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DEPARTMENT OF COMPUTER SCIENCE

Sub : Mathematics

Remark
Demonstrator's Signature
Date:- / /20

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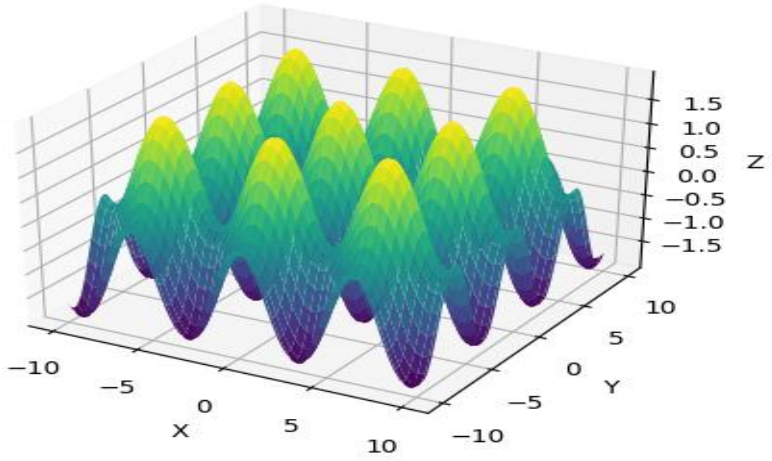
Title of the expt:-__Slip no 25_____Page.no:-_____Class:-_____BCS_____

Q1 Attempt any TWO of the following

A) Write a python program to generate 3D plot of the function Z=cos x+ cos y in -10 <x ,y<10

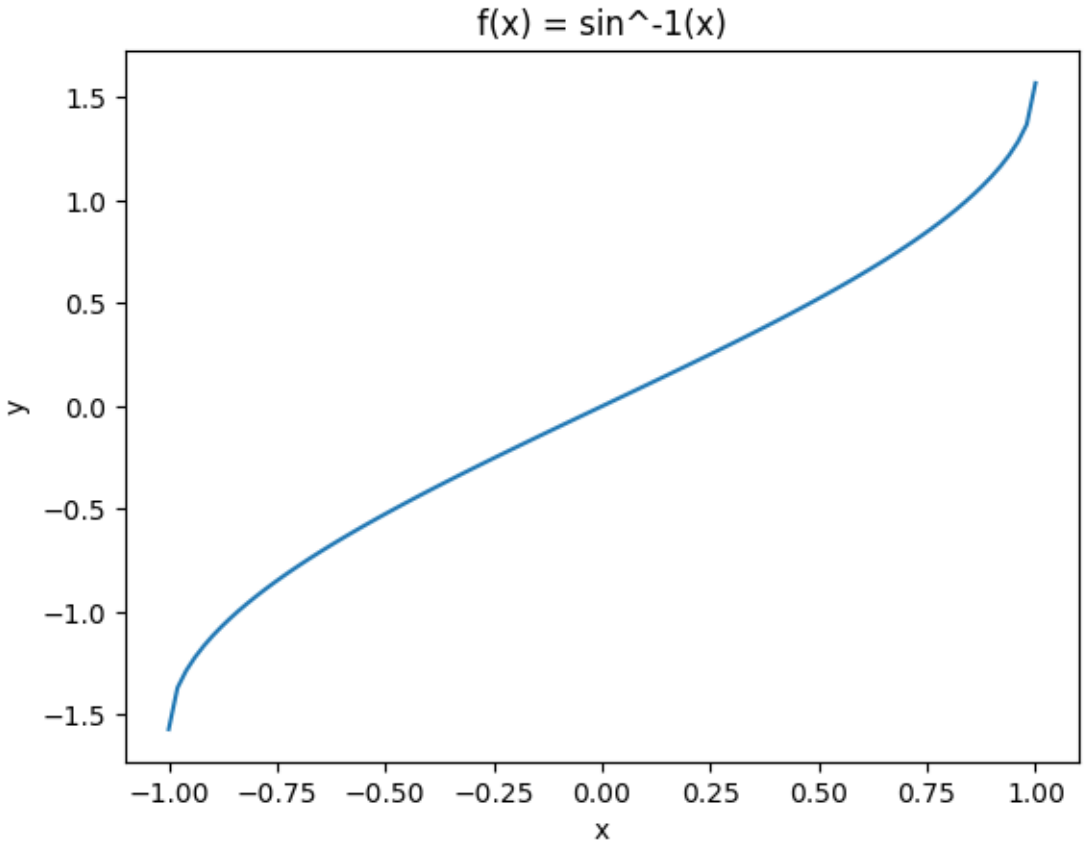
-→

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

x = np.linspace(-10, 10, 100)
y = np.linspace(-10, 10, 100)
X, Y = np.meshgrid(x, y)

