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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 13_____________________________Page.no:-_____Class:-_______BCS________

Q1. Attempt any two of the following

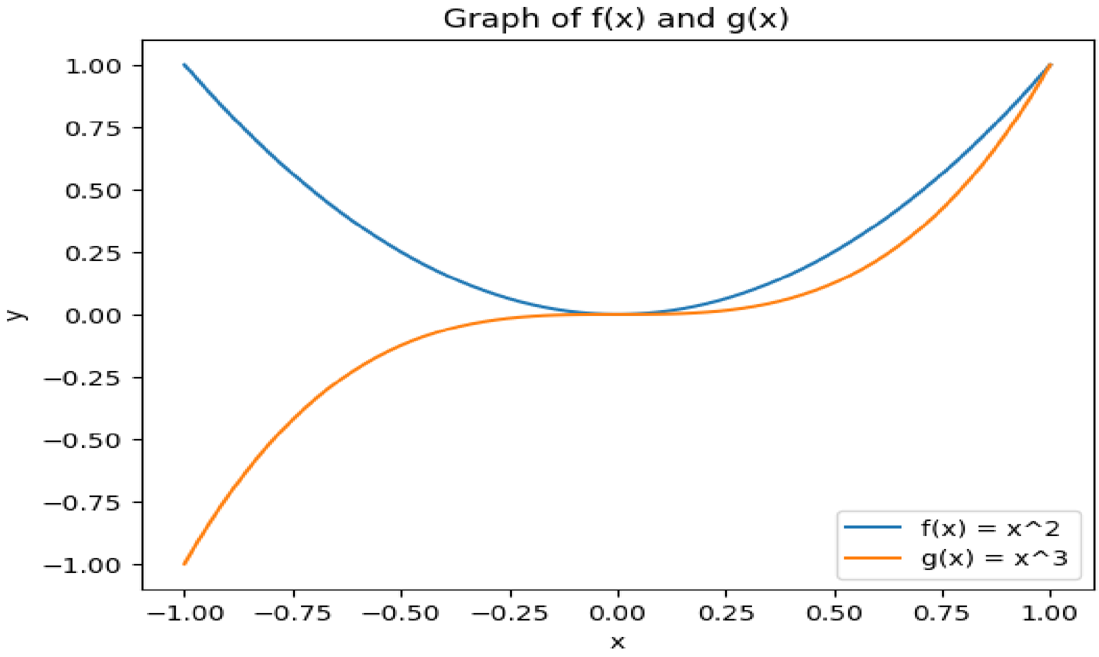
A) Write a python program to plot 2D graph of the function f(x)=x2 and g(x)=x3 in [-1,1]

-→

```
import matplotlib.pyplot as plt
import numpy as np

# Define the x values
x = np.linspace(-1, 1, 100)

# Define the functions
f = x**2
g = x**3
plt.plot(x, f, label='f(x) = x^2')
plt.plot(x, g, label='g(x) = x^3')
plt.xlabel('x')
plt.ylabel('y')
plt.title('Graph of f(x) and g(x)')
plt.legend()
plt.show()
```

