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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 14 _____Page.no:-_____Class:-_____BCS_____

Q1) Attempt any Two of the following

A) Write a python program to plot 2D graph of the function $f(x)=x^2$ and $g(x)=x^3$ in [-1,1]

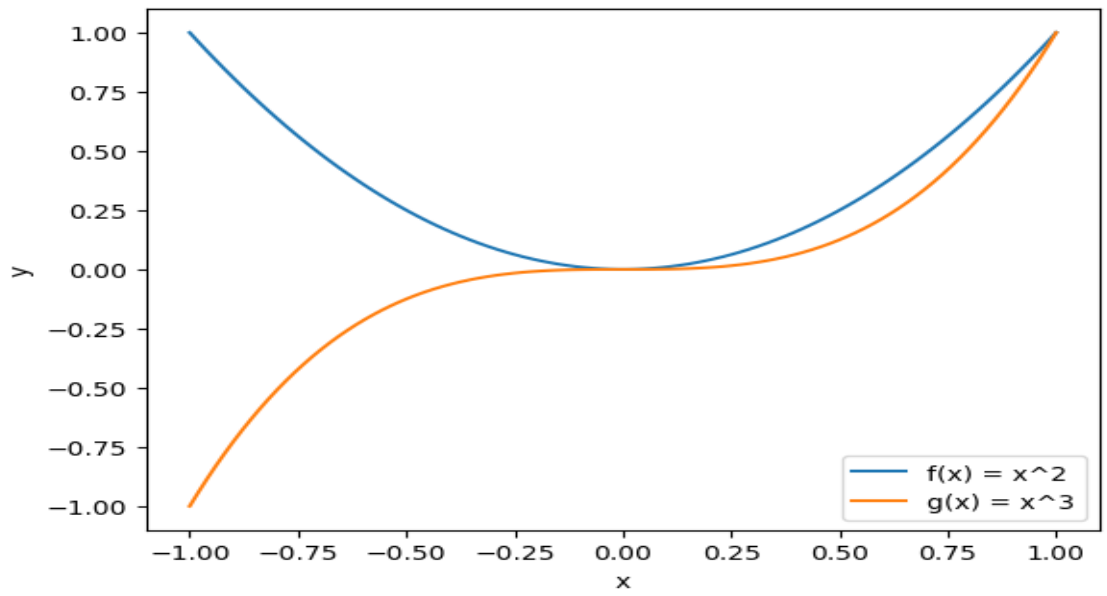
-→

```
import numpy as np
import matplotlib.pyplot as plt
def f(x):
   return x**2

def g(x):
   return x**3

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

plt.plot(x, f(x), label='f(x) = x^2')
plt.plot(x, g(x), label='g(x) = x^3')
plt.xlabel('x')
plt.ylabel('y')
plt.legend()
plt.show()
```



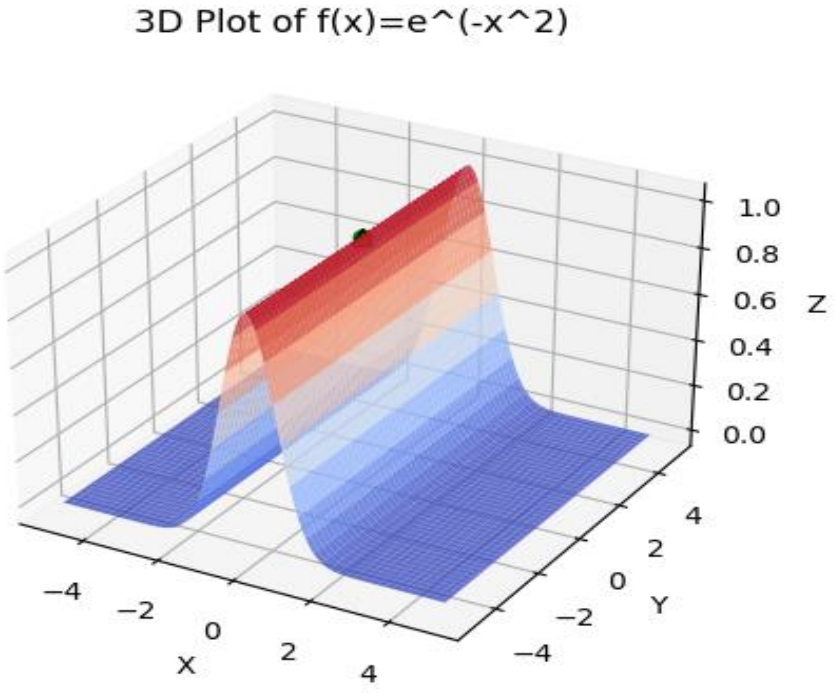
B) Write a python program to plot 3D graph of the function $f(x)=e^{-x2}$ in [-5,5] with green dashed points line with upward pointing trangle

-→

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

x = np.linspace(-5, 5, 100)
y = np.linspace(-5, 5, 100)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

surf = ax.plot_surface(X, Y, Z, cmap='coolwarm', alpha=0.8)
ax.scatter([0], [0], [1], s=50, c='green', marker='^', edgecolors='black', linewidths=1, alpha=1)
ax.plot([0], [0], [1], c='green', marker='o', linestyle='--')
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
ax.set_title('3D Plot of f(x)=e^(-x^2)')
plt.show()
```



C) Write a python program to generate 3D plot of the function z=sin(x)+cos(y) in -5 <x,y<5

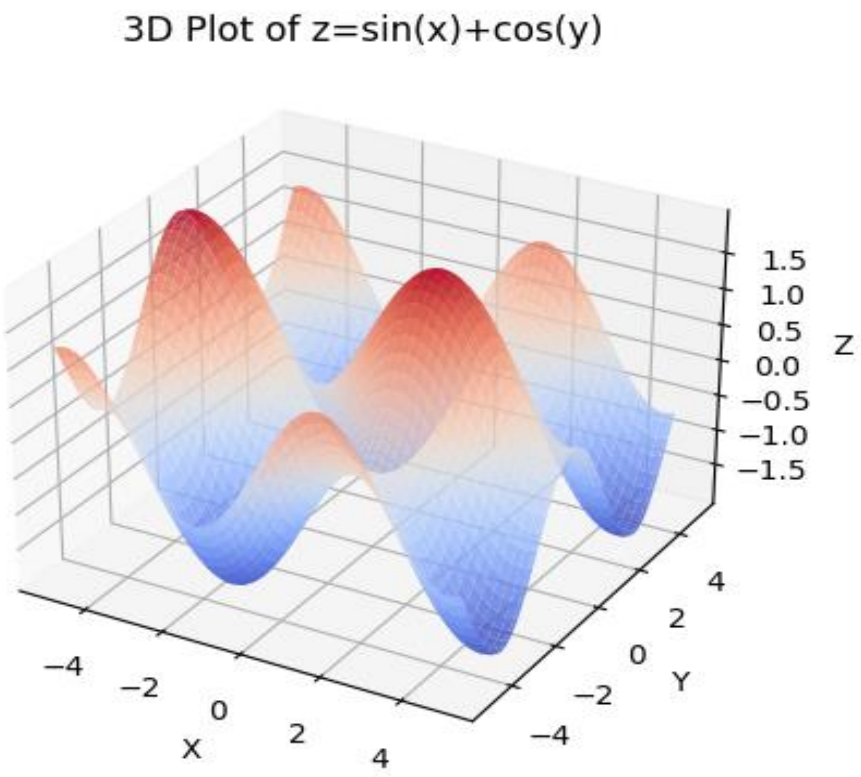
-→

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

x = np.linspace(-5, 5, 100)
y = np.linspace(-5, 5, 100)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
surf = ax.plot_surface(X, Y, Z, cmap='coolwarm', alpha=0.8)

ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
ax.set_title('3D Plot of z=sin(x)+cos(y)')
plt.show()
```

