \underline{5,141.143'} \checkmark$$

$$Y_3 = Y_1 + D_{13} \cos Az_{13} = \underline{4,500.022'} \checkmark$$