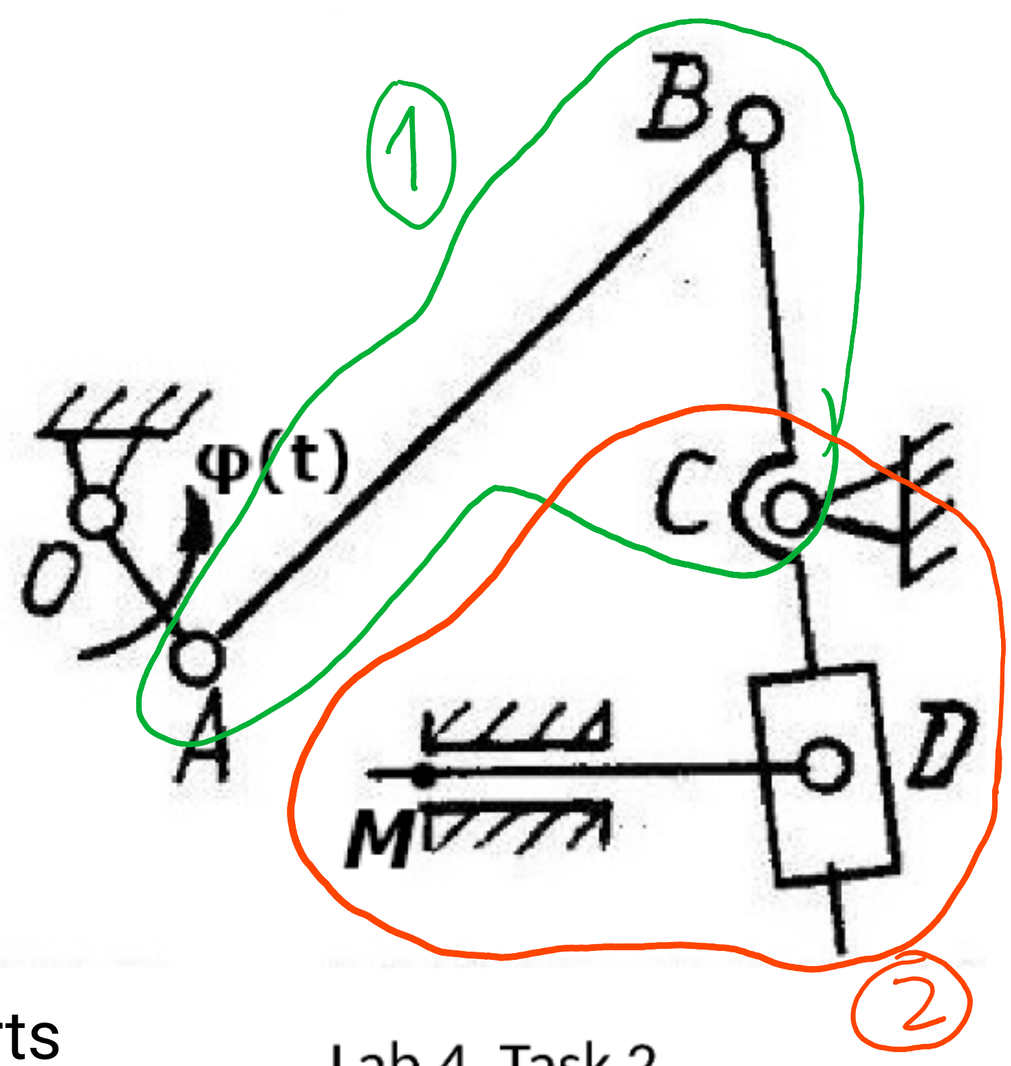
The task to find kinematics for the whole mechanism and velocities for *D*.



Lab 4, Task 2

You know all lengths (*OA*, *AB*, *BC*), $\varphi(t)$.
Coordinates of all bases are known. The basis near to *M* point is horizontal respect to the ground.

High Level Algorithm
1) Imagine how the mechanism works
2) Using Assur groups, decouple it on a smaller parts
3) Find kinematics (I prefer to use geometrical)
4) Draw velocities directions
5) Find all velocities
6) Draw directions of accelerations
7) Solve it

HINTS:
1) For kinematics - try to represent it as a set of lines/circles (line - slider, circle - rotational joint), which intersects somehow.
2) Each vector equation gives you 2 equations -> you can find 2 variables

SOLUTION:
We can decouple the mechanism into 2: 4 link bar (OABC, ABC - assur group), BCDM (MDC - assur group)

1) 4 link bar is intersection of 2 circles (CB and AB)
The system can be solved using "fsolver" in Matlab.

$$\begin{cases} (x_B - x_A)^2 + (y_B - y_A)^2 = AB^2 \\ (x_B - x_C)^2 + (y_B - y_C)^2 = BC^2 \\ \bar{X}_A = R(\varphi)\,\overline{OA} \end{cases}$$

Next is BCDM
MD - horizontal line -> M we know
BCD - line: B and C points are known
In our case we have to find the intersection of 2 lines:

$$\bar{X}_D \Leftarrow \begin{cases} \dfrac{(x_D - x_C)}{(y_D - y_C)} = \dfrac{(x_B - x_C)}{(y_B - y_C)} \\ y_D = y_M \end{cases}$$