

Experiment Number 1

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

The adjoint of

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 :-

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

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

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]:

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

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

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

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 :-

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

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

Conclusion :-Basic Operations on Matrices are performed Successfully.

In [0]: