2. Operation on Matrices

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0.1 2. Operations on Matrices

2.1 Trace of a Matrix

[2]:
```
import sympy as sp
sp.init_printing()
```

[3]:
```
M1 = sp.diag(2,3,4,-5)
M1
```

[3]:
$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & -5 \end{bmatrix}$$

[4]:
```
sp.trace(M1)
```

[4]:
$$4$$

2.2 Determinant of a Matrix

[5]:
```
M2 = sp.Matrix([[1,2,3],[2,1,2],[1,-2,1]])
M2
```

[5]:
$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 1 & -2 & 1 \end{bmatrix}$$

[6]:
```
sp.det(M2)
```

[6]:
$$-10$$

[7]:
```
M2.det()
```

[7]:
$$-10$$

[8]:
```
M3 = sp.diag(1,2,3)
M3
```

[8]:
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

[9]:
```
sp.det(M3)
```

[9]:
$$6$$

2.3 Transpose of a Matrix

[10]:
```
M4 = sp.Matrix(2,3,[1,3,2,4,5,1])
M4
```

[10]:
$$\begin{bmatrix} 1 & 3 & 2 \\ 4 & 5 & 1 \end{bmatrix}$$

[11]:
```
M5=sp.transpose(M4)
M5
```

[11]:
$$\begin{bmatrix} 1 & 4 \\ 3 & 5 \\ 2 & 1 \end{bmatrix}$$

[14]:
```
M5.transpose() #this can also me used
```

[14]:
$$\begin{bmatrix} 1 & 3 & 2 \\ 4 & 5 & 1 \end{bmatrix}$$

[15]:
```
M5.T # this can also be used
```

[15]:
$$\begin{bmatrix} 1 & 3 & 2 \\ 4 & 5 & 1 \end{bmatrix}$$

2.4 Power of a Matrix

[16]:
```
M6 = sp.Matrix(3,3,[1,2,3,1,4,6,1,2,0])
M6
```

[16]:
$$\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 6 \\ 1 & 2 & 0 \end{bmatrix}$$

[18]:
```
M6**2 #Matrix M6 to the power of 2
```

[18]:
$$\begin{bmatrix} 6 & 16 & 15 \\ 11 & 30 & 27 \\ 3 & 10 & 15 \end{bmatrix}$$

[20]:
```
M6**10 #Matrix M6 multiplied 10 times
```

[20]:
$$\begin{bmatrix} 24934833 & 70711222 & 73548483 \\ 46195061 & 131001666 & 136257516 \\ 17289861 & 49032322 & 51002772 \end{bmatrix}$$

2.5 Inverse of a Matrix

[21]:
```
M7 = sp.Matrix([[1,2,3],[3,2,1],[1,1,0]])
M7
```

[21]:

$$\begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

[22]:
```
M7.inv()
```

[22]:
$$\begin{bmatrix} -\frac{1}{4} & \frac{3}{4} & -1 \\ \frac{1}{4} & -\frac{3}{4} & 2 \\ \frac{1}{4} & \frac{1}{4} & -1 \end{bmatrix}$$

2.6 Adding, subtracting and constant multiplication of two Matrices

[24]:
```
A = sp.Matrix(3,4,[1,2,1,2,1,2,1,2,1,2,1,2])
B = sp.Matrix(3,4,[2,1,2,1,2,1,2,1,2,1,2,1])
display("A = ",A)
display("B = ",B)
```

'A = '

$$\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 2 & 1 & 2 \\ 1 & 2 & 1 & 2 \end{bmatrix}$$

'B = '

$$\begin{bmatrix} 2 & 1 & 2 & 1 \\ 2 & 1 & 2 & 1 \\ 2 & 1 & 2 & 1 \end{bmatrix}$$

[25]:
```
#Add two matrices A and B
A+B
```

[25]:
$$\begin{bmatrix} 3 & 3 & 3 & 3 \\ 3 & 3 & 3 & 3 \\ 3 & 3 & 3 & 3 \end{bmatrix}$$

[26]:
```
A-B
```

[26]:
$$\begin{bmatrix} -1 & 1 & -1 & 1 \\ -1 & 1 & -1 & 1 \\ -1 & 1 & -1 & 1 \end{bmatrix}$$

[27]:
```
5*A
```

[27]:
$$\begin{bmatrix} 5 & 10 & 5 & 10 \\ 5 & 10 & 5 & 10 \\ 5 & 10 & 5 & 10 \end{bmatrix}$$

2.7 Multiplying two matrices

[28]:
```
M1 = sp.Matrix(2,3,[2,1,2,1,2,1])
M2 = sp.Matrix(3,4,[1,2,1,2,1,2,1,2,1,2,1,2])
display(M1)
display(M2)
```

$$\begin{bmatrix} 2 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 2 & 1 & 2 \\ 1 & 2 & 1 & 2 \end{bmatrix}$$

[29]:
```
M1*M2
```

[29]:
$$\begin{bmatrix} 5 & 10 & 5 & 10 \\ 4 & 8 & 4 & 8 \end{bmatrix}$$

2.8 Rank of a Matrix

[31]:
```
M3 = sp.Matrix(3,3,[1,2,3,4,5,6,7,8,9])
M3
```

[31]:
$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

[32]:
```
M3.rank()
```

[32]:
2

[ ]:
```

```