Z = f(X, Y)
fig = plt.figure()
ax = fig.gca(projection='3d')
ax.plot_surface(X, Y, Z, cmap='viridis')
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
plt.show()
```



B) Using python plot the graph of function f(x)=$\sin^{-1}$(x) on the interval [-1,1]
-→

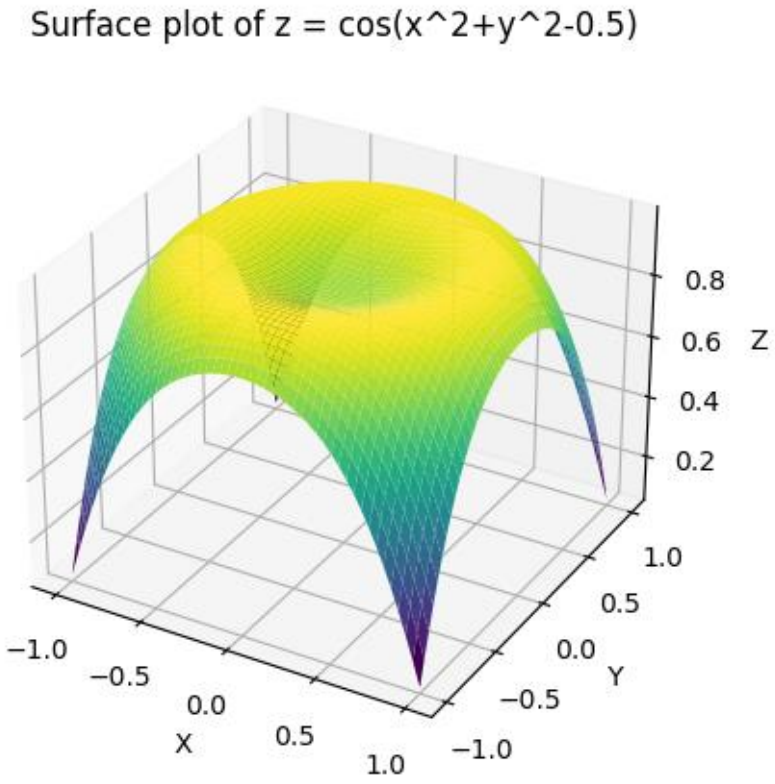
```
import numpy as np
import matplotlib.pyplot as plt
def f(x):
    return np.arcsin(x)

x = np.linspace(-1, 1, 100)
y = f(x)

plt.plot(x, y)
plt.title("f(x) = sin^-1(x)")
plt.xlabel("x")
plt.ylabel("y")
plt.show()
```



C)Using python plot the surface plot of the function $z=\cos(x^2+y^2-0.5)$ in the interval form -1<x,y<1

-→

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
def f(x, y):
    return np.cos(x**2 + y**2 - 0.5)

x = np.linspace(-1, 1, 50)
y = np.linspace(-1, 1, 50)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X, Y, Z, cmap='viridis')
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
plt.title('Surface plot of z = cos(x^2+y^2-0.5)')
plt.show()
```