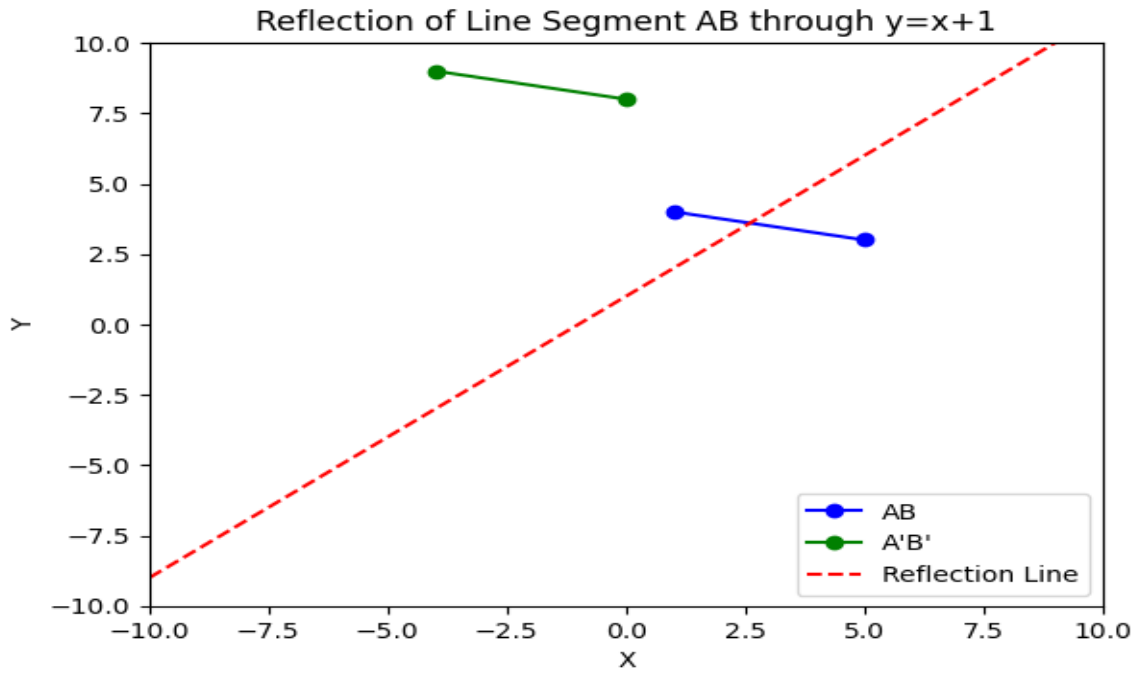


Q2)Attempt any TWO of the following

A) Write a python program to reflect the line segment joining the points A[5,3] and B[1,4] through the line y=x+1

-→

```
import numpy as np
import matplotlib.pyplot as plt
A = np.array([5, 3])
B = np.array([1, 4])
x = np.linspace(-10, 10, 100)
y = x + 1
M = (A + B) / 2
v = A - M
n = np.array([-1, 1])
p = np.dot(v, n) * n
Ar = A - 2 * p
Br = B - 2 * p
plt.plot([A[0], B[0]], [A[1], B[1]], 'bo-', label='AB')
plt.plot([Ar[0], Br[0]], [Ar[1], Br[1]], 'go-', label='A\'B\'')
plt.plot(x, y, 'r--', label='Reflection Line')
plt.xlim(-10, 10)
plt.ylim(-10, 10)
plt.xlabel('X')
plt.ylabel('Y')
plt.title('Reflection of Line Segment AB through y=x+1')
plt.legend()
plt.show()
```

