Three-Point Resection (Tienstra Formula)

Coordinates of an occupied station from three known points and the two horizontal angles observed between them, by Tienstra's barycentric formula.

Method: Tienstra's solution of the three-point resection (Snellius–Pothenot problem)

Input parameters

Unit system: SI

Parameter	Value	Unit
Easting of A	1,000.0	m
Northing of A	5,000.0	m
Easting of B	1,800.0	m
Northing of B	5,300.0	m
Easting of C	2,300.0	m
Northing of C	4,600.0	m
Angle at P between B and C	104.31	°
Angle at P between C and A	153.83	°

Calculated results

Parameter	Value	Unit
Easting of P	1,700.0	m
Northing of P	4,950.0	m
Third angle at P (A to B) = 360° − α − β	101.86	°
Distance P to A	701.78	m

Notes for this case

• Tienstra: P = Σ K_i X_i / Σ K_i with K_A = 1/(cot A − cot α), where A is the triangle angle at A and α the angle observed at P opposite it (between B and C). Fails on the danger circle through the three points.

Formula and method

$$E_P = \frac{K_A E_A + K_B E_B + K_C E_C}{K_A + K_B + K_C}, \quad K_A = \frac{1}{\cot A - \cot \alpha}, \; K_B = \frac{1}{\cot B - \cot \beta}, \; K_C = \frac{1}{\cot C - \cot \gamma}$$

Variables

E_A	Easting of A	m
N_A	Northing of A	m
E_B	Easting of B	m
N_B	Northing of B	m
E_C	Easting of C	m
N_C	Northing of C	m
α	Angle at P between B and C	rad
β	Angle at P between C and A	rad
E_P	Easting of P	m
N_P	Northing of P	m
γ	Third angle at P (A to B) = 360° − α − β	rad
D_{PA}	Distance P to A	m

Method and standards

Three-point resection.

Assumptions and limits

- Plane coordinates, error-free angles, P not on the danger circle.

References

Tienstra's solution of the three-point resection (Snellius–Pothenot problem)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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