In [4]:

```
from sage.matrix.constructor import matrix
```

ADDITION OF MATRIX OF 3X3 ORDER

In [12]:

```
matrix_A = Matrix([[1,2,3],[4,5,6],[7,8,9]])
show("A = ",matrix_A)
```

$$\texttt{A = }\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

In [11]:

```
matrix_B = Matrix([[7,6,5],[1,2,3],[9,8,3]])
show("B = ",matrix_B)
```

$$\texttt{B = }\begin{pmatrix} 7 & 6 & 5 \\ 1 & 2 & 3 \\ 9 & 8 & 3 \end{pmatrix}$$

In [14]:

```
Resultant_Matrix = matrix_A + matrix_B
show("Addition = ",Resultant_Matrix)
```

$$\texttt{Addition = }\begin{pmatrix} 8 & 8 & 8 \\ 5 & 7 & 9 \\ 16 & 16 & 12 \end{pmatrix}$$

ADDITION OF MATRIX OF 4X4 ORDER

In [23]:

```
matrix_A = Matrix([[1,2,3,5],[4,5,6,8],[7,8,9,7],[1,2,3,4]])
show("A = ",matrix_A)
```

$$\texttt{A = }\begin{pmatrix} 1 & 2 & 3 & 5 \\ 4 & 5 & 6 & 8 \\ 7 & 8 & 9 & 7 \\ 1 & 2 & 3 & 4 \end{pmatrix}$$

In [24]:

```
matrix_B = Matrix([[7,6,5,4],[1,2,3,2],[9,8,3,3],[7,5,3,1]])
show("B = ",matrix_B)
```

$$\texttt{B = }\begin{pmatrix} 7 & 6 & 5 & 4 \\ 1 & 2 & 3 & 2 \\ 9 & 8 & 3 & 3 \\ 7 & 5 & 3 & 1 \end{pmatrix}$$

In [26]:

```
Resultant_MatriIx = matrix_A + matrix_B
show("Addition = ",Resultant_MatriIx)
```

$$\texttt{Addition} = \begin{pmatrix} 8 & 8 & 8 & 9 \\ 5 & 7 & 9 & 10 \\ 16 & 16 & 12 & 10 \\ 8 & 7 & 6 & 5 \end{pmatrix}$$

SUBSTRACTION OF MATRIX OF 3X3 ORDER

In [28]:

```
matrix_A = Matrix([[1,2,3],[4,5,6],[7,8,9]])
show("A = ",matrix_A)
matrix_B = Matrix([[7,6,5],[1,2,3],[9,8,3]])
show("B = ",matrix_B)
Resultant_Matix = matrix_A + matrix_B
show("Substraction = ",Resultant_Matix)
```

$$\texttt{A} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

$$\texttt{B} = \begin{pmatrix} 7 & 6 & 5 \\ 1 & 2 & 3 \\ 9 & 8 & 3 \end{pmatrix}$$

$$\texttt{Substraction} = \begin{pmatrix} 8 & 8 & 8 \\ 5 & 7 & 9 \\ 16 & 16 & 12 \end{pmatrix}$$

SUBSTRACTION OF MATRIX OF 4X4 ORDER

In [30]:

```
matrix_A = Matrix([[1,2,3,1],[4,5,6,2],[7,8,9,8],[1,4,7,8]])
show("A = ",matrix_A)
matrix_B = Matrix([[7,6,5,1],[1,2,3,0],[9,8,3,3],[9,6,3,2]])
show("B = ",matrix_B)
resultant_Matix = matrix_A + matrix_B
show("Substraction = ",resultant_Matix)
```

$$\texttt{A =}\begin{pmatrix}1 & 2 & 3 & 1\\ 4 & 5 & 6 & 2\\ 7 & 8 & 9 & 8\\ 1 & 4 & 7 & 8\end{pmatrix}$$

$$\texttt{B =}\begin{pmatrix}7 & 6 & 5 & 1\\ 1 & 2 & 3 & 0\\ 9 & 8 & 3 & 3\\ 9 & 6 & 3 & 2\end{pmatrix}$$

$$\texttt{Substraction =}\begin{pmatrix}8 & 8 & 8 & 2\\ 5 & 7 & 9 & 2\\ 16 & 16 & 12 & 11\\ 10 & 10 & 10 & 10\end{pmatrix}$$

