1)(a) Let be the displacement from the static equilibrium position, so that (assuming the mass of the link/rod to be negligible):

Substituting and from equations 2 and 3 into 1:

(b) Let be the displacement from the static equilibrium position, so that:

2.On impact, the initial conditions are:

Since the springs are in parallel, thus their equivalent stiffness,

Thus the system is underdamped, and the maximum displacement is reached when the velocity is zero, thus solving for :

3 a. Since there are oscillations with exponentially decreasing amplitude, the system is underdamped.

b.

c.

d.