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College Sangamner

DEPARTMENT OF COMPUTER SCIENCE

Sub : Mathematics

Remark
Demonstrator's
Signature
Date:- / /20

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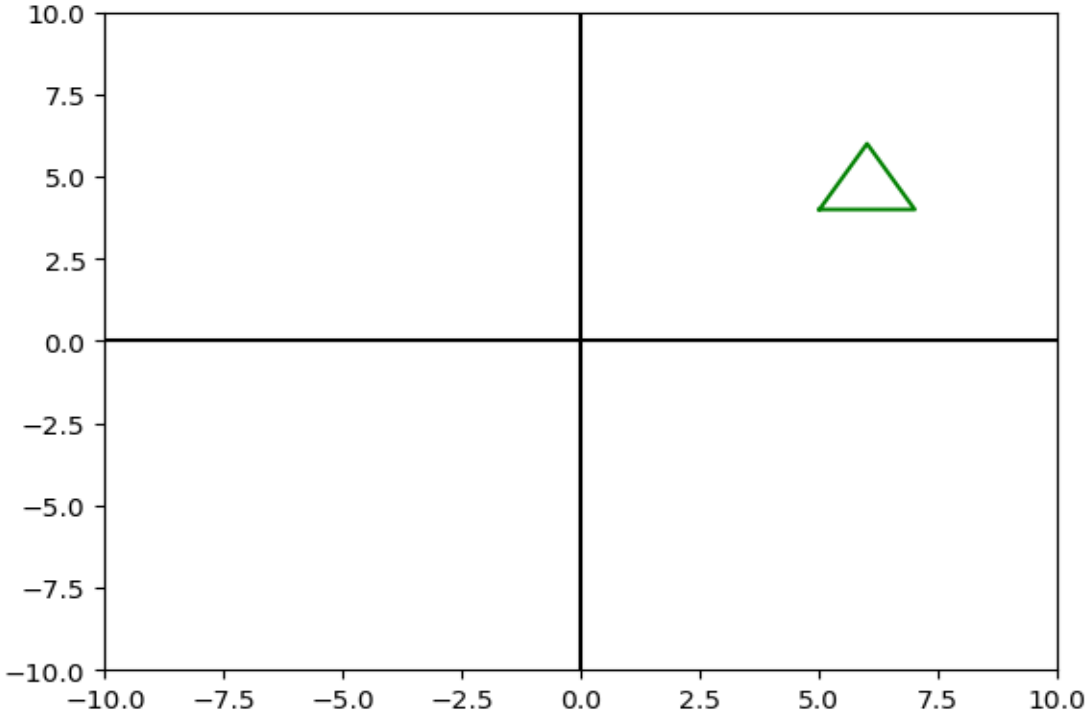
Title of the expt:-__Slip no 9_____Page.no:-_____Class:-_____BCS_____

Q1 Attempt any TWO of the following

A) Write a python program to Plot 2D X-axis and Y-axis black color and in the same diagram plot green triangle with vertices [5,4],[7,4],[6,6]

-→

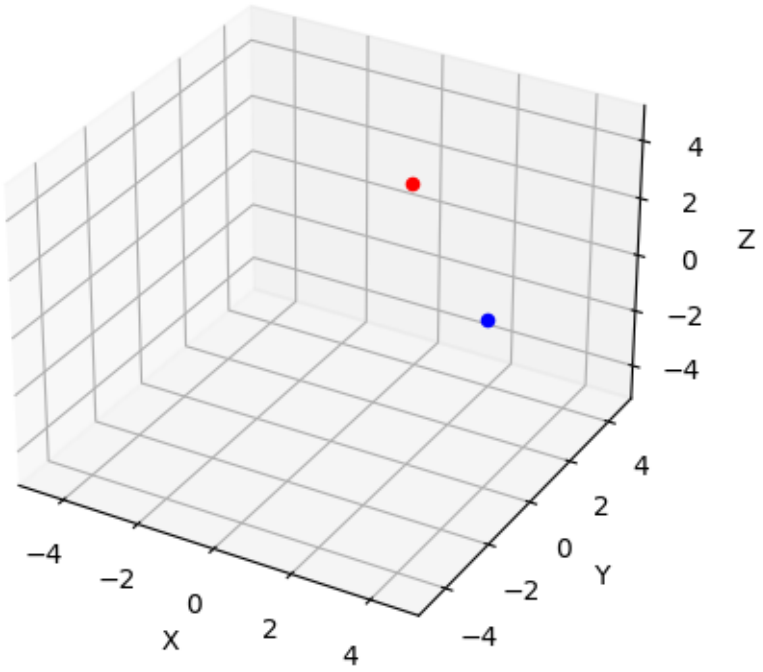
```
import matplotlib.pyplot as plt
plt.xlim(-10, 10)
plt.ylim(-10, 10)
plt.axhline(0, color='black')
plt.axvline(0, color='black')
x = [5, 7, 6, 5]
y = [4, 4, 6, 4]
plt.plot(x, y, color='green')
plt.show()
```



