Sahakar Maharshi Bhausaheb Santuji Thorat

College Sangamner

DEPARTMENT OF COMPUTER SCIENCE

Sub : Mathematics

Remark
Demonstrator's Signature
Date:- / /20

Name:-Gorde Yash Somnath__________________________ Roll.No:-21___Date:-________________

Title of the expt:-__Slip no 21_____________________________Page.no:-_____Class:-______BCS________

Q1) Attempt any TWO of the following

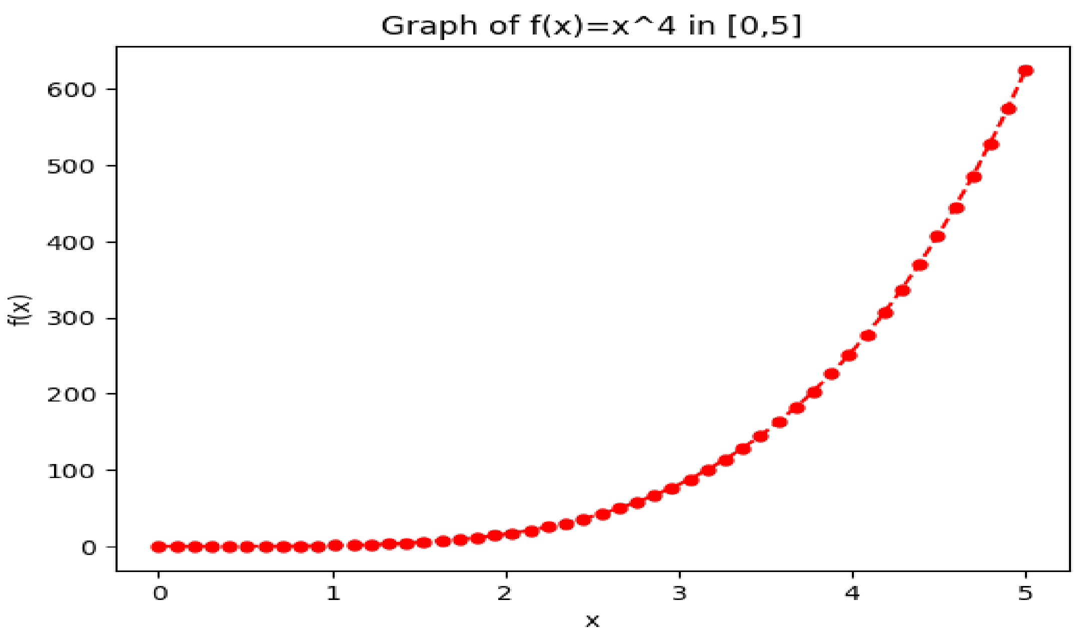
A) Write a python program to plot 2D graph of the function $f(x)=x^4$ in [0,5] with red dashed line with circle markers

-→

```
import numpy as np
import matplotlib.pyplot as plt
def f(x):
   return x**4

x = np.linspace(0, 5)
y = f(x)

plt.plot(x, y, 'o-', color='red', linestyle='dashed', markersize=5)
plt.xlabel('x')
plt.ylabel('f(x)')
plt.title('Graph of f(x)=x^4 in [0,5]')
plt.show()
```

