

**First practical work**  
**Topic: Direct geodetic  
problem (task)**

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## Purpose of the work:

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Based on the known coordinates, it is necessary to determine the coordinates of the second point according to the known horizontal distance (line) and the known directional angle.

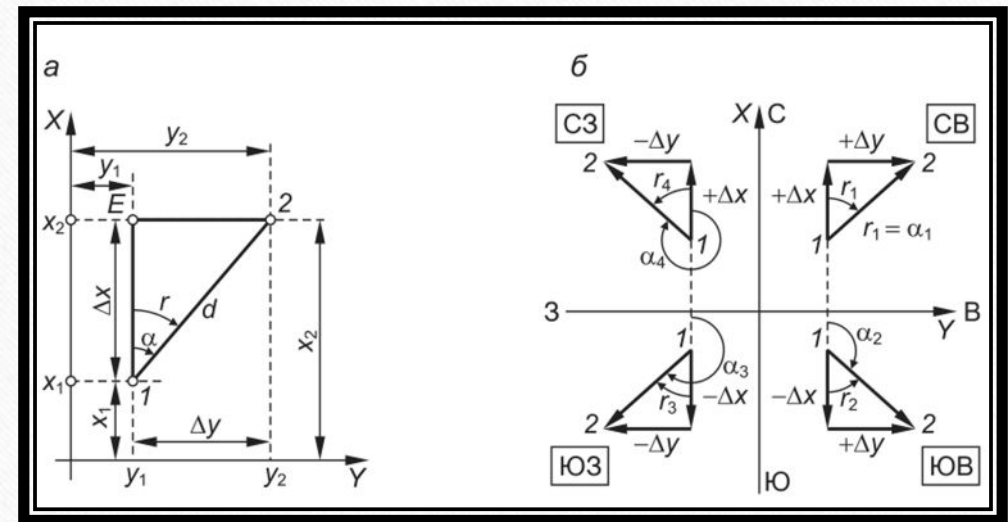
# Introduction

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Computational processing of the results of measurements on the ground, carried out in the preparation of plans, the solution of a number of land management problems, the preparation of data for the removal of projects in nature are directly related to direct geodetic problems on coordinates.

# Direct geodetic problem.

The essence of this problem (pic. 1): according to the known coordinates of point 1 ( $X_1, Y_1$ ) of line 1-2, the directional angle of this line  $\alpha_{1-2}$  and its horizontal distance  $D_{1-2}$   $d_{1-2}$ , it is required to determine the coordinates of point 2.



Pic. 1. Direct geodetic problem

• Drawing through points 1 and 2 lines parallel to the coordinate axes, we get a right triangle 1-2'-2, in which the hypotenuse  $D_{1-2}$  and the acute angle  $r = \alpha_{1-2}$  are known.

The legs of this triangle are the increment of the  $\Delta x$  and  $\Delta y$  coordinates, which can be obtained by the formulas:

$$\Delta x = D_{1-2} \cos \alpha_{1-2}; \Delta y = D_{1-2} \sin \alpha_{1-2}.$$

Examination:

$$D = \sqrt{\Delta X^2 + \Delta Y^2}$$

- It should be remembered that in the general case, the signs of the increments of coordinates depend on the quarter determined by the directional angle of the given direction (tabl. 1)

Quarter and their name	The value of directional angles	Connection of rumbes (table corners) with directional angle	Coordinate increment signs	
			$\Delta X$	$\Delta Y$
1 quarter – NE,	$0^\circ — 90^\circ$		+	+
2 quarter – SE	$90^\circ — 180^\circ$		-	+
3 quarter – SW,	$180^\circ — 270^\circ$		-	-
4 quarter – NW	$270^\circ — 360^\circ$		+	-

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- Then the coordinates of the desired point 2 are determined by the formulas:

$$X_2 = X_1 + \Delta X;$$

$$Y_2 = Y_1 + \Delta Y;$$

or

$$X_2 = X_1 + D_{1-2} \cos \alpha_{1-2};$$

$$Y_2 = Y_1 + D_{1-2} \sin \alpha_{1-2};$$

The increment of coordinates and the coordinates of the required point are calculated with an accuracy corresponding to the accuracy of measuring the horizontal length of the line.