Kernel: SageMath 10.2

Experiment Number 1

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Roll No. :-31

Aim:-To study various Basic Operations on Matrices of Any Order.

Defining a Matrix 2x2

In [1]:
```
from sage.matrix.constructor import Matrix
```

In [3]:
```
matrix_A=Matrix([[1,2],[3,4]])
```

In [6]:
```
print("Matrix A =")
show(matrix_A)
```

Out[6]:
```
Matrix A =
```
$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

Defining a Matrix 3x3

In [7]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
```

In [8]:
```
print("Matrix A =")
show(matrix_A)
```

Out[8]:
```
Matrix A =
```
$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

Determinant of a Matrix :-

Determinant of a Matrix of Order 2x2

In [9]:
```
matrix_A=Matrix([[1,2],[3,4]])
```

In [10]:
```
determinant_A=matrix_A.det()
```

In [14]:
```
print("Matrix A is :-")
show(matrix_A)
print("Determinant of Matrix A is :",determinant_A)
```

Out[14]:
```
Matrix A is :-
```
$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$
```
Determinant of Matrix A is : -2
```

Determinant of a Matrix of Order 3x3

In [15]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
```

In [16]:

In [16]:
```
print("Matrix A is :-")
show(matrix_A)
print("Determinant of Matrix A is :",determinant_A)
```

Out[16]:
```
Matrix A is :-
```

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

```
Determinant of Matrix A is : -2
```

Ad-joint of a Matrix

Ad-joint of a Matrix of order 2x2

In [19]:
```
matrix_A=Matrix([[1,2],[3,4]])
```

In [30]:
```
print("matrix_A")
show(matrix_A)

print("The adjoint of Matrix  is :-")
adjoint_A=matrix_A.adjugate()
show(adjoint_A)
```

Out[30]:
```
matrix_A
```

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

```
The adjoint of Matrix  is :-
```

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

Ad-joint of a Matrix of order 3x3

In [31]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
```

In [32]:
```
print("matrix_A")
show(matrix_A)

print("The adjoint of Matrix  is :-")
adjoint_A=matrix_A.adjugate()
show(adjoint_A)
```

Out[32]:
```
matrix_A
```

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

```
The adjoint of Matrix  is :-
```

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

Inverse of A Matrix :-

Inverse of A Matrix of Order 2x2

In [37]:
```
matrix_A=Matrix([[1,2],[3,4]])
show(matrix_A)

inverse_A=matrix_A.inverse()
print("Inverse is :-")
show(inverse_A)
```

Out[37]:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

Inverse is :-

Inverse is :-

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

Inverse of A Matrix of Order 3x3

In [50]:
```
matrix_A=Matrix([[1,2,3],[3,4,5],[6,9,8]])
show(matrix_A)

inverse_A=matrix_A.inverse()
print("Inverse is :-")
show(inverse_A)
```

Out[50]:

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

Inverse is :-

$$\begin{pmatrix} -\frac{13}{8} & \frac{11}{8} & -\frac{1}{4} \\ \frac{3}{4} & -\frac{5}{4} & \frac{1}{2} \\ \frac{3}{8} & \frac{3}{8} & -\frac{1}{4} \end{pmatrix}$$

Addition of Two Matrices

Addition of Two Matrices of Order 2x2

In [53]:
```
matrix_A=Matrix([[1,2],[3,4]])
show(matrix_A)

matrix_B=Matrix([[4,3],[2,1]])
show(matrix_B)

print("The resultant Matrix is :-")

result_matrix=matrix_A + matrix_B
show(result_matrix)
```

Out[53]:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$$

The resultant Matrix is :-

$$\begin{pmatrix} 5 & 5 \\ 5 & 5 \end{pmatrix}$$

Addition of Two Matrices of Order 3x3

In [54]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
show(matrix_A)

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

print("The resultant Matrix is :-")

result_matrix=matrix_A + matrix_B
show(result_matrix)
```

Out[54]:

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

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

The resultant Matrix is :-

$$\begin{pmatrix} 10 & 10 & 10 \end{pmatrix}$$

$$\begin{pmatrix} 10 & 10 & 10 \\ 10 & 10 & 10 \end{pmatrix}$$

Subtraction of Two Matrices

Subtraction of Two Matrices of Order 2x2

In [55]:
```
matrix_A=Matrix([[1,2],[3,4]])
show(matrix_A)

matrix_B=Matrix([[4,3],[2,1]])
show(matrix_B)

print("The resultant Matrix is :-")

result_matrix=matrix_A - matrix_B
show(result_matrix)
```

Out[55]:
$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$$

The resultant Matrix is :-

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

Subtraction of Two Matrices of Order 3x3

In [56]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
show(matrix_A)

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

print("The resultant Matrix is :-")

result_matrix=matrix_A - matrix_B
show(result_matrix)
```

Out[56]:
$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

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

The resultant Matrix is :-

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

Multiplication of Two Matrices

Multiplication of Two Matrices of Order 2x2

In [57]:
```
matrix_A=Matrix([[1,2],[3,4]])
show(matrix_A)

matrix_B=Matrix([[4,3],[2,1]])
show(matrix_B)

print("The resultant Matrix is :-")

result_matrix=matrix_A * matrix_B
show(result_matrix)
```

Out[57]:
$$\begin{pmatrix} 1 & 2 \\$$

$$\begin{pmatrix} 3 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$$

```
The resultant Matrix is :-
```

$$\begin{pmatrix} 8 & 5 \\ 20 & 13 \end{pmatrix}$$

Multiplication of Two Matrices of Order 3x3

In [58]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
show(matrix_A)

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

print("The resultant Matrix is :-")

result_matrix=matrix_A * matrix_B
show(result_matrix)
```

Out[58]:

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

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

```
The resultant Matrix is :-
```

$$\begin{pmatrix} 30 & 24 & 18 \\ 84 & 69 & 54 \\ 138 & 114 & 90 \end{pmatrix}$$

Transpose of Matrix

Transpose of Matrix of order 2x2

In [60]:
```
matrix_A=Matrix([[1,2],[3,4]])
show(matrix_A)

transpose_A=matrix_A.transpose()
print("Transpose of Matrix a is :-")
show(transpose_A)
```

Out[60]:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

```
Transpose of Matrix a is :-
```

$$\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$$

Transpose of Matrix of order 3x3

In [61]:
```
matrix_A=Matrix([[1,2,3],[4,5,6],[7,8,9]])
show(matrix_A)

transpose_A=matrix_A.transpose()
print("Transpose of Matrix a is :-")
show(transpose_A)
```

Out[61]:

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

```
Transpose of Matrix a is :-
```

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

$$\begin{pmatrix} 2 & 5 & 8 \\ 3 & 6 & 9 \end{pmatrix}$$

Conclusion :-Basic Operations on Matrices are performed Successfully.

In [0]: