Practical 1_1

```
c1=34+7j
c2=32+27j
c1+c2
print("Addition of two complex number is ", c1+c2)
print("Subtraction of two complex number is ", c1-c2)
print("Multiplication of two complex number is ", c1*c2)
print("Division of two complex number is ", c1/c2)
```

Output

```
Addition of two complex number is  (66+34j)
Subtraction of two complex number is  (2-20j)
Multiplication of two complex number is  (899+1142j)
Division of two complex number is  (0.728465487735311-0.39589275527666856j)
```

Practical 1_2

```
t=3+4j
print(t)
m=t.conjugate()
print("conjugate of t is  ",m)
```

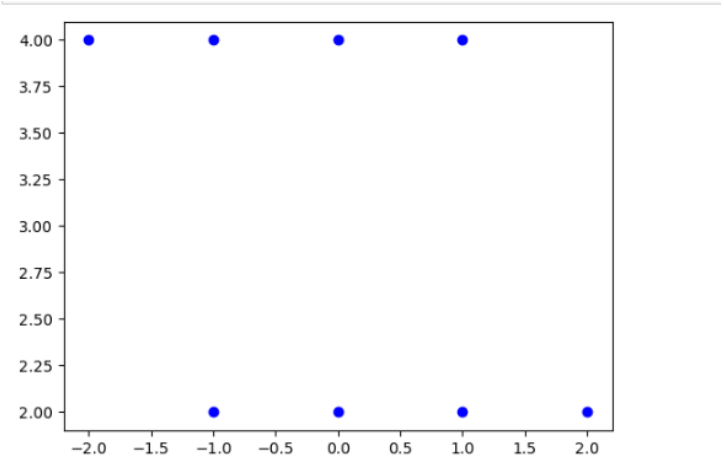
Output

```
(3+4j)
conjugate of t is   (3-4j)
```

Practical 1_3

```
import matplotlib.pyplot as plt
x=3+2j
a=[-2+4j,-1+2j,0+2j,1+2j,2+2j,-1+4j,0+4j,1+4j]
A=[x.real for x in a]
B=[x.imag for x in a]
plt.scatter(A,B,color="blue")
plt.show()
```

Output



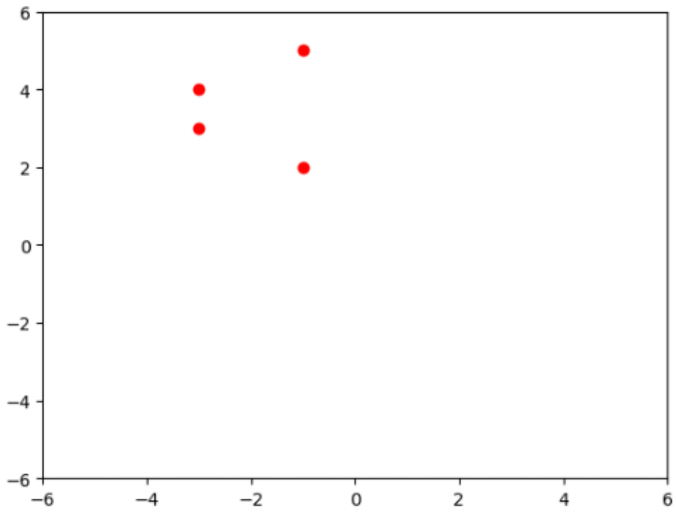
Practical 1_4

```
import matplotlib.pyplot as plt
s={3+3j,4+3j,2+1j,5+1j,2+1j}
angle=int(input("Enter the angle rotation"))
if angle==90:
    s1={x*1j for x in s}
    print(s1)
    x=[x.real for x in s1]
    y=[x.imag for x in s1]
    plt.plot(x,y,'ro')
    plt.axis([-6,6,-6,6])
    plt.show()
elif angle==180:
    s1={x*-1 for x in s1}
    print(s1)
    x=[x.real for x in s1]
    y=[x.imag for x in s1]
    plt.plot(x,y,'ro')
    plt.axis([-6,6,-6,6])
```

```
    plt.show()
else:
    print("invalid angle")
```

Output

```
Enter the angle rotation90
{(-3+4j), (-1+2j), (-1+5j), (-3+3j)}
```



Practical 2

```
import numpy as np
#enter vector as n-list
x=np.array([5,6,7])
y=np.array([1,2,3])
print(x)
print(y)
print("enter value of a and b")
a=int(input())
b=int(input())
c=a*x+b*y
d=np.dot(x,y)
print("au+bv vector is " , c)
print("dot product is ",d)
```

