Mini project Code Explanation

- Task 1:
  This task in the code file is subdivided into two code blocks, one named Task 1 (without dynamics) and Task 1 (with dynamics) the desired trajectories can be entered in the code itself.
  1. Task 1 (without dynamics): This code block runs on the equations number 3 which directly calculates the angle values corresponding to the x and y desired values for that moment. A pre-feeded trajectory of an ellipse is loaded in the code. Every time the loop runs, a new value of x and y determines the values of q1 and q2, and corresponding values lead to changes in the x1,y1, and x2,y2 values (coordinates of the link's endpoints x2,y2 is the end effector, using the equation 1) making the 2R manipulator chase the desired coordinates.
  2. Task 1 (with dynamics): This part is mostly the same as the before but with the introduction of dynamics equations obtained from the Lagrange's equations giving us the values of torques required from the motors present in the joints. These equations require the values of the first and the second derivatives with respect to time for both the angles q1 and q2. These are determined by using the discretization formula and thus using the prior angle values, and then a time step dt is used to get the values for the derivatives.

- Task 2:
  For this task the simulation will go to a point on a plane the sole reason for this is that .render function is called in between the function and thus the whole path till reaching the desired point can be seen using the same equation 3 and 1 calculating the angles and the end effector coordinates. After reaching that point using the the equation 4 that shows relation between the components of force (using the plane of application orientation) and desired motor torques, we can get the exact values of torques required for the desired force.

- Task 3:
  For this task the initial position and the mean position about which the spring action is to be performed can be changed (the codeline from which we can change that has a comment above it). Upon solving the spring action along the x and y axis we can get a harmonic trajectory which when made follow using the same idea as task 1 we can get a spring like action. Also for the desired effect dynamically we can use the idea of equation 6 and the derivative logic to get the torques value.

- Task 4:
  To get the workspace for the the 2R manipulator its just a matter of two for loops that for a specific degree of q1, the whole range of q2 will mark the whole range of motion of the end effector. The piece of code upon running will directly show the result.