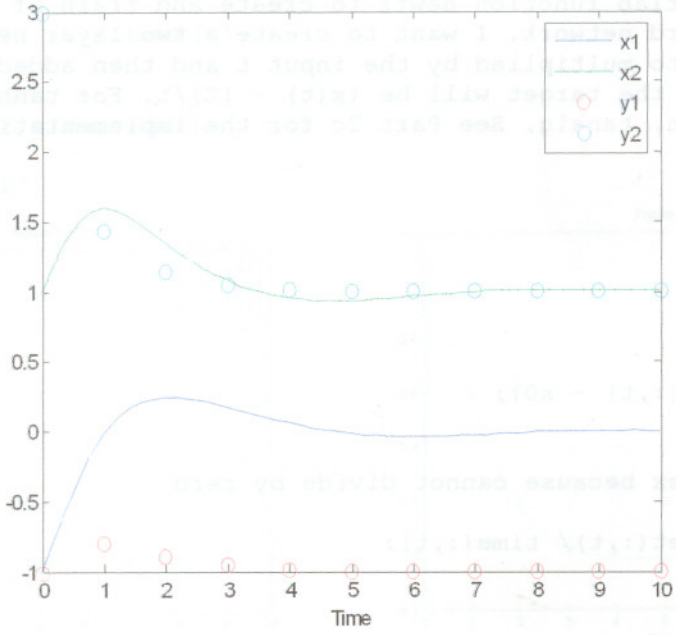
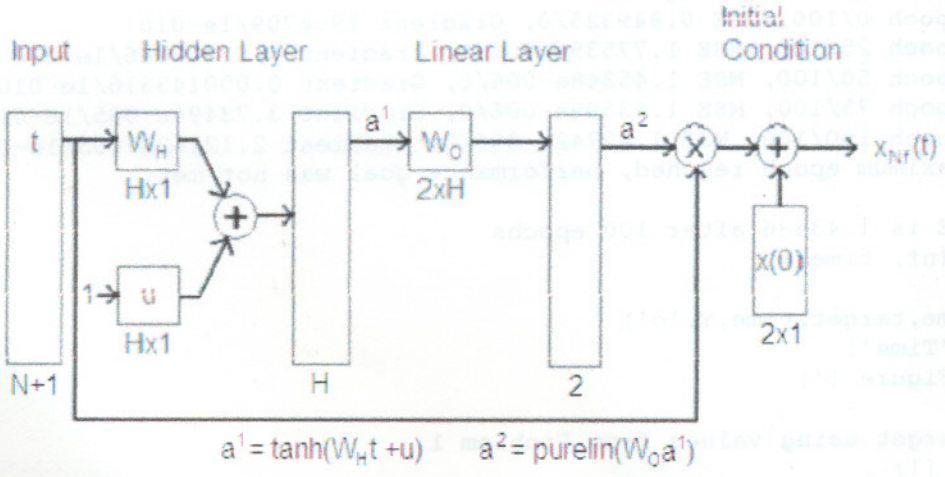



```
>> sum = 0;
>> for t = 1:11
sum = sum + (x(t)-out(t))^2;
end
>> mean_square_error = sum/22
mean_square_error =
    0.4227
```

```
>> %y(t) is represented by 'o' in the diagram. They do not match up with x(t)
but demonstrate a similar curvature. As t->∝, y(t) goes towards the initial
conditions over time. With the weight of y1 = 21 and the weight of y2 = -1,
the mean square error is 0.4227.
```

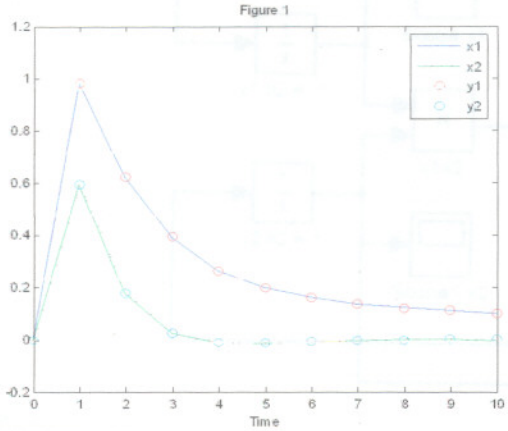
Problem 2a:

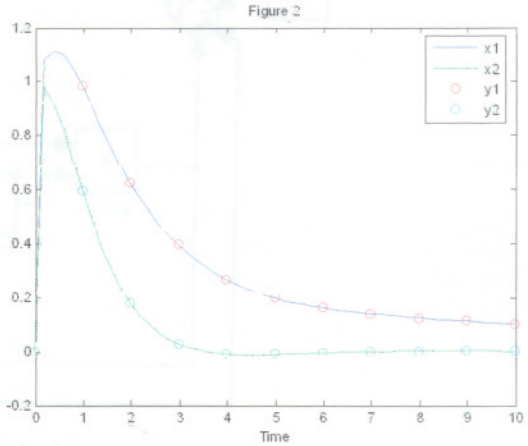



```
>> %x_Nf(t) =(purelin(tanh(W_H t+u)W_O)*t)+x(0)
```

```
Problem 2c:
>> T = 10;
>> H = 5;
>> N = 10;

>> target = [];
>> for t = 1:1:11
target = [target x(:,t) - x0];
end

>> %Skip first index because cannot divide by zero
>> for t = 2:1:11
target(:,t) = target(:,t)/ time(:,t);
end
>> target
target =
  Columns 1 through 7
         0    0.9856    0.6229    0.3935    0.2663    0.1973    0.1607
         0    0.5969    0.1770    0.0275   -0.0105   -0.0124   -0.0058
  Columns 8 through 11
    0.1395    0.1244    0.1116    0.1006
   -0.0006    0.0013    0.0010    0.0004

>> nf = newff([0 T],[H 2],{'tansig' 'purelin'});
>> nf.biasConnect = [1; 0];
>> %The inputConnect, layerConnect, outputConnect, and targetConnect are
correct
>> nf = init(nf);
>> Y = sim(nf, time);

>> %Want MSE = 0
>> nf = train(nf, time, target);
TRAINLM, Epoch 0/100, MSE 0.849325/0, Gradient 19.6709/1e-010
TRAINLM, Epoch 25/100, MSE 1.77539e-006/0, Gradient 0.00313746/1e-010
TRAINLM, Epoch 50/100, MSE 1.45348e-006/0, Gradient 0.000143316/1e-010
TRAINLM, Epoch 75/100, MSE 1.43599e-006/0, Gradient 3.73494e-005/1e-010
TRAINLM, Epoch 100/100, MSE 1.42742e-006/0, Gradient 2.12162e-005/1e-010
TRAINLM, Maximum epoch reached, performance goal was not met.

>> %The MSE is 1.43e-6 after 100 epochs
>> Y = sim(nf, time);

>> plot(time,target,time,Y,'o')
>> xlabel('Time')
>> title('Figure 1')

>> %Plot target using values from Problem 1
>> xout2 = [];
>> for t = 1:51
xout2 = [xout2 xout(t,:)' - x0];
```

```
end
>> for t = 2:51
xout2(:,t) = xout2(:,t)/ tout(t);
end

>> plot(tout,xout2,time,Y,'o')
>> xlabel('Time')
>> title('Figure 2')
```






```
>> %In Figure 1, x is plotted with a time interval of 1 sec since T = 10 and
N = 10. In Figure 2, x is plotted with a time step of .2 sec as provided from
the simulation in Problem 1. Both figures illustrate that the neural network
is close in representing the differential equation of gene transcription
described in problem 1.
```