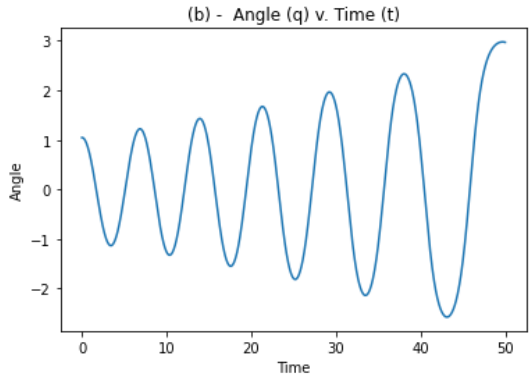
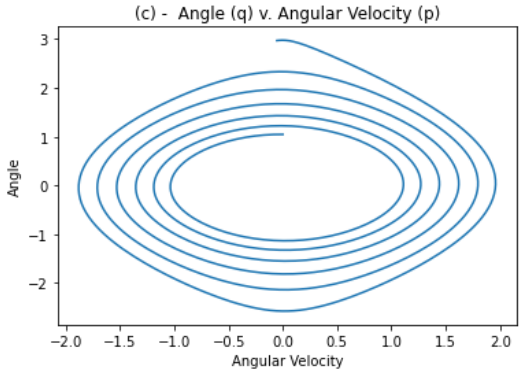
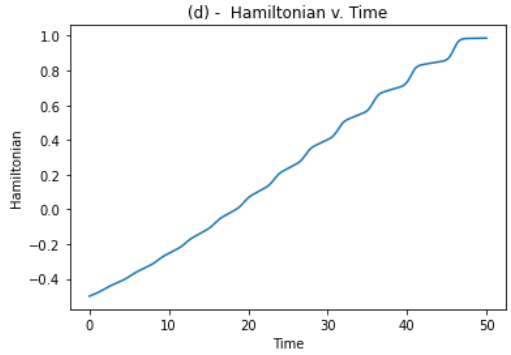
1. (i)

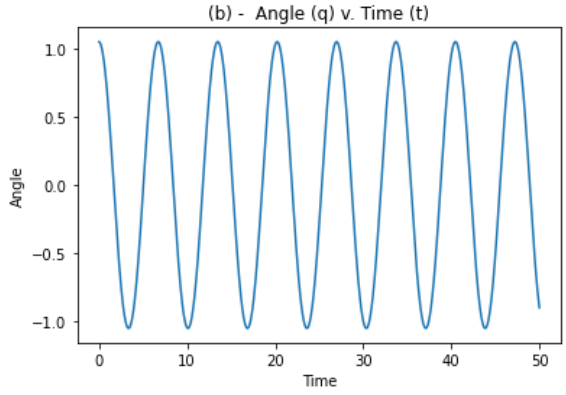
a) p_N = -0.054867441689298135, q_N = 2.9703622219987755