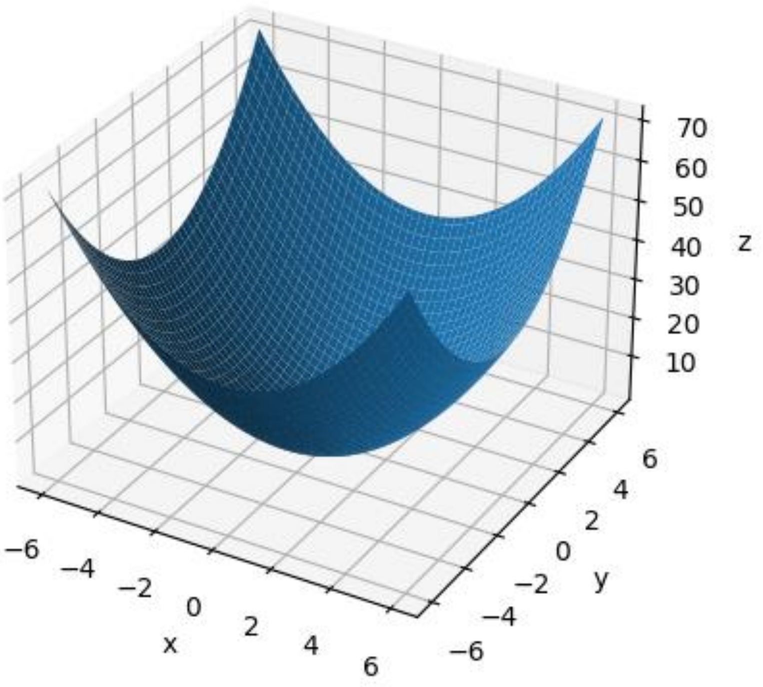


B) Using Python plot the surface plot of parabola $z=x^2+y^2$ in $-6 <x,y<6$

-→

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
x = np.linspace(-6, 6, 100)
y = np.linspace(-6, 6, 100)
X, Y = np.meshgrid(x, y)
Z = X**2 + Y**2

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X, Y, Z)
ax.set_xlabel('x')
ax.set_ylabel('y')
ax.set_zlabel('z')
plt.show()
```

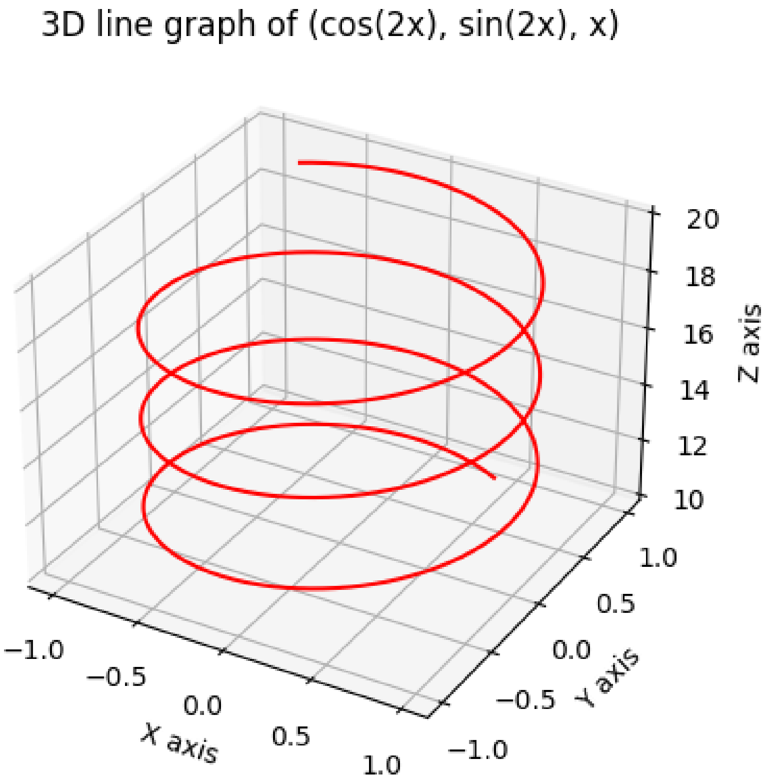


C) Write a python program to plot the 3D line graph whose parametric equation is (cos(2x),sin(2x),x) for $10 \leq x \leq 20$ (in red color) with title to the graph

-→

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
x = np.linspace(10, 20, 1000)
y = np.cos(2*x)
z = np.sin(2*x)
w = x
```

```
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot(y, z, w, color='red')
ax.set_xlabel('X axis')
ax.set_ylabel('Y axis')
ax.set_zlabel('Z axis')
plt.title('3D line graph of (cos(2x), sin(2x), x)')
plt.show()
```



Q2) Attempt any TWO of the following

A) Write a python program to reflect the ΔABC through the line y=3 where A(1,0),B(2,-1),C(-1,3)

