Tutorial Assignment 7 Solutions

Question 1

In[2]:=
```
A = {{1, -2, 7, 5}, {-2, -1, -9, -7}, {1, 13, -8, -4}}
```

Out[2]=
```
{{1, -2, 7, 5}, {-2, -1, -9, -7}, {1, 13, -8, -4}}
```

In[3]:=
```
A // MatrixForm
```

Out[3]//MatrixForm=

$$\begin{pmatrix} 1 & -2 & 7 & 5 \\ -2 & -1 & -9 & -7 \\ 1 & 13 & -8 & -4 \end{pmatrix}$$

In[4]:=
```
RowReduce[A] // MatrixForm
```

Out[4]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 5 & \frac{19}{5} \\ 0 & 1 & -1 & -\frac{3}{5} \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[7]:=
```
Transpose[A][[1]] // MatrixForm
Transpose[A][[2]] // MatrixForm
```

The Basis of the column space of A is

$$\text{Col } A = \left\{ \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}, \begin{pmatrix} -2 \\ -1 \\ 13 \end{pmatrix} \right\}$$

Question 2

In[9]:=
```
B = {{1, -2, 3, 0, -1}, {2, -4, 7, -3, 3}, {3, -6, 8, 3, -8}}
```

Out[9]=
```
{{1, -2, 3, 0, -1}, {2, -4, 7, -3, 3}, {3, -6, 8, 3, -8}}
```

In[10]:=
```
B // MatrixForm
```

Out[10]//MatrixForm=

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

```
RowReduce[B] // MatrixForm
```

Out[11]//MatrixForm=

$$\begin{pmatrix} 1 & -2 & 0 & 9 & -16 \\ 0 & 0 & 1 & -3 & 5 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

So the Null space is

$$\text{Nul } B = \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} -9 \\ 0 \\ 3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 16 \\ 0 \\ -5 \\ 0 \\ 1 \end{pmatrix} \right\}$$

Question 3

In[12]:=
```
p = Polygon[{{0, 0}, {1, 0}, {1, 1}, {0, 1}}];
```

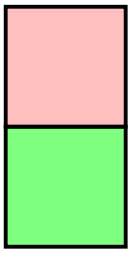
In[13]:=
```
Clear[t];
t[x_] := {{1, 0}, {0, -1}}.x
```

In[15]:=
```
tp = Polygon[{t[{0, 0}], t[{1, 0}], t[{1, 1}], t[{0, 1}]}]
```

Out[15]=
```
Polygon[{{0, 0}, {1, 0}, {1, -1}, {0, -1}}]
```

In[16]:=
```
Show[{Graphics[{Opacity[0.5], EdgeForm[Thick], Pink, p}],
  Graphics[{Opacity[0.5], EdgeForm[Thick], Green, tp}]}]
```

Out[16]=



Question 4

Columns of matrix A are not linearly independent so the transformation is not one-to-one

Question 5

Columns of Matrix B do not span the whole column space of B (not every row has a pivot in RREF form of B) so the transformation is not on-to.