Math 483 – Homework 6

1)Parameters σ=10, b=8/3, r=0.5. The figures below for the initial conditions indicated all show that the system tends to the stable point (0,0,0). This is achieved within 2 time steps.
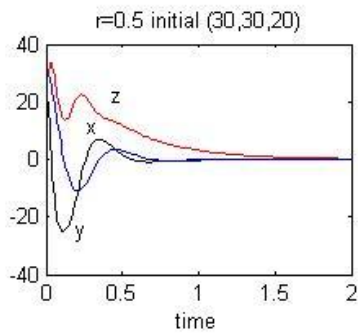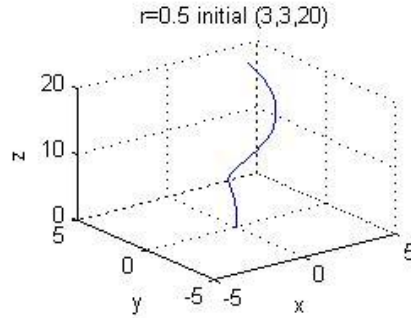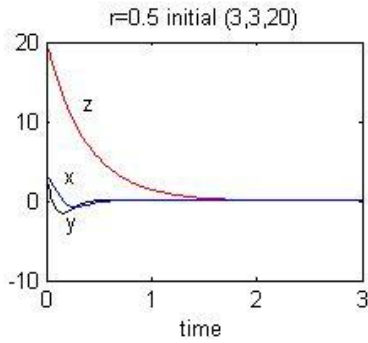

r=0.5 initial (3,3,20)

r=0.5 initial (3,3,20)

r=0.5 initial (30,30,20)

r=0.5 initial (30,30,20)

r=0.5 initial (300,300,20)

r=0.5 initial (300,300,20)
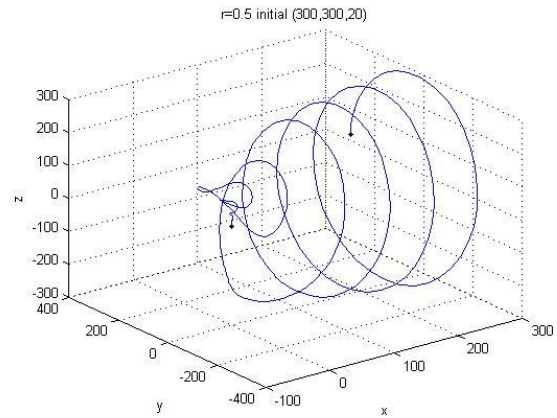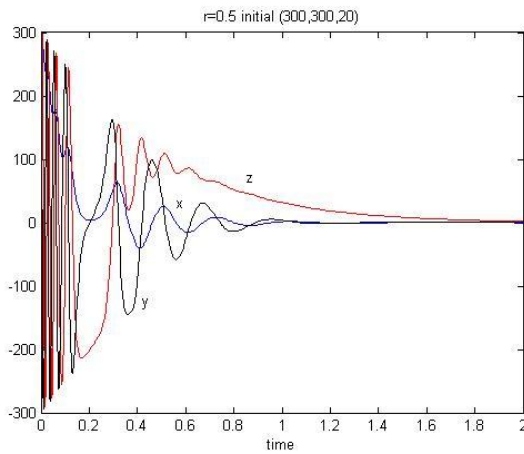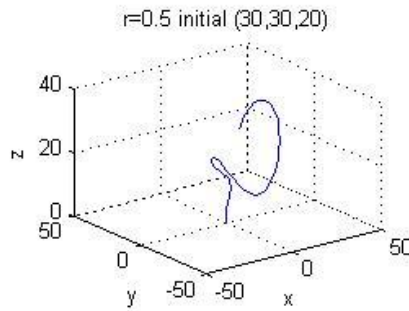
2a) Parameters σ=10, b=8/3, r=10. Theoretically we expect tow fixed points

$$C\pm = (\ \pm\sqrt{b(r-1)},\ \pm\sqrt{b(r-1)}, r-1)$$

For the case r=10 we get C± =(± 4.899, ± 4.899, 9). As can be seen in the graphs for the choice of initial condition the system directly tends to C+. The value at 500 time iterations is very close to the theoretical numbers.
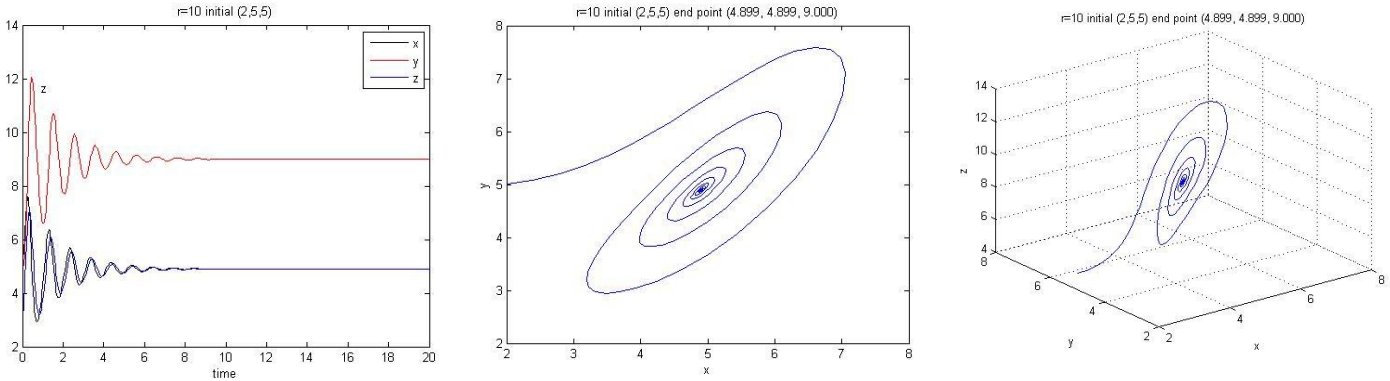
2a) Parameters σ=10, b=8/3, r=20. The theoretical values for the stable points are:
 C± =(± 7.1181, ± 7.1181, 19). As can be seen in the graphs for the choice of initial condition the hovers around C- but effectively settles in C+. The value at time is (± 7.1012, ± 7.1012, 19.0765).

Note that the number of time iterations had to be extended to at least 40 in order to better capture the trend towards the fixed points.