B) Write a program in python to rotate the point through YZ-plane in anticlockwise direction(rotation through Y-axis by an angle of 90◦)

-→

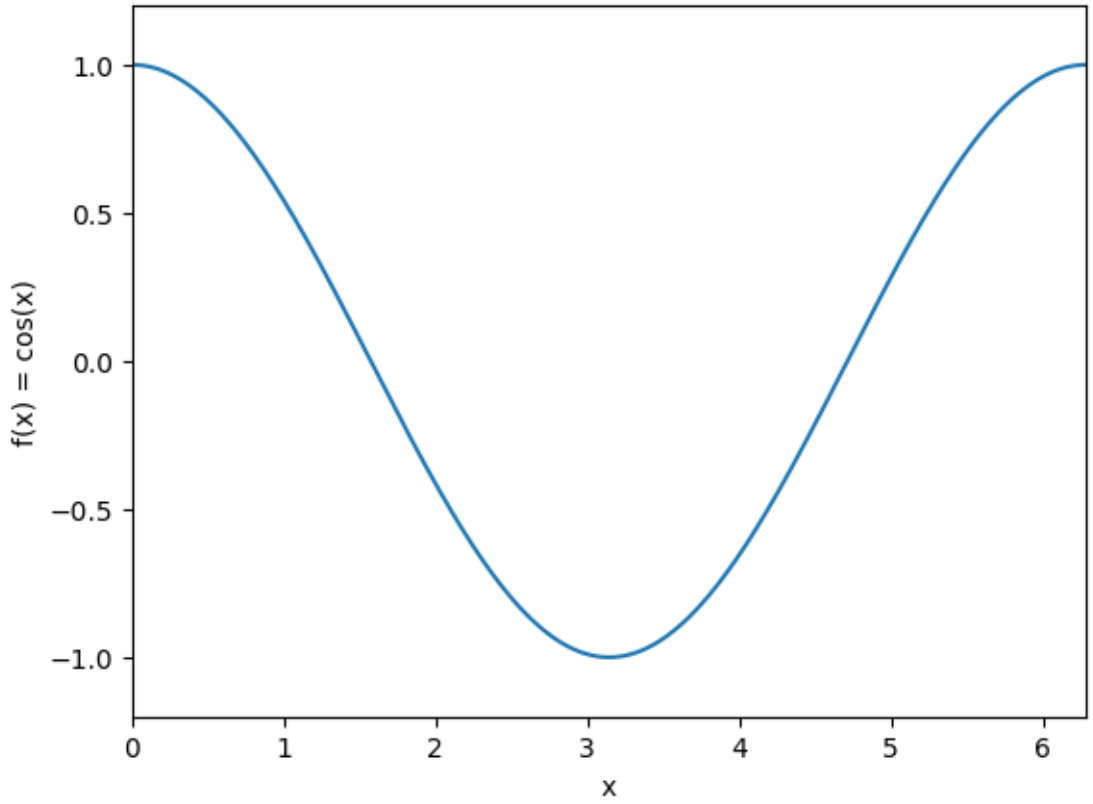
```
import numpy as np
import matplotlib.pyplot as plt
p = np.array([[1], [2], [3]])
theta = np.radians(90)
rot_matrix = np.array([[np.cos(theta), 0, np.sin(theta)],
                       [0, 1, 0],
                       [-np.sin(theta), 0, np.cos(theta)]])
p_rotated = np.dot(rot_matrix, p)
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.scatter(p[0], p[1], p[2], c='red', marker='o')
ax.scatter(p_rotated[0], p_rotated[1], p_rotated[2], c='blue', marker='o')
ax.set_xlim(-5, 5)
ax.set_ylim(-5, 5)
ax.set_zlim(-5, 5)
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
plt.show()
```