DETERMINANT OF MATRIX OF 3X3 ORDER

In [31]:

```
matrix_A = Matrix([[1,2,3],[4,5,6],[7,8,9]])
show("A = ",matrix_A)
```

$$\texttt{A =}\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{pmatrix}$$

In [34]:

```
det_A = matrix_A.det()
show("Determinant = ",det_A)
```

$$\texttt{Determinant =}0$$

DETERMINANT OF MATRIX OF 4X4 ORDER

In [35]:

```
matrix_B = Matrix([[7,6,5,1],[1,2,3,0],[9,8,3,3],[9,6,3,2]])
show("B = ",matrix_B)
det_B = matrix_B.det()
show("Determinant = ",det_B)
```

$$\texttt{B =}\begin{pmatrix}7 & 6 & 5 & 1\\ 1 & 2 & 3 & 0\\ 9 & 8 & 3 & 3\\ 9 & 6 & 3 & 2\end{pmatrix}$$

$$\texttt{Determinant =}-16$$

ADJOINT OF MATRIX OF 3X3 ORDER

In [36]:

```
matrix_M = Matrix([[1,2,3],[4,5,6],[7,8,9]])
show("M = ",matrix_M)
adj_M = matrix_M.adjugate()
show("Adjoint = ",adj_M)
```

$$\texttt{M =}\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{pmatrix}$$

$$\texttt{Adjoint =}\begin{pmatrix}-3 & 6 & -3\\ 6 & -12 & 6\\ -3 & 6 & -3\end{pmatrix}$$

ADJOINT OF MATRIX OF 4X4 ORDER

In [40]:

```
matrix_N = Matrix([[1,2,3,1],[4,5,6,4],[7,8,9,7],[10,11,12,8]])
show("N = ",matrix_N)
adj_N = matrix_N.adjugate()
show("Adjoint = ",adj_N)
```

$$\texttt{N =}\begin{pmatrix}1 & 2 & 3 & 1\\ 4 & 5 & 6 & 4\\ 7 & 8 & 9 & 7\\ 10 & 11 & 12 & 8\end{pmatrix}$$

$$\texttt{Adjoint =}\begin{pmatrix}6 & -12 & 6 & 0\\ -12 & 24 & -12 & 0\\ 6 & -12 & 6 & 0\\ 0 & 0 & 0 & 0\end{pmatrix}$$

INVERSE OF MATRIX OF 3X3 ORDER

In [50]:

```
matrix_H = Matrix([[1,2,1],[4,5,6],[7,8,9]])
show("H = ",matrix_H)
invers_H = matrix_H.inverse()
show("Inverse = ",invers_H)
```

$$\texttt{H =}\begin{pmatrix}1 & 2 & 1\\ 4 & 5 & 6\\ 7 & 8 & 9\end{pmatrix}$$

$$\texttt{Inverse =}\begin{pmatrix}-\frac{1}{2} & -\frac{5}{3} & \frac{7}{6}\\ 1 & \frac{1}{3} & -\frac{1}{3}\\ -\frac{1}{2} & 1 & -\frac{1}{2}\end{pmatrix}$$

INVERSE OF MATRIX OF 4X4 ORDER

In [51]:

```
matrix_H = Matrix([[1,2,1,2],[4,5,6,5],[7,8,9,3],[1,4,5,6]])
show("H = ",matrix_H)
invers_H = matrix_H.inverse()
show("Inverse = ",invers_H)
```

$$\texttt{H =}\begin{pmatrix} 1 & 2 & 1 & 2 \\ 4 & 5 & 6 & 5 \\ 7 & 8 & 9 & 3 \\ 1 & 4 & 5 & 6 \end{pmatrix}$$

$$\texttt{Inverse =}\begin{pmatrix} \frac{1}{68} & \frac{25}{34} & -\frac{7}{34} & -\frac{35}{68} \\ \frac{13}{17} & -\frac{13}{17} & \frac{5}{17} & \frac{4}{17} \\ -\frac{49}{68} & -\frac{1}{34} & \frac{3}{34} & \frac{15}{68} \\ \frac{3}{34} & \frac{7}{17} & -\frac{4}{17} & -\frac{3}{34} \end{pmatrix}$$

Conclusion :- Hence all the operations are performed on the materices of order 3x3 and 4x4.