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College Sangamner

DEPARTMENT OF COMPUTER SCIENCE

Sub : Mathematics

Remark
Demonstrator's Signature
Date:- / /20

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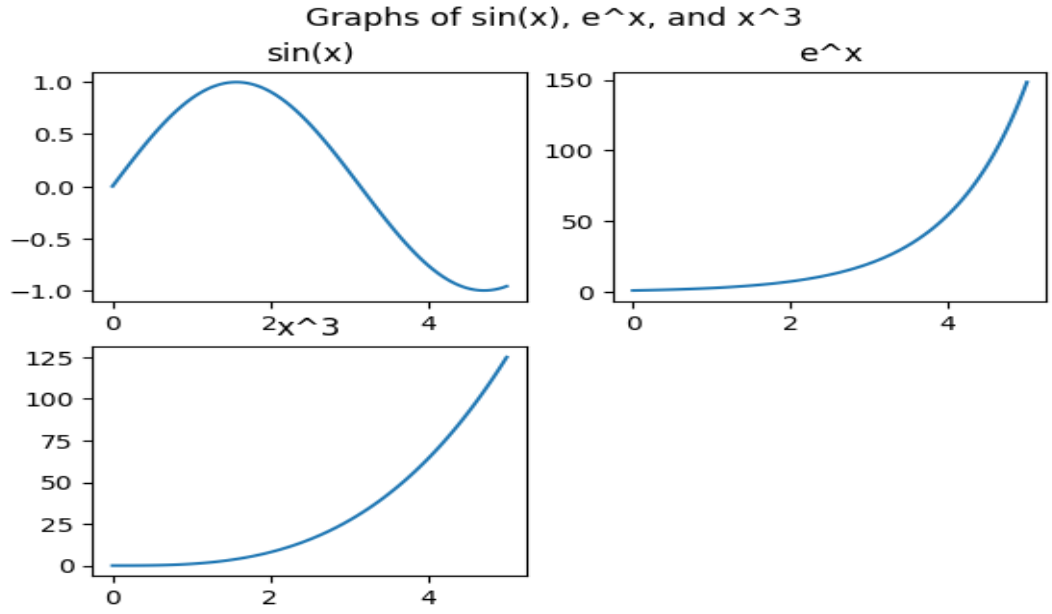
Title of the expt:-__Slip no 19_____Page.no:-_____Class:-_____BCS_____

Q1 . Attempt any TWO of the following

A) Write a python program to plot the graph of sin(x),e^x and x^3 in [0,5] in one figure with 2x2 subplots

-→

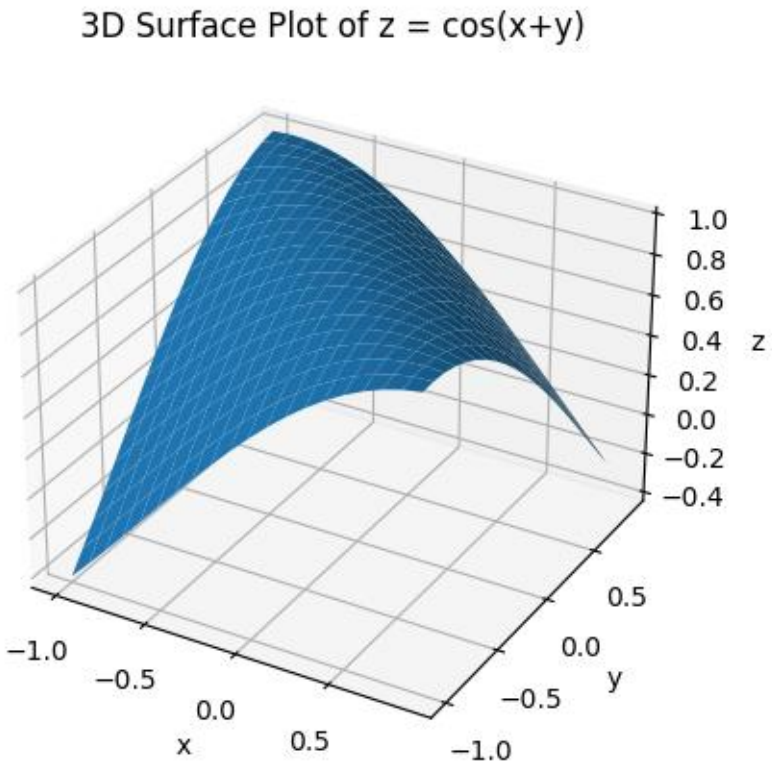
```
import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(0, 5, 100)
y1 = np.sin(x)
y2 = np.exp(x)
y3 = x**3
fig, axs = plt.subplots(2, 2)

axs[0, 0].plot(x, y1)
axs[0, 0].set_title('sin(x)')
axs[0, 1].plot(x, y2)
axs[0, 1].set_title('e^x')
axs[1, 0].plot(x, y3)
axs[1, 0].set_title('x^3')
axs[1, 1].axis('off')
fig.suptitle('Graphs of sin(x), e^x, and x^3')
plt.show()
```



