In[]:=
```
Remove["Global`*"]
```

Vector and Matrix manipulation. vectors u & v, matrices A & B

Turning list u & v into matrix form

In[]:=
```
u = {5, 3, 1, 2}
v = {I, 4, 1 - I, -4}
um = MatrixForm[u]
vm = MatrixForm[v]
```

Out[]= {5, 3, 1, 2}

Out[]= {i, 4, 1 - i, -4}

Out[]//MatrixForm=

$$\begin{pmatrix} 5 \\ 3 \\ 1 \\ 2 \end{pmatrix}$$

Out[]//MatrixForm=

$$\begin{pmatrix} i \\ 4 \\ 1-i \\ -4 \end{pmatrix}$$

In[]:=
```
vt = ConjugateTranspose[v]
```

Out[]= {i, 4, 1 - i, -4}

In[]:=
```
vtm = MatrixForm[vt]
```

Out[]//MatrixForm=

$$\begin{pmatrix} i \\ 4 \\ 1-i \\ -4 \end{pmatrix}$$

In[]:=
```
b = {{0, 9, -3 + I, 9}, {9, 6, 2 - I, 4}, {-3 - I, 2 + I, 12, -7 + I}, {9, 4, -7 - I, -4}}
```

Out[]= {{0, 9, -3 + i, 9}, {9, 6, 2 - i, 4}, {-3 - i, 2 + i, 12, -7 + i}, {9, 4, -7 - i, -4}}

In[]:=
```
MB = MatrixForm[b]
```

Out[]//MatrixForm=

$$\begin{pmatrix} 0 & 9 & -3+i & 9 \\ 9 & 6 & 2-i & 4 \\ -3-i & 2+i & 12 & -7+i \\ 9 & 4 & -7-i & -4 \end{pmatrix}$$

In[]:=
```
HermitianMatrixQ[b]
```

Out[]= True

In[]:=
```
vn = vt.v
```

Out[]= 31 - 2 i

In[•]:= **a = {{1, -3, -7, 3}, {5, 8, 5, 6}, {7, 4, 7, 5}, {-3, 2, 0, 4}}**

Out[•]= {{1, −3, −7, 3}, {5, 8, 5, 6}, {7, 4, 7, 5}, {−3, 2, 0, 4}}

In[•]:= **MA = MatrixForm[a]**

Out[•]//MatrixForm=

$$\begin{pmatrix} 1 & -3 & -7 & 3 \\ 5 & 8 & 5 & 6 \\ 7 & 4 & 7 & 5 \\ -3 & 2 & 0 & 4 \end{pmatrix}$$

In[•]:= **au = a.u**

Out[•]= {−5, 66, 64, −1}

In[•]:= **aum = MatrixForm[au]**

Out[•]//MatrixForm=

$$\begin{pmatrix} -5 \\ 66 \\ 64 \\ -1 \end{pmatrix}$$

In[•]:= **vb = v.b**

Out[•]= $\{-4+2\,i,\ 11+8\,i,\ 47-15\,i,\ 26+17\,i\}$

In[•]:= **vbm = MatrixForm[vb]**

Out[•]//MatrixForm=

$$\begin{pmatrix} -4+2\,i \\ 11+8\,i \\ 47-15\,i \\ 26+17\,i \end{pmatrix}$$

In[•]:= **a == b**

Out[•]= False

In[•]:= **ai = Inverse[a]**

Out[•]= $\left\{\left\{\frac{110}{1693}, \frac{84}{1693}, \frac{50}{1693}, -\frac{271}{1693}\right\}, \left\{-\frac{51}{1693}, \frac{392}{1693}, -\frac{331}{1693}, -\frac{136}{1693}\right\}, \left\{-\frac{158}{1693}, -\frac{213}{1693}, \frac{236}{1693}, \frac{143}{1693}\right\}, \left\{\frac{108}{1693}, -\frac{133}{1693}, \frac{203}{1693}, \frac{288}{1693}\right\}\right\}$

In[•]:= **aim = MatrixForm[ai]**

Out[•]//MatrixForm=

$$\begin{pmatrix} \frac{110}{1693} & \frac{84}{1693} & \frac{50}{1693} & -\frac{271}{1693} \\ -\frac{51}{1693} & \frac{392}{1693} & -\frac{331}{1693} & -\frac{136}{1693} \\ -\frac{158}{1693} & -\frac{213}{1693} & \frac{236}{1693} & \frac{143}{1693} \\ \frac{108}{1693} & -\frac{133}{1693} & \frac{203}{1693} & \frac{288}{1693} \end{pmatrix}$$

In[•]:= **ai.a == a.ai**

Out[•]= True