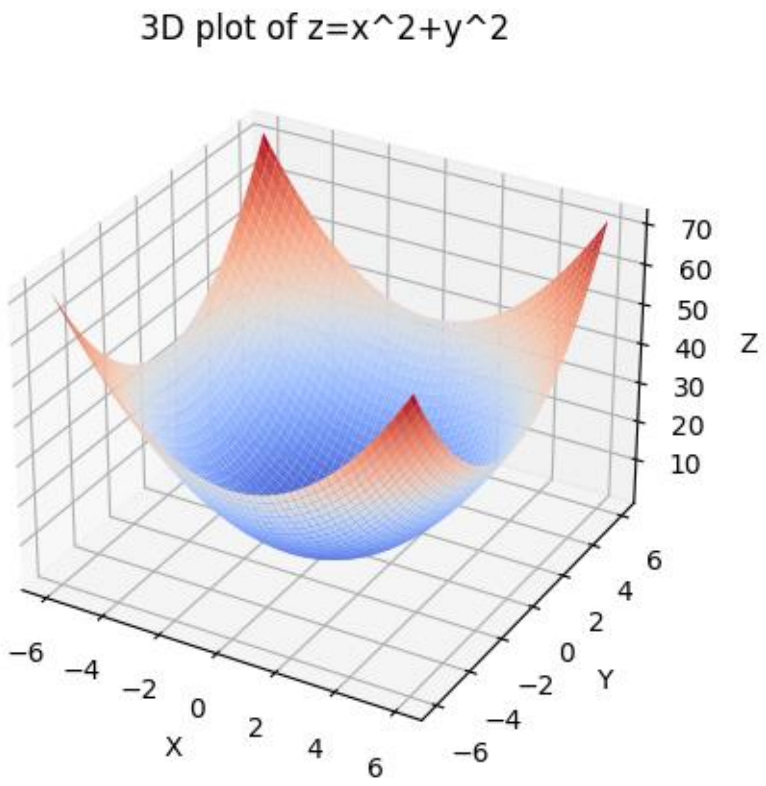


B) Write a python program to generate 3D plot of the function $z=x^2+y^2$ in -6<x,y<6
-→

```
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
def z_func(x, y):
    return x**2 + y**2

x = np.linspace(-6, 6, 100)
y = np.linspace(-6, 6, 100)
X, Y = np.meshgrid(x, y)
Z = z_func(X, Y)

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X, Y, Z, cmap='coolwarm')
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
ax.set_title('3D plot of z=x^2+y^2')
plt.show()
```

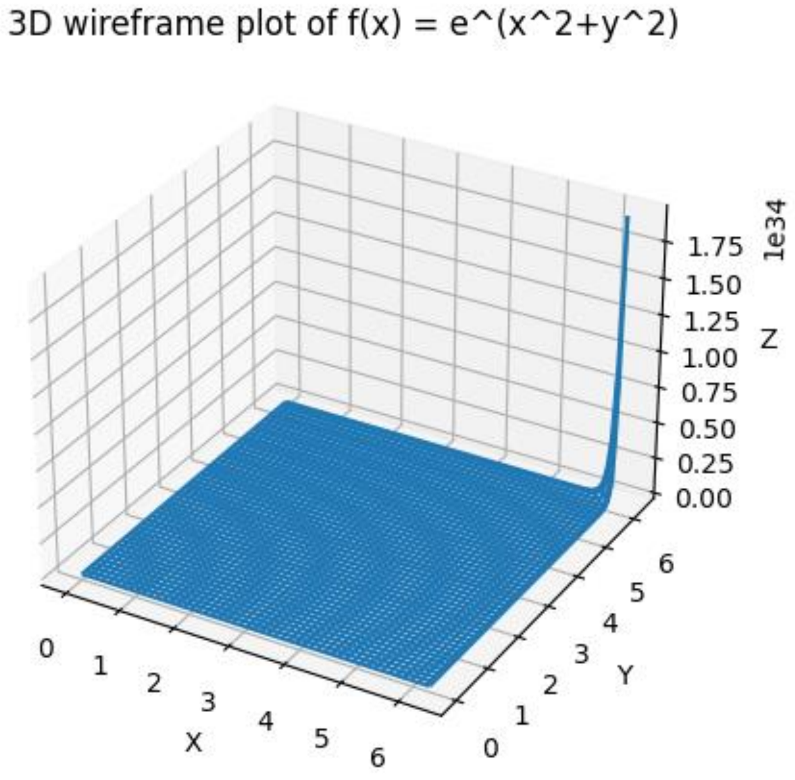


C) Write a python program to plot 3D graph of the function $f(x)=e^{x2+y2}$ for x,y E[0,2π] using wireframe
-→

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
def f(x, y):
   return np.exp(x**2 + y**2)

x = np.linspace(0, 2*np.pi, 100)
y = np.linspace(0, 2*np.pi, 100)
X, Y = np.meshgrid(x, y)

Z = f(X, Y)
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_wireframe(X, Y, Z)
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
ax.set_title('3D wireframe plot of f(x) = e^(x^2+y^2)')
plt.show()
```



Q 2) Attempt any TWO of the following

A) if the line segment joining the points A[2,5],B[4,-13] is transformed to the line segment A'B' by the transformation matrix [T]=$\begin{matrix} 2 & 3 \\ 4 & 1 \end{matrix}$, then using python find the slop and midpoint of the transformed line

-→