B) write python program to plot 3D surface plot of the function z=cos([x]+[y]) in -1<x,y<1

-→

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
x = np.arange(-1, 1, 0.1)
y = np.arange(-1, 1, 0.1)
X, Y = np.meshgrid(x, y)
Z = np.cos(X + Y)

fig = plt.figure()
ax = fig.gca(projection='3d')
surf = ax.plot_surface(X, Y, Z)
ax.set_xlabel('x')
ax.set_ylabel('y')
ax.set_zlabel('z')
ax.set_title('3D Surface Plot of z = cos(x+y)')
plt.show()
```

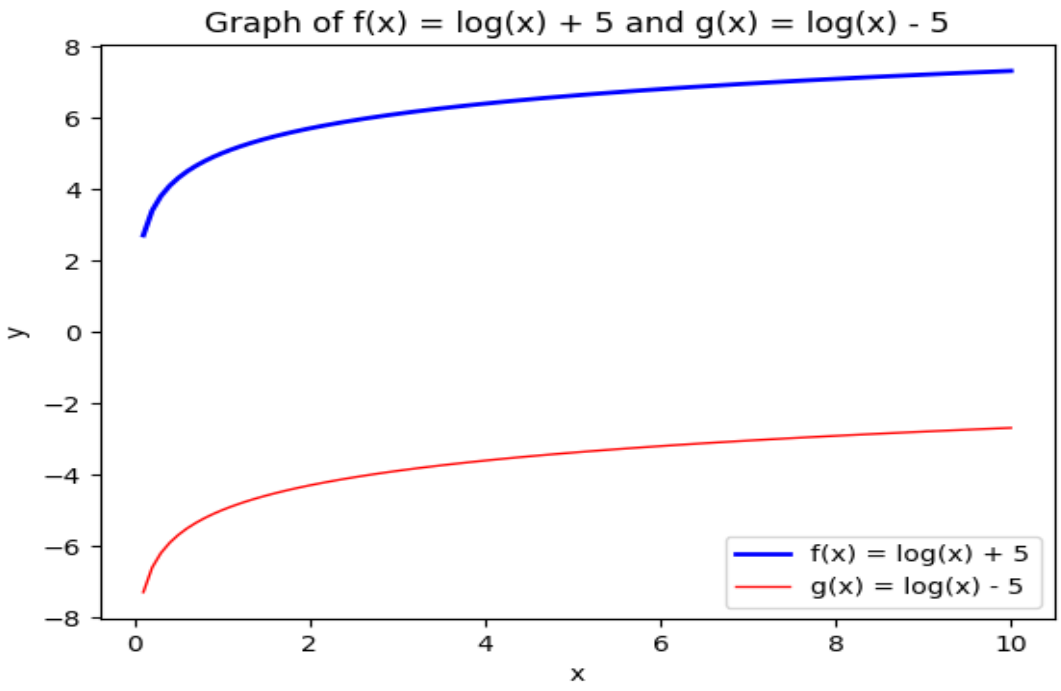


C) Write a python program to plot 2D graph of the function f(x)=log(x)+5 and g(x)=log(x)-5 in [0,10] by setting different line width and different colors ot the curve

-→

```
import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(0.1, 10, 100)
f = np.log(x) + 5
g = np.log(x) - 5
```

```
plt.plot(x, f, linewidth=2, color='blue', label='f(x) = log(x) + 5')
plt.plot(x, g, linewidth=1, color='red', label='g(x) = log(x) - 5')

plt.legend()
plt.xlabel('x')
plt.ylabel('y')
plt.title('Graph of f(x) = log(x) + 5 and g(x) = log(x) - 5')
plt.show()
```



Q2) Attempt any TWO of the following

A) Write a python program to rotate the ray by 90◦ in clockwise direction having starting point(0,0) and end point (4,4)

-→