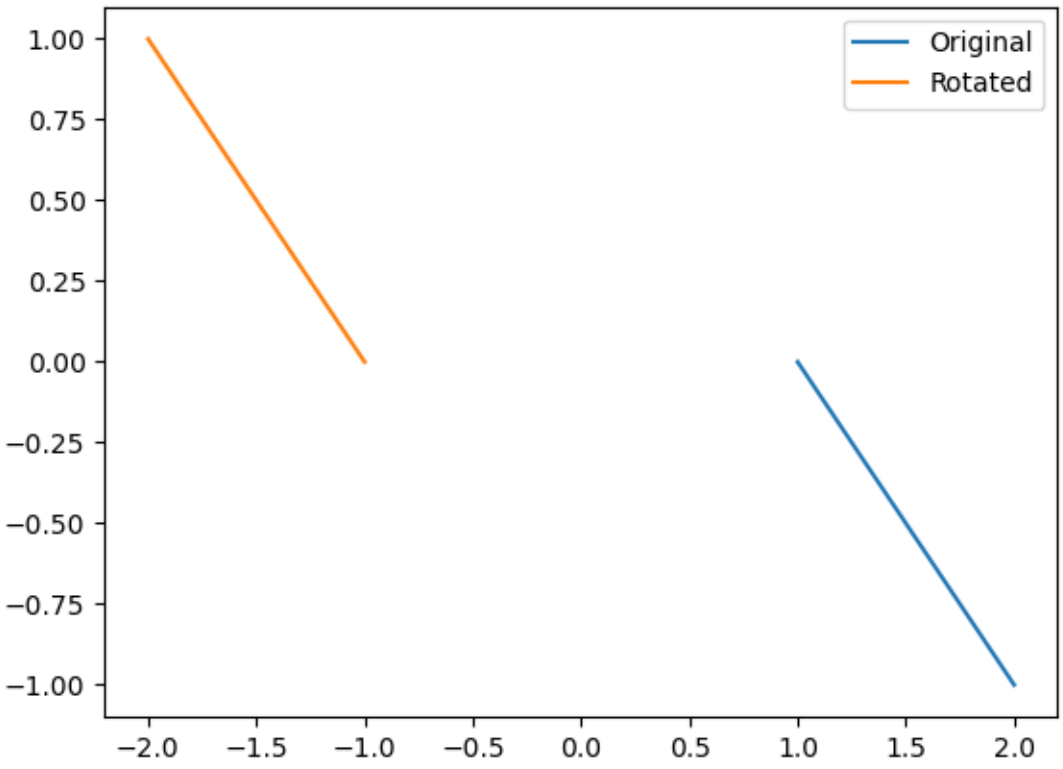


Q2) Attempt any TWO of the following

A) Rotate the line segment by 180◦ having end points (1,0) and (2,-1)

-→

```
import numpy as np
import matplotlib.pyplot as plt
x = np.array([1, 2])
y = np.array([0, -1])
T = np.array([[-1, 0],
              [0, -1]])
new_coords = np.dot(T, np.vstack([x, y]))

plt.plot(x, y, label='Original')
plt.plot(new_coords[0], new_coords[1], label='Rotated')
plt.legend()
plt.show()
```



B) Using sympy,declare the points P(5,2),Q(5,-2),R(5,0) chevk whether these points are colliner.Declare the ray passing through the points P and Q find the length of this ray between P and Q ,Also find slop of this ray

-→

```
from sympy import Point, Ray
P = Point(5, 2)
```

```
Q = Point(5, -2)
R = Point(5, 0)

if P.is_collinear(Q, R):
    print("Points P, Q, and R are collinear")
else:
    print("Points P, Q, and R are not collinear")

ray_PQ = Ray(P, Q)

length_PQ = P.distance(Q)
print("Length of ray PQ:", length_PQ)

slope_PQ = ray_PQ.slope
print("Slope of ray PQ:", slope_PQ)
```

output :

```
Points P, Q, and R are collinear
Length of ray PQ: 4
Slope of ray PQ: oo
```

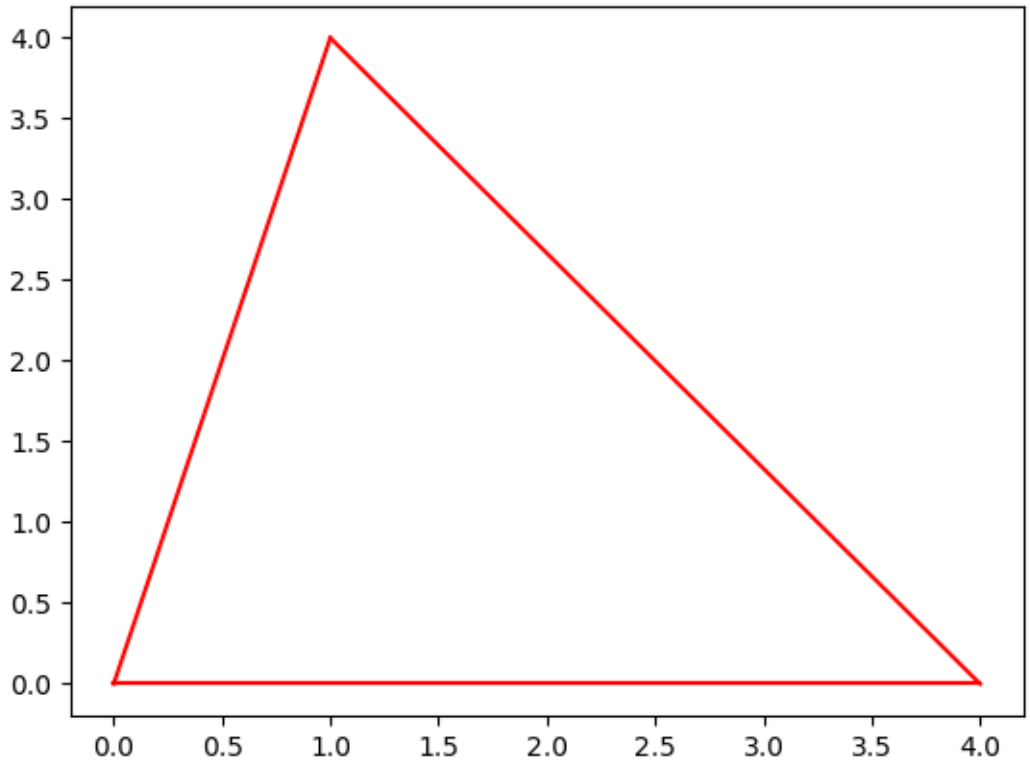
C)Generate triangle with vertices (0,0),(4,0),(1,4) check whether the triangle is Scalene triangle

