Intersection of a Line (Direction) with a Circle (Distance)

Coordinates of the two points where a line of known azimuth from a point meets a circle of given radius about another point, for stake-out and COGO.

Method: Coordinate geometry: line and circle

Input parameters

Unit system: SI

Parameter	Value	Unit
Northing of the line's start point P	1,000.0	m
Easting of the line's start point P	1,000.0	m
Azimuth of the line	60.000	°
Northing of circle centre C	1,150.0	m
Easting of circle centre C	1,100.0	m
Radius (distance from C)	120.00	m

Calculated results

Parameter	Value	Unit
Near intersection northing	1,036.0	m
Near intersection easting	1,062.4	m
Distance from P to the near point	72.074	m
Far intersection northing	1,125.6	m
Far intersection easting	1,217.5	m
Distance from P to the far point	251.13	m

Notes for this case

• Points on the line are P + d(cos α, sin α); substituting into the circle (N − N_C)² + (E − E_C)² = r² gives a quadratic d² + 2bd + c = 0. Two real roots give two intersections (negative d means behind P); a zero discriminant means the line is tangent. Choose the solution that matches the field sketch.

Formula and method

$$d^2 + 2bd + c = 0, \quad b = \Delta N \cos\alpha + \Delta E \sin\alpha, \quad c = \Delta N^2 + \Delta E^2 - r^2$$

Variables

NP	Northing of the line's start point P	m
EP	Easting of the line's start point P	m
α	Azimuth of the line	rad
NC	Northing of circle centre C	m
EC	Easting of circle centre C	m
r	Radius (distance from C)	m
N_1	Near intersection northing	m
E_1	Near intersection easting	m
d_1	Distance from P to the near point	m
N_2	Far intersection northing	m
E_2	Far intersection easting	m
d_2	Distance from P to the far point	m

Method and standards

Line–circle.

Assumptions and limits

- Plane coordinates.

References

Coordinate geometry: line and circle

Report details

Report reference	FCC-NTAP-ZREV (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/line-circle-intersection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.