Task 1:

The Image file is in the same directory as the code file. You may find both the force diagrams and the system of equations on that image. The most trivial equations are ignored and replaced with their result in order to avoid complications.

Task 2:

The solution of the system of equations is quite complicated since there are too many variables and factors that can affect. For example, the direction of the force of friction depends on the direction of velocity at that time moment, that solving for all cases by hand was a hard task. Moreover, whenever the object is not moving the magnitude of the force of friction depends on the magnitudes of forces being applied. Not to complicate things, I have created an augmented matrix of linear equations for each timestamp and I calculate the values of accelerations for each timestamp with its own system of equations.

The problem of the direction of the friction is solved by changing the sign of friction coefficient “myu” in code.

The problem of its magnitude is solved by reducing the number of equations/unknowns, which mathematically replaces acceleration with 0, as when the force of friction is not at its maximum then the acceleration is 0.

Task 3:

The Folder contains two files.

One is Environment.py, where you set up the environment for the program: you give all the inputs that are specified in the task. Optionally you can input the gravity coefficient (10 by default).

The other file is main.py where you may find the test values and results. Results contain explanations for each outcome and all of them discuss the graph obtained by the motions.

Note\*

The motion of M1 and M2 in vertical direction and the motion of M3 in horizontal direction are trivial, therefore they are not addressed. First two have a constant y coordinate (as was initiated). Third has the exact same horizontal motion as M1. All the graphs refer to the non-trivial motions.