```
import numpy as np
T = np.array([[2, 3], [4, 1]])
A = np.array([[2], [5]])
B = np.array([[4], [-13]])

A_prime = T @ A
B_prime = T @ B
slope = (B_prime[1, 0] - A_prime[1, 0]) / (B_prime[0, 0] - A_prime[0, 0])
midpoint = (A_prime + B_prime) / 2

print("Slope of the transformed line segment A'B':", slope)
print("Midpoint of the transformed line segment A'B':", midpoint)
```

output :

```
Slope of the transformed line segment A'B': 0.2
Midpoint of the transformed line segment A'B': [[-6.]
 [ 8.]]
```

B **)write a python program to plot the square with vertices at [4,4],[2,4],[2,2],[4,2] and find its uniform expansion by factor 3, uniform reduction by factor 0.4**

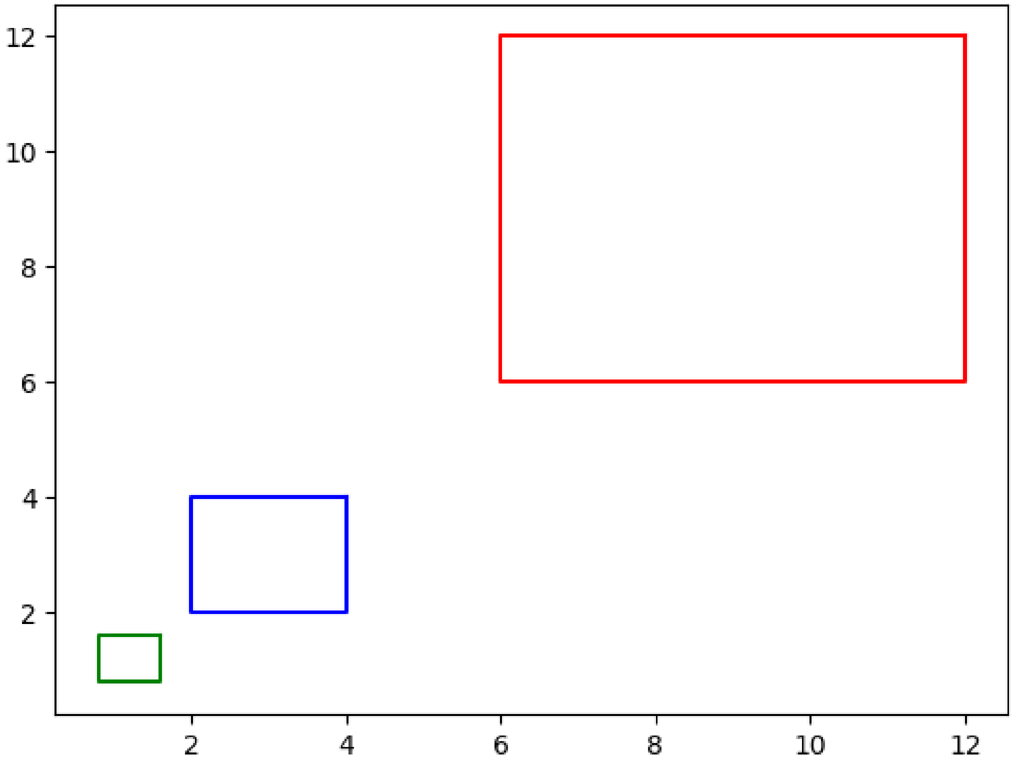
-→

```
import matplotlib.pyplot as plt
import numpy as np
fig, ax = plt.subplots()
square = np.array([[4,4], [2,4], [2,2], [4,2], [4,4]])
ax.plot(square[:,0], square[:,1], color='blue')

expansion_matrix = np.array([[3,0], [0,3]])
expanded_square = np.dot(square, expansion_matrix)
ax.plot(expanded_square[:,0], expanded_square[:,1], color='red')

reduction_matrix = np.array([[0.4,0], [0,0.4]])
reduced_square = np.dot(square, reduction_matrix)
ax.plot(reduced_square[:,0], reduced_square[:,1], color='green')
```

```
plt.show()
```



C) Write a python program to find the quation of the transformed line if shering is applied on the line 2x+y=3 in x and y direction by 2 and -3 units respectively
-→

