Hwk 3, Due Sept 25

1. Analyze the bifurcation properties of the following problems.
   (a) $x' = x^2 + ax + 1$
   (b) $x' = ax + x^2$
   (c) $x' = ax + x^3$
   (d) $x' = x + \frac{ax}{1 + x^2}$.

2. (a) A 10 lb object stretches a spring 1 ft by itself. There is no damping and no external forces acting on the system. The spring is initially displaced 5 in upwards from its equilibrium position and given an initial velocity of 1 ft/sec downward. Find the displacement $u(t)$ at any time $t$.

   (b) Take the spring and mass system from (a) and attach a damper to it that will exert a force of 12 lb when the velocity is 2 ft/s. Find the displacement $u(t)$ at any time.