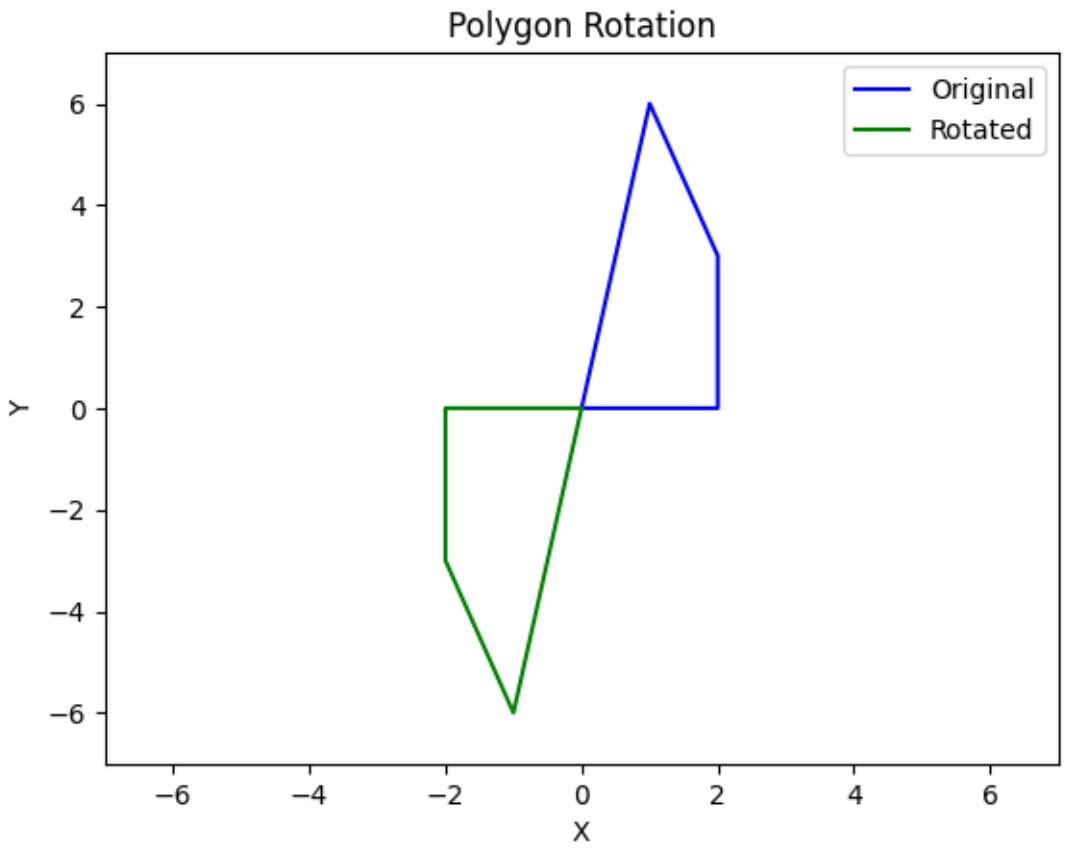


B**) Write a python program to draw a polygon with vertices (0,0),(2,0),(2,3) and (1,6) and rotate it by 180◦**

-→

```
import numpy as np
import matplotlib.pyplot as plt
vertices = np.array([[0, 0], [2, 0], [2, 3], [1, 6], [0, 0]])
plt.plot(vertices[:, 0], vertices[:, 1], 'b-', label='Original')
theta = np.pi  # 180 degrees in radians
R = np.array([[np.cos(theta), -np.sin(theta)],
              [np.sin(theta), np.cos(theta)]])
rotated_vertices = vertices @ R
plt.plot(rotated_vertices[:, 0], rotated_vertices[:, 1], 'g-', label='Rotated')

plt.xlim(-7, 7)
plt.ylim(-7, 7)
plt.xlabel('X')
plt.ylabel('Y')
plt.title('Polygon Rotation')
plt.legend()
plt.show()
```



C) Write a python program to find the area and perimeter of the tringle ABC where A[0,0],B[5,0],C[3,3]

-→

```
import math
A = [0, 0]
B = [5, 0]
C = [3, 3]

a = math.dist(B, C)  # Length of side a (opposite vertex A)
b = math.dist(A, C)  # Length of side b (opposite vertex B)
c = math.dist(A, B)  # Length of side c (opposite vertex C)
perimeter = a + b + c
s = perimeter / 2
area = math.sqrt(s * (s - a) * (s - b) * (s - c))

print(f"The area of the triangle ABC is {area:.2f} square units")
print(f"The perimeter of the triangle ABC is {perimeter:.2f} units")
```

output :

```
The area of the triangle ABC is 7.50 square units
The perimeter of the triangle ABC is 12.85 units
```