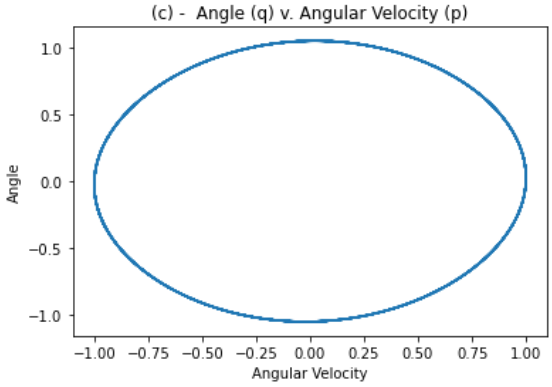


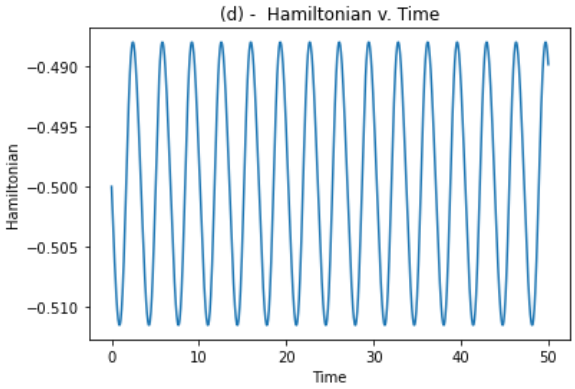




1. (ii) p_N = -0.5185144287989518, q_N = -0.8965541537450286

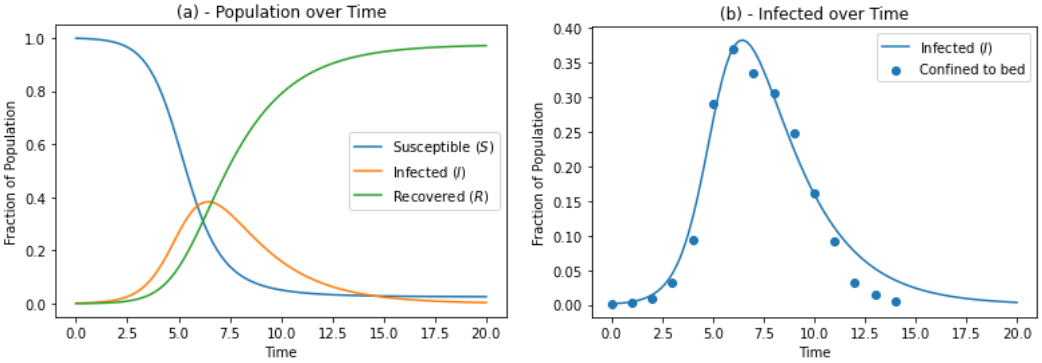


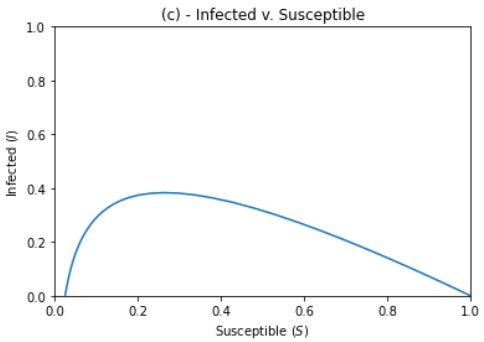




1. The sympletic Euler's method works properly compared to the forward Euler's method, which grew increasingly erroneous. The sympletic method oscillates regularly, thus keeping the Hamiltonian system fairly constant within a variation of about 0.025.

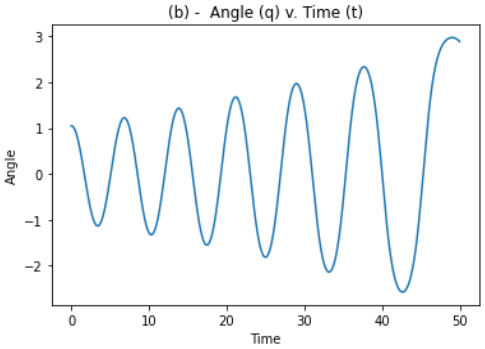
2.

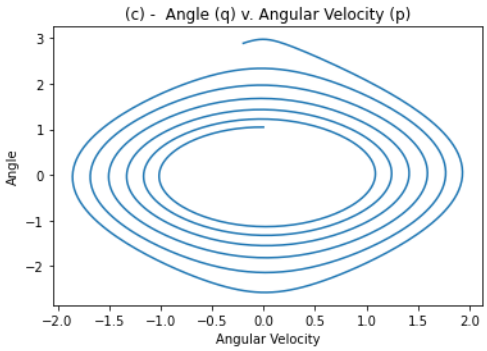


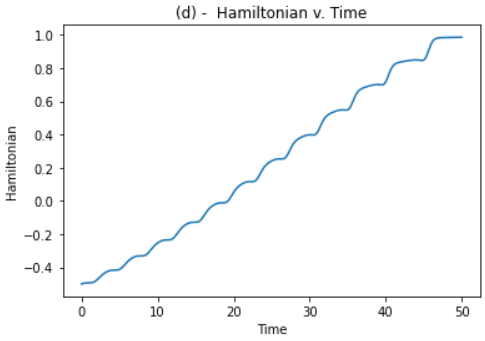


d) Total residents who did not contract the flu: **19**. Peak number of infected: **292**. Time of greatest number of infected: **6.4646464646464645**.

3. a) p_N = -0.19570383358947646, q_N = 2.884001182143138


(b) - Angle (q) v. Time (t)
Angle
Time


(c) - Angle (q) v. Angular Velocity (p)
Angle
Angular Velocity


(d) - Hamiltonian v. Time
Hamiltonian
Time