Output

```
[5 6 7]
[1 2 3]
enter value of a and b
34
12
au+bv vector is  [182 228 274]
dot product is  38
```

Practical 3_1

```
import numpy as np
M=np.array([[1,1,1],[3,4,7],[9,6,3]])
M
#matrix M is
print("matrix M is ",M)
Y=M[0:1]
Y
#first row of matrix M is
print("first row of matrix M is ",Y)
x=M[0:2]
#first two rows of matrix M is
print("first two rows of matrix M is ",x)
t=M[0:3]
#all rows of matrix M is
print("all three rows of matrix M is ",t)
```

Output

```
matrix M is  [[1 1 1]
 [3 4 7]
 [9 6 3]]
first row of matrix M is  [[1 1 1]]
first two rows of matrix M is  [[1 1 1]
 [3 4 7]]
all three rows of matrix M is  [[1 1 1]
 [3 4 7]
 [9 6 3]]
```

Practical 3_2

```
import numpy as np
M=np.array([[1,1,1],[3,4,7],[9,6,3]])
M
#matrix M is
print("matrix M is ",M)
Y=M[:,0:1]
Y
#first column of matrix M is
print("first column of matrix M is ",Y)
x=M[:,0:2]
#first two columns of matrix M is
print("first two columns of matrix M is ",x)
t=M[:,0:3]
#all columns of matrix M is
print("all three columns of matrix M is ",t)
```

Output

```
matrix M is  [[1 1 1]
 [3 4 7]
 [9 6 3]]
first column of matrix M is  [[1]
 [3]
 [9]]
first two columns of matrix M is  [[1 1]
 [3 4]
 [9 6]]
all three columns of matrix M is  [[1 1 1]
 [3 4 7]
 [9 6 3]]
```


Practical 3_3

```
import numpy as np
M=np.array([[1,1,1],[3,4,7],[9,6,3]])
M
#matrix M is
print("matrix M is ",M)
a=6
scalar=a*M
print("scalar-matrix multiplication is  ",scalar)
```

Output

```
matrix M is  [[1 1 1]
 [3 4 7]
 [9 6 3]]
scalar-matrix multiplication is   [[ 6  6  6]
 [18 24 42]
 [54 36 18]]
```

Practical 3_4

```
x=[[12,7],[4,5],[3,8]]
t=[[0,0,0],[0,0,0]]
print("original matrix")
print(x)
print("transpose of matrix")
for i in range(len(x)):
      for j in range(len(x[0])):
            t[j][i]=x[i][j]
            for r in t:
                  print(r)
```

Output

```
original matrix
[[12, 7], [4, 5], [3, 8]]
transpose of matrix
[12, 0, 0]
[0, 0, 0]
[12, 0, 0]
[7, 0, 0]
[12, 4, 0]
[7, 0, 0]
[12, 4, 0]
[7, 5, 0]
[12, 4, 3]
[7, 5, 0]
[12, 4, 3]
[7, 5, 8]
```


Practical 4_1

```
import numpy as np
x=np.array([1,4,6])
y=np.array([[2,3],[3,4],[4,5]])
print(np.dot(x,y))
```

Output

```
[38 49]
```

Practical 4_2

```
import numpy as np
A=np.array([[3,2,2],[4,1,5],[1,2,3]])
print("matrix A is ",A)
B=np.array([[1,2,3],[1,1,1],[2,2,2]])
print("matrix B is ",B)
print("multiplication of two matrices A & B is ")
M=([[0,0,0],[0,0,0],[0,0,0]])
for i in range(len(A)):
      for j in range(len(B[0])):
            for k in range(len(B)):
                  M[i][j]+=A[i][k]*B[k][j]
                  for r in M:
                        print(r)
```