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

-→

```
import numpy as np
from scipy.optimize import linprog
c = np.array([-150, -75])
A = np.array([[4, 6], [5, 3]])
b = np.array([24, 15])
x_bounds = (0, None)
y_bounds = (0, None)
res = linprog(c, A_ub=A, b_ub=b, bounds=[x_bounds, y_bounds])
```

```
print("Status: ", res.message)
print("Optimal values:\n x =", res.x[0], "\n y =", res.x[1])
print("Optimal value of the objective function: Z =", -res.fun)
```

output :

```
Status:  Optimization terminated successfully. (HiGHS Status 7: Optimal)
Optimal values:
 x = 3.0
 y = 0.0
Optimal value of the objective function: Z = 450.0
```

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

Min Z=x+y
Subject to x≥6
y≥6
x+y≤11
x,y≥0

-→

```
from scipy.optimize import linprog
obj = [1, 1]
lhs = [[-1, 0], [0, -1], [1, 1]]
rhs = [-6, -6, 11]
bounds = [(0, None), (0, None)]
result = linprog(c=obj, A_ub=lhs, b_ub=rhs, bounds=bounds, method='simplex')

print("Status:", result.message)
print("Optimal Solution:", result.fun)
print("Optimal Decision Variables:", result.x)
```

output :

```
Optimal Solution: 12.0
Optimal Decision Variables: [6. 6.]
```

B) Attempt any ONE of the following

I) Apply each of the following transformation on the point P[2,-3]

A) Reflection through X-axis

B) Scaling in X-cordinate by factor 2

C) Scaling in Y-coordinate by factor 1.5

D) Reflection through the line y=x

-→

```
import numpy as np
P = np.array([2, -3])
A = np.array([[1, 0], [0, -1]])
P1 = A.dot(P)
print("Reflection through X-axis:", P1)

B = np.array([[2, 0], [0, 1]])
P2 = B.dot(P)
print("Scaling in X-coordinate by factor 2:", P2)

C = np.array([[1, 0], [0, 1.5]])
P3 = C.dot(P)
print("Scaling in Y-coordinate by factor 1.5:", P3)

D = np.array([[0, 1], [1, 0]])
P4 = D.dot(P)
print("Reflection through the line y=x:", P4)
```

output :

```
Reflection through X-axis: [2 3]
Scaling in X-coordinate by factor 2: [ 4 -3]
Scaling in Y-coordinate by factor 1.5: [ 2.  -4.5]
Reflection through the line y=x: [-3  2]
```

II) Apply each of the following transformation on the points P[3,-1]

A) Shering in Y-direction by 2 units

B) Scaling in X and Y direction by ½ and 3 units respectively

C) Shering in both X and Y direction by -2 and 4 units respectively

D) Rotation about origin by an angle 30 degree

-→

```
import numpy as np
import math
P = np.array([3, -1])
A = np.array([[1, 2], [0, 1]])
```

```
P1 = A.dot(P)
print("Sherring in Y-direction by 2 units:", P1)

B = np.array([[0.5, 0], [0, 3]])
P2 = B.dot(P)
print("Scaling in X and Y direction by ½ and 3 units respectively:", P2)

C = np.array([[1, -2], [-4, 1]])
P3 = C.dot(P)
print("Sherring in both X and Y direction by -2 and 4 units respectively:", P3)

angle = 30
theta = math.radians(angle)
D = np.array([[math.cos(theta), -math.sin(theta)], [math.sin(theta), math.cos(theta)]])
P4 = D.dot(P)
print("Rotation about origin by an angle 30 degree:", P4)
```

output :

```
Sherring in Y-direction by 2 units: [ 1 -1]
Scaling in X and Y direction by ½ and 3 units respectively: [ 1.5 -3. ]
Sherring in both X and Y direction by -2 and 4 units respectively: [  5 -13]
Rotation about origin by an angle 30 degree: [3.09807621 0.6339746 ]
```