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```
clc;
```

Question 1

Part a) - See attached bottom of page 4

```
% Part b)
x = [2; 1; -3]
y = [-1; 2; -1]
A = [-5 3 0;3 -1 -4;0 -4 2]
x'*A*y
y'*A*x
clear
```

```
x =
     2
     1
    -3
y =
    -1
     2
    -1
A =
    -5     3     0
     3    -1    -4
     0    -4     2
ans =
    51
ans =
    51
```

Question 2

See attached, top of page 4

Question 3

Part a)

```
syms A M
a = inv(M)*A*M
```

```
[V,D] = eig(A)
[V,D] = eig(a) % Yes they have the same eigenvectors
% Part b)
A = [.5 .5; .5 .5]
a = [1 .5; 0 0]
M = [1 0; 1 1]
% Part c) - See attached top of page 5
% Part d)
[V,D] = eig(A)
[V,D] = eig(a)
clear


a =
A
V =
1
D =
A
V =
1
D =
A
A =
    0.5000    0.5000
    0.5000    0.5000
a =
    1.0000    0.5000
         0         0
M =
     1     0
     1     1
V =
   -0.7071    0.7071
    0.7071    0.7071
D =
     0     0
     0     1
V =
    1.0000   -0.4472
         0    0.8944
D =
     1     0
     0     0
```

Question 4

```
syms U S V A
% Part a)
[U,S,V] = svd(A)
A*A'
% Part b)
A = [1 4; 2 8]
[V,D] = eig(A'*A)
[V,D] = eig(A*A')
[U,S,V] = svd(A)
% Part c) - The eigenvectors are different but that of A'*A have the same
% numbers just in a different pattern with V. U seems to be the eigenvalues
% from A*A' but moved in the same pattern as with the vector of V.
% The eigenvalues are the same.


U =
```

```
1
S =
A
V =
1
ans =
A*conj(A)
A =
     1     4
     2     8
V =
   -0.9701    0.2425
    0.2425    0.9701
D =
     0     0
     0    85
V =
   -0.8944    0.4472
    0.4472    0.8944
D =
     0     0
     0    85
U =
   -0.4472   -0.8944
   -0.8944    0.4472
S =
    9.2195         0
         0    0.0000
V =
   -0.2425   -0.9701
   -0.9701    0.2425
```

Question 5

Part a)

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Sorry for backwards order

2)

a) Linearly dependent Let $u=v=w$ for all

$u, 2u, 3u$

b) Linearly independent

$2u, -2u, 4u$

c) Linearly dependent

$0, 0, 0$

d) Linearly dependent

$1, 1, 1$

1)

a) $x^T A * y = y^T A * x$

$$\begin{bmatrix} x_1 & x_2 \\ x_3 & x_4 \end{bmatrix}^T \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} * \begin{bmatrix} y_1 & y_2 \\ y_3 & y_4 \end{bmatrix} \Rightarrow \begin{bmatrix} x_1 & x_3 \\ x_2 & x_4 \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} x_1 A_1 & x_3 A_2 \\ x_2 A_1 & x_4 A_2 \end{bmatrix} \begin{bmatrix} y_1 & y_2 \\ y_3 & y_4 \end{bmatrix}$$

$$\begin{bmatrix} x_1 A_1 y_1 + x_3 A_2 y_3 & x_1 A_1 y_2 + x_3 A_2 y_4 \\ x_2 A_1 y_1 + x_4 A_2 y_3 & x_2 A_1 y_2 + x_4 A_2 y_4 \end{bmatrix}$$

$$y^T A * x \Rightarrow \begin{bmatrix} y_1 & A_1 & y_3 A_2 \\ y_2 A_1 & y_4 A_2 \end{bmatrix} \begin{bmatrix} x_1 & x_2 \\ x_3 & x_4 \end{bmatrix} \Rightarrow$$

$$\begin{bmatrix} y_1 A_1 x_1 + y_3 A_2 x_3 & x_1 A_1 x_2 + y_3 A_2 x_4 \\ y_2 A_1 x_1 + y_4 A_2 x_3 & y_2 A_1 x_2 + y_4 A_2 x_4 \end{bmatrix}$$

Statement is true

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Eigenvectors & Eigenvalues of A

$$A = \begin{bmatrix} 0.5 & 0.5 \\ 0.5 & 0.5 \end{bmatrix} \Rightarrow \begin{bmatrix} 0.5-\lambda & 0.5 \\ 0.5 & 0.5-\lambda \end{bmatrix}$$

$$(0.5-\lambda_1)(0.5-\lambda) - 0.25 = 0 \qquad \boxed{\lambda_1 = 0 \quad \lambda_2 = 1}$$

$$\begin{bmatrix} 0.5-0 & 0.5 \\ 0.5 & 0.5-0 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{matrix} 0.5V_1 + 0.5V_2 = 0 \\ 0.5V_1 + 0.5V_2 = 0 \end{matrix}$$

$$\boxed{\text{If } V_1 = 1 \quad V_2 = -1}$$