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1)Problem A.8)

In[2]:=
```
A := {{-1, 1, i}, {2, 0, 3}, {2 i, -2 i, 2}}
B := {{2, 0, -i}, {0, 1, 0}, {i, 3, 2}}
MatrixForm[A + B] (*matches*)
```

Out[4]//MatrixForm=

$$\begin{pmatrix} 1 & 1 & 0 \\ 2 & 1 & 3 \\ 3\,i & 3-2\,i & 4 \end{pmatrix}$$

In[5]:=
```
MatrixForm[A.B] (* Matrix, Vector,
and Dot Products are defined with dots in Mathematica. *)
```

Out[5]//MatrixForm=

$$\begin{pmatrix} -3 & 1+3\,i & 3\,i \\ 4+3\,i & 9 & 6-2\,i \\ 6\,i & 6-2\,i & 6 \end{pmatrix}$$

In[6]:=
```
(*Commutator [A,B] = AB - BA*) MatrixForm[(A.B) - (B.A)]
```

Out[6]//MatrixForm=

$$\begin{pmatrix} -3 & 1+3\,i & 3\,i \\ 2+3\,i & 9 & 3-2\,i \\ -6+3\,i & 6+i & -6 \end{pmatrix}$$

In[7]:=
```
MatrixForm[Transpose[A]] (*matches*)
```

Out[7]//MatrixForm=

$$\begin{pmatrix} -1 & 2 & 2\,i \\ 1 & 0 & -2\,i \\ i & 3 & 2 \end{pmatrix}$$

In[8]:=
```
MatrixForm[Conjugate[A]](*matches*)
```

Out[8]//MatrixForm=

$$\begin{pmatrix} -1 & 1 & -i \\ 2 & 0 & 3 \\ -2\,i & 2\,i & 2 \end{pmatrix}$$

In[9]:=
```
MatrixForm[ConjugateTranspose[A]](*matches*)
```

Out[9]//MatrixForm=

$$\begin{pmatrix} -1 & 2 & -2\,i \\ 1 & 0 & 2\,i \\ -i & 3 & 2 \end{pmatrix}$$

In[10]:=
```
Det[B](*matches*)
```

Out[10]= 3

In[11]:=
```
MatrixForm[Inverse[B]](*matches*)
```

Out[11]//MatrixForm=

$$\begin{pmatrix} \frac{2}{3} & -\frac{i}{3} & \frac{i}{3} \\ 0 & 1 & 0 \\ -\frac{i}{3} & -2 & \frac{2}{3} \end{pmatrix}$$

In[12]:=
```
MatrixForm[B.Inverse[B]] (*matches. It is the 3 X 3 indentity as expected.*)
```

Out[12]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

In[13]:=
```
Det[A] (* matches. The satement for inverse
 is an iff so the inverse for A does not exist.*)
```

Out[13]= 0

In[14]:=
```
a := {{i}, {2 i}, {2}}
b := {{2}, {1 - i}, {0}}
MatrixForm[A.a] (*matches*)
```

Out[16]//MatrixForm=

$$\begin{pmatrix} 3\,i \\ 6+2\,i \\ 6 \end{pmatrix}$$

In[17]:=
```
MatrixForm[ConjugateTranspose[a].b](*matches*)
```

Out[17]//MatrixForm=

$$\begin{pmatrix} -2-4\,i \end{pmatrix}$$

In[18]:=
```
MatrixForm[Transpose[a].B.b](*matches*)
```

Out[18]//MatrixForm=

$$\begin{pmatrix} 8+4\,i \end{pmatrix}$$

In[19]:=
```
MatrixForm[a.ConjugateTranspose[b]] (*matches*)
```

Out[19]//MatrixForm=

$$\begin{pmatrix} 2\,i & -1+i & 0 \\ 4\,i & -2+2\,i & 0 \\ 4 & 2+2\,i & 0 \end{pmatrix}$$

```
Tr[B] (* matches.The Trace of a matrix is given by the Tr command in Mathematica.*)
```

Out[20]= 5