First I name the matrix of our system.

In[1]:=
```
mA = {{3, 0, -1, 1}, {1, 1, -2, 2}, {2, -1, 1, 3}}
```

Out[1]=
```
{{3, 0, -1, 1}, {1, 1, -2, 2}, {2, -1, 1, 3}}
```

To display this matrix in the traditional form I use

In[ ]:=
```
MatrixForm[mA]
```

Out[ ]//MatrixForm=

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

Now I row reduce the matrix mA. The command that performs row reduction is applied to the matrix mA and then, MatrixForm displays the result in convenient form:

In[2]:=
```
MatrixForm[RowReduce[mA]]
```

Out[2]//MatrixForm=

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

What I see is that each row has a pivot entry. This tells me that whatever the augmented column is, the system with this matrix will always have a solution. The reason for this is that a system with three equation can have at most three pivots. Here, all pivots are in the columns which belong to the system, so the augmented column cannot be a pivot column.

Now form the augmented matrix

In[6]:=
```
mAa = {{3, 0, -1, 1, -2}, {1, 1, -2, 2, 3}, {2, -1, 1, 3, 8}}
```

Out[6]= {{3, 0, -1, 1, -2}, {1, 1, -2, 2, 3}, {2, -1, 1, 3, 8}}

In[7]:=
```
MatrixForm[mAa]
```

Out[7]//MatrixForm=

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

In[8]:=
```
MatrixForm[RowReduce[mAa]]
```

Out[8]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & -\frac{1}{3} & 0 & -\frac{7}{4} \\ 0 & 1 & -\frac{5}{3} & 0 & -\frac{7}{4} \\ 0 & 0 & 0 & 1 & \frac{13}{4} \end{pmatrix}$$