```
from scipy.linalg import inv
a, b, c = 2, 1, -3
T = [[1, 2], [-3, 1]]
T_inv = inv(T)

coeffs = [a*T_inv[0][0] + b*T_inv[1][0],
        a*T_inv[0][1] + b*T_inv[1][1],
        c]

print(f"The equation of the transformed line is {coeffs[0]:.0f}x + {coeffs[1]:.0f}y + {coeffs[2]:.0f} = 0")
```

output :
The equation of the transformed line is 1x + -0y + -3 = 0

Q 3) Attempt the following

I) Write a python program to solve the following LPP :

Min Z=4x+2y

Subject to x+y≤3

x-y≥2

x,y≥0

-→

```
from scipy.optimize import linprog
obj_func_coeffs = [4, 2]
lhs_ineq_coeffs = [[1, 1], [-1, 1]]
rhs_ineq_values = [3, 2]
bounds = [(0, None), (0, None)]
result = linprog(c=obj_func_coeffs, A_ub=lhs_ineq_coeffs, b_ub=rhs_ineq_values,
bounds=bounds, method='simplex')

print('Optimal value:', round(result.fun, 2))
print('Optimal point:', (round(result.x[0], 2), round(result.x[1], 2)))
```

output :

```
Optimal value: 0.0
Optimal point: (0.0, 0.0)
```

II) Write a python program to solve the following LPP :

Max Z=2x+4y

Subject to 2x+y≤18

2x+2y≥30

X+2y=26

X,y≥0

-→

```
from scipy.optimize import linprog
obj = [-2, -4]

lhs_ineq = [[2, 1], [-2, -2]]
rhs_ineq = [18, -30]
lhs_eq = [[1, 2]]
rhs_eq = [26]
bounds = [(0, None), (0, None)]
result = linprog(c=obj, A_ub=lhs_ineq, b_ub=rhs_ineq, A_eq=lhs_eq, b_eq=rhs_eq,
bounds=bounds, method="simplex")
```

```
print("Optimal value:", round(result.fun, 2))
print("x =", round(result.x[0], 2))
print("y =", round(result.x[1], 2))
```

output :

```
Optimal value: -52.0
x = 3.33
y = 11.33
```

B) Attempt any ONE of the following

I) Apply the following transformation on the point P[-2,4]
A) Reflection through line 3x+4y=5
B) Scaling in X-coordinate by factor 6
C) Scaling in Y-coordinate by factor 4.1
D) Reflection through lne y=2x+3
-→

```
import numpy as np
P = np.array([-2, 4])
A = np.array([[7/25, 24/25], [24/25, -7/25]])
P_A = np.dot(A, P)
print("A) Point after reflection through line 3x + 4y = 5:", P_A)

B = np.array([[6, 0], [0, 1]])
P_B = np.dot(B, P)
print("B) Point after scaling in X-coordinate by factor 6:", P_B)

C = np.array([[1, 0], [0, 4.1]])
P_C = np.dot(C, P)
print("C) Point after scaling in Y-coordinate by factor 4.1:", P_C)

D = np.array([[4/5, -2/5], [-2/5, -4/5]])
P_D = np.dot(D, P)
print("D) Point after reflection through line y = 2x + 3:", P_D)
```

output :

```
A) Point after reflection through line 3x + 4y = 5: [ 3.28 -3.04]
```

B) Point after scaling in X-coordinate by factor 6: [-12   4]
C) Point after scaling in Y-coordinate by factor 4.1: [-2. 16.4]
D) Point after reflection through line y = 2x + 3: [-3.2 -2.4]

II) Apply the following transformation on the point P[-2,4]
A) Shering in Y direction by 7 units
B) Scaling in both X and Y direction by 4 and 7 units respectively
C) Rotation about origin by an angle 48 degree
D) Reflection through line y=x
-→

```
import numpy as np
import math
P = np.array([-2, 4])

A = np.array([[1, 0], [7, 1]])
P = np.dot(A, P)

B = np.array([[4, 0], [0, 7]])
P = np.dot(B, P)

theta = math.radians(48)
C = np.array([[math.cos(theta), -math.sin(theta)], [math.sin(theta), math.cos(theta)]])
P = np.dot(C, P)

D = np.array([[0, 1], [1, 0]])
P = np.dot(D, P)

print("Final point after all transformations:", P)
```

output :

Final point after all transformations: [-52.78430105 46.66709293]