```
import numpy as np
start = np.array([0, 0])
end = np.array([4, 4])

theta = np.pi/2  # 90 degrees in radians
R = np.array([[np.cos(theta), -np.sin(theta)],
              [np.sin(theta), np.cos(theta)]])
new_end = R.dot(end - start) + start

print(f"The new end point is ({new_end[0]:.2f}, {new_end[1]:.2f})")
```

output :

The new end point is (-4.00, 4.00)

B) Write a python program to reflect the triangle ABC through the line y=3 where A[1,0],B[2,-1], and C[-1,3]
-→

```
import numpy as np
A = np.array([1, 0])
B = np.array([2, -1])
C = np.array([-1, 3])
L = np.array([0, 3])
R = np.array([[1, 0],
              [0, -1]])

A_new = R.dot(A - L) + L
B_new = R.dot(B - L) + L
C_new = R.dot(C - L) + L

print(f"The new vertex A is ({A_new[0]:.2f}, {A_new[1]:.2f})")
print(f"The new vertex B is ({B_new[0]:.2f}, {B_new[1]:.2f})")
print(f"The new vertex C is ({C_new[0]:.2f}, {C_new[1]:.2f})")
```

output :

```
The new vertex A is (1.00, 6.00)
The new vertex B is (2.00, 7.00)
The new vertex C is (-1.00, 3.00)
```

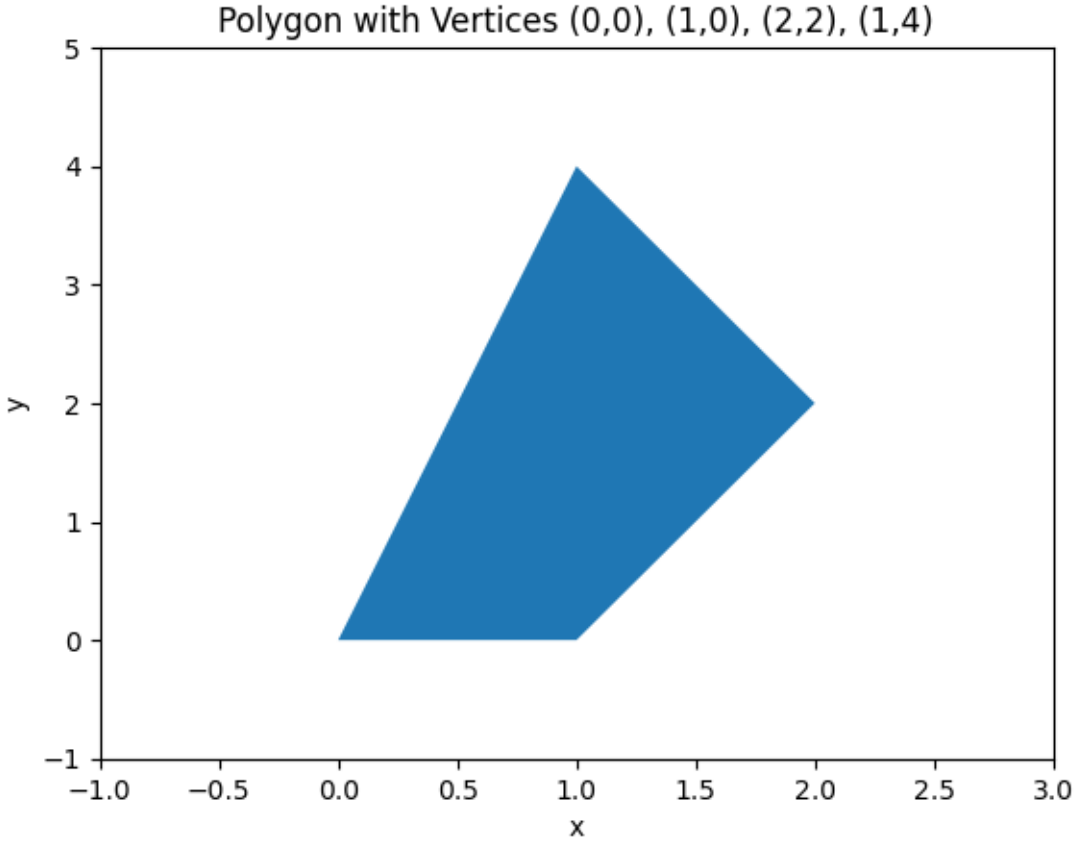
c) Write a python program to draw a polygon with vertices (0,0),(1,0),(2,2),(1,4), Also find area and perimeter of the player
-→

