LDA *and* **PCA:**

1] LDA:

Code:

```
% Given data sets
X_p = [ 4,2,2,3,4,6,3,8; 1,4,3,6,4,2,2,3; 0,1,1,0,-1,0,1,0];
X_n = [ 9,6,9,8,10;      10,8,5,7,8;      1,0,0,1,-1];

% calculating mean value for classes
mean_p = mean(X_p,2);
mean_n = mean(X_n,2);

% calculating within class scatter matrix
for p = mean_p
    Sw_p = (X_p - p)*(X_p - p)';
end
for n = mean_n
    Sw_n = (X_n - n)*(X_n - n)';
end
%disp(Sw_p); disp(Sw_n)

% calculating total within class scatter
Sw = Sw_p + Sw_n;
%disp(Sw)

% mean value of total mean of both class
m = (mean_p + mean_n)/2;
% calculating between class scatter matrix
for a = mean_p
    Sb = (a-m)*(a-m)' ;
end
%disp(Sb)

% finding eigen values and eigen vectors
[eig_vec, eig_val] = eig(Sw, Sb);

disp(eig_val)
disp(eig_vec)
```

Output:

Within class scatter for positive data:

30.0000 -6.0000 -5.0000
-6.0000 16.8750 -1.2500
-5.0000 -1.2500 3.5000

Within class scatter for negative data:

9.2000	*-0.2000*	*-1.4000*
-0.2000	*13.2000*	*1.4000*
-1.4000	*1.4000*	*2.8000*

Within class scatter overall:

39.2000	*-6.2000*	*-6.4000*
-6.2000	*30.0750*	*0.1500*
-6.4000	*0.1500*	*6.3000*

Between class scatter matrix:

4.8400	*4.9225*	*-0.0550*
4.9225	*5.0064*	*-0.0559*
-0.0550	*-0.0559*	*0.0006*

Eigen Values:

2.5941	*0*	*0*
0	*Inf*	*0*
0	*0*	*Inf*

Eigen Vectors:

-0.9142	*1.0000*	*0.1288*
-1.0000	*-0.9928*	*-0.1155*
-0.8614	*-0.8552*	*1.0000*

2] PCA:

Code:

```
X = [ -2, 1,  4,  6,  5,  3,  6, 2 ;
       9, 3,  2, -1, -4, -2, -4, 5 ;
       0, 7, -5,  3,  2, -3,  4, 6 ];

% mean vector calculation
m = mean(X);
% scatter matrix calculation
S = (X-m)*(X-m)';

% covariance matrix calculation
C = cov(S);
disp(C)

% eigen value and vector for scatter matrix
[S_vec , S_val ] = eig(S);
% eigen value and vector for covariance matrix
[C_vec , C_val ] = eig(C);

disp(C_val); disp(C_vec)
```

Output:

mean of X:

2.3333 3.6667 0.3333 2.6667 1.0000 -0.6667 2.0000 4.3333

Covariance matrix:

0.8790 -0.9081 0.0291
-0.9081 1.2056 -0.2975
0.0291 -0.2975 0.2684

Eigen values:

0.0000 0 0
0 0.3526 0
0 0 2.0005

Eigen vectors:

-0.5774 0.5253 -0.6251
-0.5774 0.2787 0.7674
-0.5774 -0.8040 -0.1423