Output

```
matrix A is  [[3 2 2]
 [4 1 5]
 [1 2 3]]
matrix B is  [[1 2 3]
 [1 1 1]
 [2 2 2]]
multiplication of two matrices A & B is
[3, 0, 0]
[0, 0, 0]
[0, 0, 0]
[5, 0, 0]
[0, 0, 0]
[0, 0, 0]
[9, 0, 0]
[0, 0, 0]
[0, 0, 0]
[9, 6, 0]
[0, 0, 0]
[0, 0, 0]
[9, 8, 0]
[0, 0, 0]
[0, 0, 0]
[9, 12, 0]
[0, 0, 0]
[0, 0, 0]
[9, 12, 9]
[0, 0, 0]
[0, 0, 0]
[9, 12, 11]
[0, 0, 0]
[0, 0, 0]
[9, 12, 15]
[0, 0, 0]
[0, 0, 0]
[9, 12, 15]
[4, 0, 0]
[0, 0, 0]
[9, 12, 15]
[5, 0, 0]
[0, 0, 0]
[9, 12, 15]
[15, 0, 0]
[0, 0, 0]
[9, 12, 15]
[15, 8, 0]
[0, 0, 0]
[9, 12, 15]
[15, 9, 0]
[0, 0, 0]
```

[9, 12, 15]
[15, 19, 0]
[0, 0, 0]
[9, 12, 15]
[15, 19, 12]
[0, 0, 0]
[9, 12, 15]
[15, 19, 13]
[0, 0, 0]
[9, 12, 15]
[15, 19, 23]
[0, 0, 0]
[9, 12, 15]
[15, 19, 23]
[1, 0, 0]
[9, 12, 15]
[15, 19, 23]
[3, 0, 0]
[9, 12, 15]
[15, 19, 23]
[9, 0, 0]
[9, 12, 15]
[15, 19, 23]
[9, 2, 0]
[9, 12, 15]
[15, 19, 23]
[9, 4, 0]
[9, 12, 15]
[15, 19, 23]
[9, 10, 0]
[9, 12, 15]
[15, 19, 23]
[9, 10, 3]
[9, 12, 15]
[15, 19, 23]
[9, 10, 5]
[9, 12, 15]
[15, 19, 23]
[9, 10, 11]

Practical 5

```
import numpy as np
from numpy.linalg import inv
a=np.array([[1,2],[3,4]])
b=inv(a)
print(b)
```

Output

```
[[-2.   1. ]
 [ 1.5 -0.5]]
```

Practical 6

```
from scipy.linalg import lu
import numpy as np
M=np.array([[1,2,3],[3,-1,0],[2,2,2]])
u=lu(M)
print(M)
print(u)
```

Output

```
[[ 1  2  3]
 [ 3 -1  0]
 [ 2  2  2]]
(array([[0., 0., 1.],
       [1., 0., 0.],
       [0., 1., 0.]]), array([[1.        , 0.        , 0.        ],
       [0.66666667, 1.        , 0.        ],
       [0.33333333, 0.875     , 1.        ]]), array([[ 3.        , -1.        ,  0.        ],
       [ 0.        ,  2.66666667,  2.        ],
       [ 0.        ,  0.        ,  1.25      ]]))
```

Practical 7_1

```
N=54
print(N)
a=9
b=6
print("factors of N are a and b",a,b)
x=(a+b)/2
y=(a-b)/2
print("x and y is ",x,y)
a1=x*x
```

```
b1=y*y
print("a1 and b1 is " ,a1,b1)
N=a1-b1
print(N)
```

Output

```
54
factors of N are a and b 9 6
x and y is  7.5 1.5
a1 and b1 is  56.25 2.25
54.0
```

Practical 7_2

```
import math
print("gcd of x & y is :",end="")
print(math.gcd(12,16))
```

Output

```
gcd of x & y is :4
```

Practical 8

```
import numpy as np
def oprojection (of_vec,on_vec):
      x1=np.array(of_vec)
      x2=np.array(of_vec)
      scal=np.dot(x2,x1)/np.dot(x1,x2)
      vec=scal*2
      return round(scal,10),np.around(vec,decimals=10)
print(oprojection([2.0,2.0],[1.0,0.0]))
print(oprojection([2.0,2.0],[6.0,2.0]))
```

Output

```
(1.0, 2.0)
(1.0, 2.0)
```

Practical 9

```
import numpy as np
A=np.mat("-2 1;12 -3")
print("A \n",A)
print("eigen values of A are ",np.linalg.eigvals(A))
eigenvalues,eigenvectors=np.linalg.eig(A)
print("first set of eigen values ",eigenvalues)
print("eigen vectors are ",eigenvectors)
```

Output

```
A
 [[-2  1]
 [12 -3]]
eigen values of A are  [ 1. -6.]
first set of eigen values  [ 1. -6.]
eigen vectors are  [[ 0.31622777 -0.24253563]
 [ 0.9486833   0.9701425 ]]
```