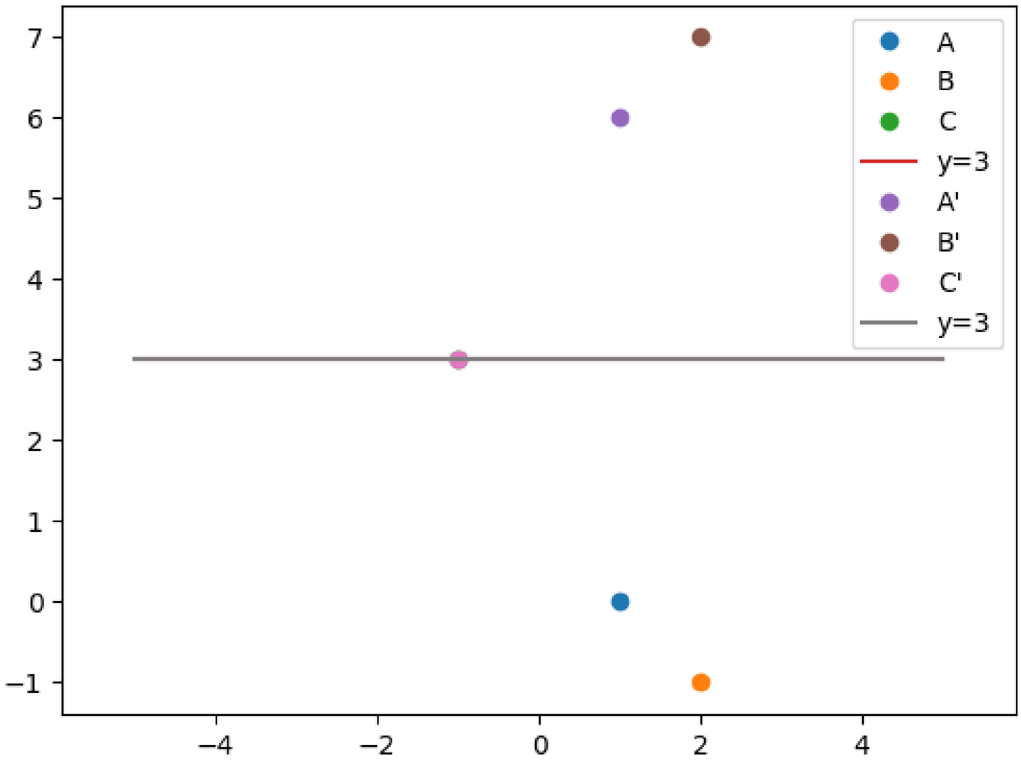
-→

```
import numpy as np
import matplotlib.pyplot as plt
A = np.array([1, 0])
B = np.array([2, -1])
C = np.array([-1, 3])
x = np.linspace(-5, 5, 100)
y = np.full_like(x, 3)

plt.plot(A[0], A[1], 'o', label='A')
plt.plot(B[0], B[1], 'o', label='B')
plt.plot(C[0], C[1], 'o', label='C')
plt.plot(x, y, label='y=3')
plt.axis('equal')
plt.grid()
plt.legend()

# Reflect the coordinates of the triangle across the line y=3
A_reflect = np.array([A[0], 2*3 - A[1]])
B_reflect = np.array([B[0], 2*3 - B[1]])
C_reflect = np.array([C[0], 2*3 - C[1]])

plt.plot(A_reflect[0], A_reflect[1], 'o', label='A\")
plt.plot(B_reflect[0], B_reflect[1], 'o', label='B\")
plt.plot(C_reflect[0], C_reflect[1], 'o', label='C\")
plt.plot(x, y, label='y=3')
plt.axis('equal')
plt.grid()
plt.legend()
plt.show()
```



B) Find the area and perimeter of the ∆ABC where A[0,0],B[5,0],C[3,3]

-→

```
import numpy as np
A = np.array([0, 0])
B = np.array([5, 0])
C = np.array([3, 3])

dist_AB = np.linalg.norm(B - A)
```

```
dist_BC = np.linalg.norm(C - B)
dist_CA = np.linalg.norm(A - C)

perimeter = dist_AB + dist_BC + dist_CA
area = 0.5 * abs((A[0]*B[1] + B[0]*C[1] + C[0]*A[1]) - (A[1]*B[0] + B[1]*C[0] + C[1]*A[0]))
print("Perimeter =", perimeter)
print("Area =", area)
```