-→

```
import matplotlib.pyplot as plt
A = [0, 0]
B = [4, 0]
C = [1, 4]

plt.plot([A[0], B[0]], [A[1], B[1]], 'r')
plt.plot([B[0], C[0]], [B[1], C[1]], 'r')
plt.plot([C[0], A[0]], [C[1], A[1]], 'r')

AB = ((B[0]-A[0])**2 + (B[1]-A[1])**2)**0.5
BC = ((C[0]-B[0])**2 + (C[1]-B[1])**2)**0.5
AC = ((C[0]-A[0])**2 + (C[1]-A[1])**2)**0.5

if AB != BC and AB != AC and BC != AC:
    print("The triangle is a scalene triangle.")
else:
    print("The triangle is not a scalene triangle.")
```

plt.show()

The triangle is a scalene triangle



Q3) Attempt the following

A) Attempt any ONE of the following

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

Max Z=150x+75y

Subject to 4x+6y≤24

5x+3y≤15

X,y≥0

-→

```
from scipy.optimize import linprog
obj = [-150, -75]
lhs = [[4, 6], [5, 3]]
rhs = [24, 15]

x_bounds = (0, None)
y_bounds = (0, None)
result = linprog(c=obj, A_ub=lhs, b_ub=rhs, bounds=[x_bounds, y_bounds])
```

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

output :

```
Optimal value: -450.0
x: 3.0
y: 0.0
```

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

Max Z=4x+y+3z+5w

Subject to 4x+6y-5z-4w≥20

-3x-2y+4z+w≤10

-8x-3y+3z+2w≤20

X,y,z,w≥0

-→

```
from scipy.optimize import linprog
obj_func = [-4, -1, -3, -5]
lhs_ineq = [
   [4, 6, -5, -4],
   [-3, -2, 4, 1],
   [-8, -3, 3, 2]
]

rhs_ineq = [20, -10, -20]
bounds = [(0, None), (0, None), (0, None), (0, None)]
res = linprog(c=obj_func, A_ub=lhs_ineq, b_ub=rhs_ineq, bounds=bounds,
method='simplex')

print("Optimal value of Z:", -res.fun)  # since we used the negative of obj_func
print("Values of x, y, z, w:", res.x)
```

output :