```
import matplotlib.pyplot as plt
vertices = [(0, 0), (1, 0), (2, 2), (1, 4)]
polygon = plt.Polygon(vertices, closed=True)
fig, ax = plt.subplots()
ax.add_patch(polygon)

ax.set_xlim(-1, 3)
ax.set_ylim(-1, 5)
ax.set_xlabel("x")
ax.set_ylabel("y")
ax.set_title("Polygon with Vertices (0,0), (1,0), (2,2), (1,4)")

area = 0.5 * abs(sum(x0*y1 - x1*y0 for ((x0, y0), (x1, y1)) in zip(vertices, vertices[1:] +
[vertices[0]])))
```

```
perimeter = sum(((x1-x0)**2 + (y1-y0)**2)**0.5 for ((x0, y0), (x1, y1)) in zip(vertices,
vertices[1:] + [vertices[0]]))

print(f"The area of the polygon is {area:.2f}")
print(f"The perimeter of the polygon is {perimeter:.2f}")
plt.show()
```

output :

The area of the polygon is 4.00
The perimeter of the polygon is 9.60



Q3) Attempt the following

A) Attempt any ONE of the following

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

Max Z=3x+5y=4z

Subject to 2x+3y≤8

2y+5z≤10

3x+2y+4z≤15

X,y≥0

-→

```
import scipy.optimize as opt
c = [-3, -5, -4]
A = [[2, 3, 0], [0, 2, 5], [3, 2, 4]]
b = [8, 10, 15]

bounds = [(0, None), (0, None), (0, None)]
res = opt.linprog(c=c, A_ub=A, b_ub=b, bounds=bounds)

print(f"Optimal Solution: {res.x}")
print(f"Optimal Objective Value: {-res.fun}")
```

output :

Optimal Solution: [2.17073171 1.2195122 1.51219512]
Optimal Objective Value: 18.65853658536585

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

Min Z=x+2y+z

Subject to x+$\frac{1}{2}y$ +$\frac{1}{2}z$ ≤1

$\frac{3}{2}x$ + 2y +z≥8

X,y≥0

-→

```
import scipy.optimize as opt
c = [1, 2, 1]
A = [[1, 1/2, 1/2], [-3/2, -2, -1]]
b = [1, -8]

bounds = [(0, None), (0, None), (0, None)]
res = opt.linprog(c=c, A_ub=A, b_ub=b, bounds=bounds)

print(f"Optimal Solution: {res.x}")
print(f"Optimal Objective Value: {res.fun}")
```

output :

Optimal Solution: None
Optimal Objective Value: None

B) Attempt any ONE of the following

I) Write a python program to apply each of the following transformation on the point P=[-2,4]

A) Rotation about origin through an angle 48 degree
B) Scaling in X-coordinate by factor 2
C) Reflection through the line y=2x-3
D) Shering in X direction by 7 units

-→

```
import math
P = [-2, 4]

theta = math.radians(48)
x = P[0]*math.cos(theta) - P[1]*math.sin(theta)
y = P[0]*math.sin(theta) + P[1]*math.cos(theta)
print(f"Rotation about origin: ({x:.2f}, {y:.2f})")

x = P[0]*2
y = P[1]
print(f"Scaling in X-coordinate: ({x:.2f}, {y:.2f})")

m = 2
c = -3
d = (P[0] + P[1]*m + 2*c)/(m*m + 1)
x = 2*d - P[0]
y = 2*m*d + 2*c - P[1]
print(f"Reflection through the line y=2x-3: ({x:.2f}, {y:.2f})")

shx = 7
x = P[0] + shx*P[1]
y = P[1]
print(f"Shearing in X direction: ({x:.2f}, {y:.2f})")
```

output :

```
Rotation about origin: (-4.31, 1.19)
Scaling in X-coordinate: (-4.00, 4.00)
Reflection through the line y=2x-3: (2.00, -10.00)
Shearing in X direction: (26.00, 4.00)
```

II) Find combined transformation of the line segment between the points A[4,-1] and B[3,0] for the following sequence of transformation
First rotation about origin through an angle π^c ;followed by scaling in x coordinate by 3 units followed by reflection through the line y=x
-→

```
import matplotlib.pyplot as plt
import numpy as np
t = np.linspace(0, 1, 100)
x = 4 - t
y = -1 + t
plt.plot(x, y, label='Original line segment')
x, y = -y, x
x *= 3
x, y = y, x

plt.plot(x, y, label='Transformed line segment')
plt.xlim(-5, 15)
plt.ylim(-5, 15)
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.legend()
plt.show()
```