Output :

```
Perimeter = 12.848191962583275
Area = 7.5
```

C) Using sympy declare the points P(5,2),Q(5,-2),R(5,0) ,check 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, Segment, Line
P = Point(5, 2)
Q = Point(5, -2)
R = Point(5, 0)
area = abs((Q.x - P.x)*(R.y - P.y) - (R.x - P.x)*(Q.y - P.y))/2
if area < 1e-6:
    print("The points are collinear")
else:
    print("The points are not collinear")

ray_PQ = Segment(P, Q).direction
length_PQ = Segment(P, Q).length
slope_PQ = Line(P, Q).slope

print("Length of ray PQ:", length_PQ)
print("Slope of ray PQ:", slope_PQ)
```

output :

```
The points are collinear
Length of ray PQ: 4
Slope of ray PQ: oo
```

Q3) Attempt the following

A) Attempt any ONE of the following

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

Max $Z=5x+3y$
Subject to $X+Y\leq7$
$2x+5y\leq1$
$X,y\geq0$

-→

```
import numpy as np
from scipy.optimize import linprog
c = np.array([5, 3])
A = np.array([[1, 1], [2, 5]])
b = np.array([7, 1])
x_bounds = (0, None)
y_bounds = (0, None)
result = linprog(c, A_ub=A, b_ub=b, bounds=[x_bounds, y_bounds],
method='simplex')

print("Status:", result.message)
print("x =", result.x[0])
print("y =", result.x[1])
print("Optimal value of Z =", result.fun)
```

output :

```
Status: Optimization terminated successfully.
x = 0.0
y = 0.0
Optimal value of Z = 0.0
```

II) write a python program to display the following LPP by using pulp module and simplex method.Find its optimal solution if exist

Max $Z=3x+2y+5z$

Subject to $x+2y+z\leq430$

$3x+4z\leq460$

$X+4y\leq120$

$X,y,z\geq0$

-→

```
from pulp import *
prob = LpProblem("LPP", LpMaximize)
x = LpVariable("x", lowBound=0)
y = LpVariable("y", lowBound=0)
z = LpVariable("z", lowBound=0)

prob += 3*x + 2*y + 5*z
prob += x + 2*y + z <= 430
prob += 3*x + 4*z <= 460
prob += x + 4*y <= 120
prob.solve()

print("Status:", LpStatus[prob.status])
print("x =", value(x))
print("y =", value(y))
print("z =", value(z))
print("Optimal value of Z =", value(prob.objective))
```

B) Attempt any ONE of the following

I) Write a python program to apply the following transformation on the point (-2,4) :

A) Shering in Y direction by 7 units

B) Scaling in X and Y direction by $\frac{7}{2}$ and 7 units respectively

C) Shering in X and Y direction by 4 and 7 units respectively

D) Rotation about origin by an angle 60◦

-→

```
import numpy as np
p = np.array([-2, 4, 1]).T
T_A = np.array([[1, 0, 0], [7, 1, 0], [0, 0, 1]])
T_B = np.array([[7/2, 0, 0], [0, 7, 0], [0, 0, 1]])
T_C = np.array([[1, 4, 0], [7, 1, 0], [0, 0, 1]])
theta = np.radians(60)
```

```
T_D = np.array([[np.cos(theta), -np.sin(theta), 0], [np.sin(theta), np.cos(theta), 0], [0, 0, 1]])

p_A = np.dot(T_A, p)
p_B = np.dot(T_B, p)
p_C = np.dot(T_C, p)
p_D = np.dot(T_D, p)

print("A) Shearing in Y direction by 7 units:", p_A)
print("B) Scaling in X and Y direction by 7/2 and 7 units respectively:", p_B)
print("C) Shearing in X and Y direction by 4 and 7 units respectively:", p_C)
print("D) Rotation about origin by an angle 60◦:", p_D)
```

Output :