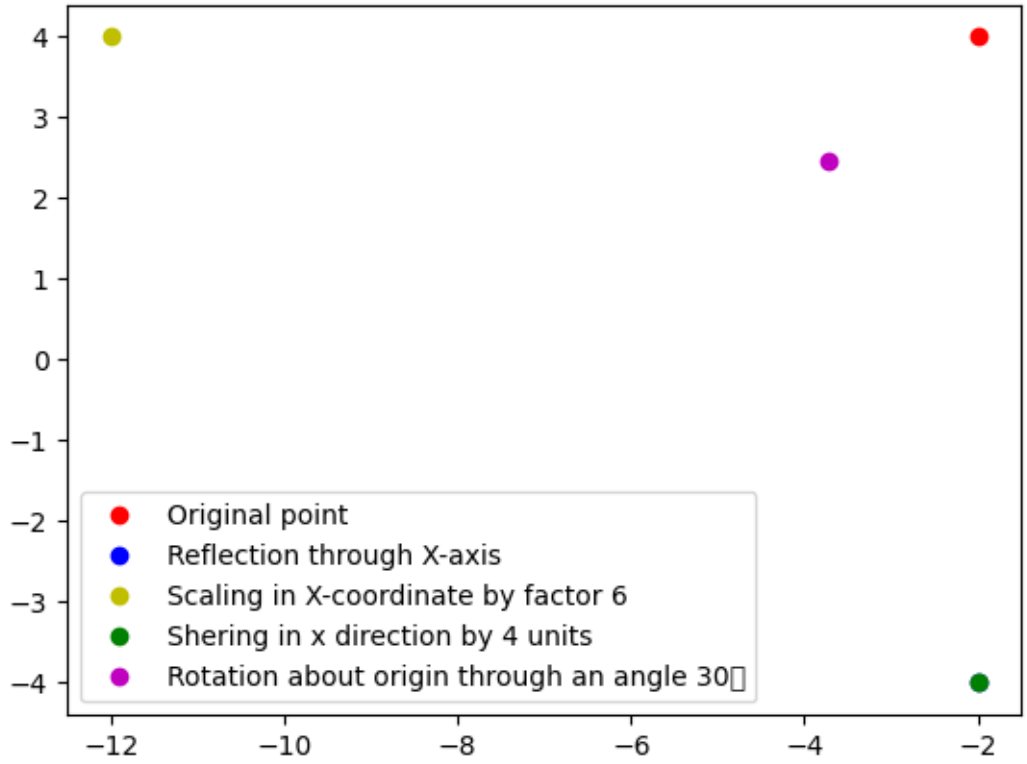
```
Optimal value of Z: 18.333333333333332
Values of x, y, z, w: [1.66666667 3.33333333 0.         1.66666667]
```

B) Attempt any ONE of the following

I) Write a python program to apply the following transformation on the point(-2,4_)
A) reflection through X-axis
B) Scaling in X-coordinate by factor 6
C) Shering in x direction by 4 units
D) Rotate about origin through an angle 30◦

-→

```
import numpy as np
import matplotlib.pyplot as plt
from math import sin, cos, radians

# Initial point
P = np.array([-2, 4])

T1 = np.array([[1, 0], [0, -1]])
T2 = np.array([[6, 0], [0, 1]])
T3 = np.array([[1, 0], [4, 1]])

theta = radians(30)
T4 = np.array([[cos(theta), -sin(theta)], [sin(theta), cos(theta)]])

P1 = np.dot(T1, P)
P2 = np.dot(T2, P)
P3 = np.dot(T3, P)
P4 = np.dot(T4, P)


plt.plot(P[0], P[1], 'ro', label='Original point')
plt.plot(P1[0], P1[1], 'bo', label='Reflection through X-axis')
plt.plot(P2[0], P2[1], 'yo', label='Scaling in X-coordinate by factor 6')
plt.plot(P3[0], P3[1], 'go', label='Shering in x direction by 4 units')
plt.plot(P4[0], P4[1], 'mo', label='Rotation about origin through an angle 30◦')

plt.legend()
plt.show()
```



II) Write a python program to find the combined transformation of the line segment between the points A[3,2] & B 2,-3] for the following sequence of transformation

A) Rotation about origin through an angle $\frac{\pi}{6}$

B) Scaling in Y-coordinate by -4 units

C) Uniform scaling by -6.4 units

D) Shering in Y direction by 5 units

-→

```
import numpy as np
A = np.array([3, 2])
B = np.array([2, -3])

def rotation(theta):
    return np.array([[np.cos(theta), -np.sin(theta)],
                     [np.sin(theta), np.cos(theta)]])

def scaling_x(k):
    return np.array([[k, 0],
                     [0, 1]])

def scaling_y(k):
    return np.array([[1, 0],
                     [0, k]])

def uniform_scaling(k):
```

```
    return np.array([[k, 0],
                     [0, k]])

def shering_y(d):
    return np.array([[1, d],
                     [0, 1]])

AB = B - A
AB = AB.reshape((2,1))
T1 = rotation(np.pi/6)
T2 = scaling_y(-4)
T3 = uniform_scaling(-6.4)
T4 = shering_y(5)
T = T4 @ T3 @ T2 @ T1

AB_transformed = T @ AB
B_transformed = A + AB_transformed.flatten()

print("The combined transformation of the line segment between A and B is:")
print(T)
print("The transformed endpoint B' is:", B_transformed)
```

output :

```
The combined transformation of the line segment between A and B is:
[[ 58.45743742 114.05125168]
 [ 12.8         22.17025034]]
The transformed endpoint B' is: [-625.71369584 -121.65125168]
```