# Distance–Distance Intersection (Two Circles)

Coordinates of the point fixed by measured distances from two known stations (trilateration of one point), both solutions left and right of the base line.

**Method:** Coordinate geometry: intersection of two circles

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Northing of station A | 1,000.0 | m |
| Easting of station A | 1,000.0 | m |
| Northing of station B | 1,000.0 | m |
| Easting of station B | 1,250.0 | m |
| Distance from A | 180.00 | m |
| Distance from B | 150.00 | m |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Northing, point left of A→B | 1,106.9 | m |
| Easting, point left of A→B | 1,144.8 | m |
| Northing, point right of A→B | 893.07 | m |
| Easting, point right of A→B | 1,144.8 | m |
| Angle at A from the base line | 36.443 | ° |

### Notes for this case

• The cosine rule gives the angle at A: cos A = (r_A² + AB² − r_B²)/(2r_A·AB). Along the base line the foot lies a = r_A cos A from A, and the point is h = r_A sin A off the line, on the left or right. The geometry is weak when the circles cross at a shallow angle (point nearly on the base line or very far).

## Formula and method

$$a = \frac{r_A^2 - r_B^2 + AB^2}{2AB}, \quad h = \sqrt{r_A^2 - a^2}$$

### Variables

| | | |
|---|---|---|
| $NA$ | Northing of station A | m |
| $EA$ | Easting of station A | m |
| $NB$ | Northing of station B | m |
| $EB$ | Easting of station B | m |
| $r_A$ | Distance from A | m |
| $r_B$ | Distance from B | m |
| $N_L$ | Northing, point left of A→B | m |
| $E_L$ | Easting, point left of A→B | m |
| $N_R$ | Northing, point right of A→B | m |
| $E_R$ | Easting, point right of A→B | m |
| $\angle A$ | Angle at A from the base line | rad |

### Method and standards

Two-circle intersection.

### Assumptions and limits

- Plane coordinates; error-free distances.

### References

Coordinate geometry: intersection of two circles

## Report details

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|---|---|
| Report reference | FCC-GFP8-FYTW (the same inputs always give the same reference) |
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

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

### This calculator online

https://calc.firecad.com/civil/surveying/two-circle-intersection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.