```
A) Shearing in Y direction by 7 units: [ -2 -10   1]
B) Scaling in X and Y direction by 7/2 and 7 units respectively: [-7. 28.  1.]
C) Shearing in X and Y direction by 4 and 7 units respectively: [ 14 -10   1]
D) Rotation about origin by an angle 60◦: [-4.46410162  0.26794919  1.        ]
```

II) Write a python program to plot 2D x-axis and y-axis in black colour.in the same diagram plot

A) Green tringle with vertices [5,4],[7,4],[6,6]

B)Blue rectangle with vertices[2,2],[10,2],[10,8],[2,8]

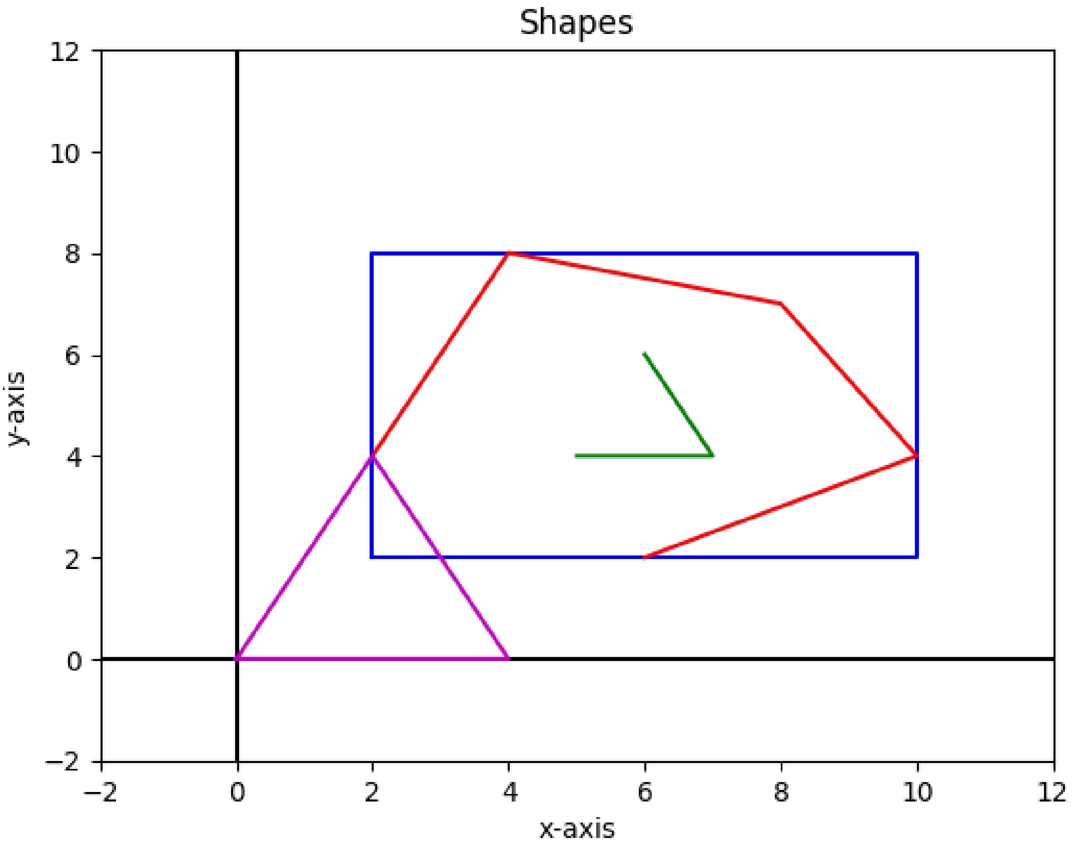
C)Red polygon with vertices[6,2],[10,4],[8,7],[4,8],[2,4]

D)Isosceles triangle with vertices [0,0],[4,0],[2,4]

-→

```
import matplotlib.pyplot as plt
plt.axhline(y=0, color='black')
plt.axvline(x=0, color='black')
plt.plot([5, 7, 6], [4, 4, 6], 'g')
plt.plot([2, 10, 10, 2, 2], [2, 2, 8, 8, 2], 'b')
plt.plot([6, 10, 8, 4, 2], [2, 4, 7, 8, 4], 'r')
plt.plot([0, 4, 2, 0], [0, 0, 4, 0], 'm')
plt.xlim(-2, 12)
plt.ylim(-2, 12)

plt.title('Shapes')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.show()
```


Shapes
y-axis
x-axis