C) Using Python plot the graph of function f(x)=cos(x) on the interval [0,2π]
-→

```
import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(0, 2*np.pi, 1000)
y = np.cos(x)

plt.plot(x, y)
plt.xlim(0, 2*np.pi)
plt.ylim(-1.2, 1.2)
plt.xlabel('x')
plt.ylabel('f(x) = cos(x)')
plt.show()
```



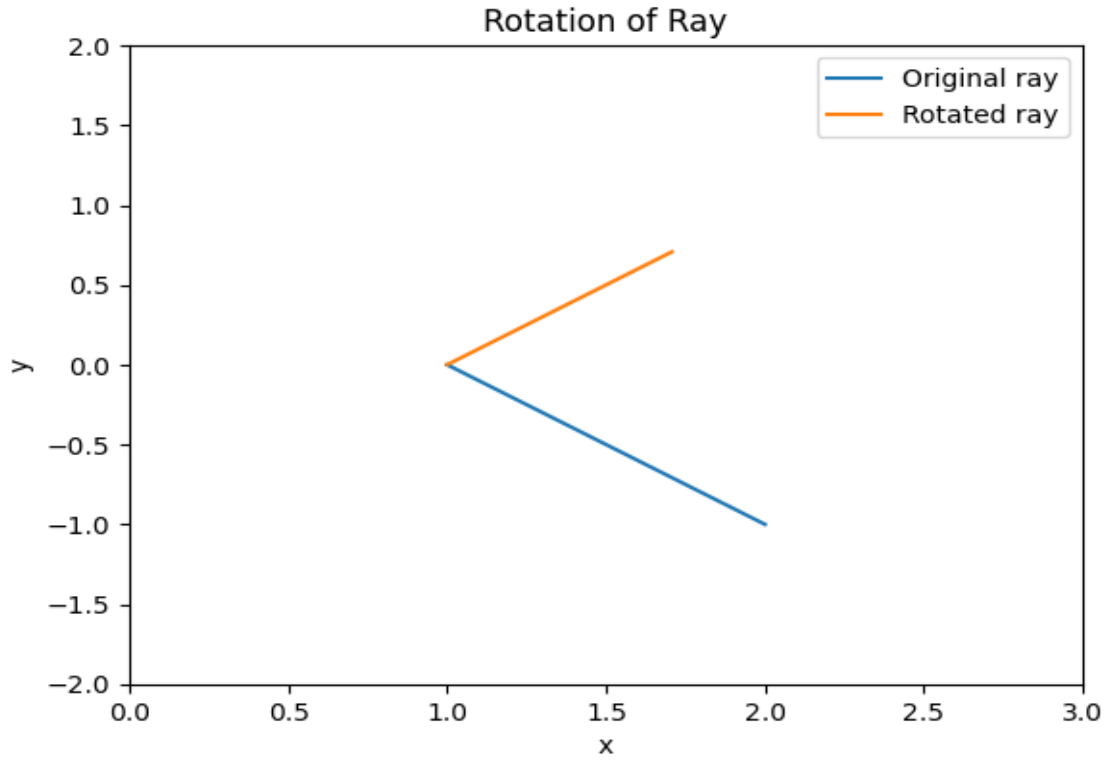
Q2) Attempt any TWO of the following

A) Write a python program to rotate the ray by 90◦ having starting point (1,0) and (2,-1)
-→

```
import math
import matplotlib.pyplot as plt
```

```
start = [1, 0]
end = [2, -1]
theta = math.atan2(end[1]-start[1], end[0]-start[0])
new_end = [start[0] + math.cos(theta + math.radians(90)), start[1] + math.sin(theta +
math.radians(90))]

plt.plot([start[0], end[0]], [start[1], end[1]], label='Original ray')
plt.plot([start[0], new_end[0]], [start[1], new_end[1]], label='Rotated ray')
plt.xlim(0, 3)
plt.ylim(-2, 2)
plt.xlabel('x')
plt.ylabel('y')
plt.title('Rotation of Ray')
plt.legend()
plt.show()
```



B) Using sympy declare the points A(0,7), B(5,2). Declare the line segment passing through them Find length and midpoint of the line ssegment passing through points A and B

-→

```
from sympy import Point
from sympy import Segment
A = Point(0, 7)
B = Point(5, 2)
AB = Segment(A, B)
length = AB.length
print("Length of AB:", length)
midpoint = AB.midpoint
print("Midpoint of AB:", midpoint)
```

output :

```
Length of AB: 5*sqrt(2)
Midpoint of AB: Point2D(5/2, 9/2)
```

c) Write a python program to find the area and perimeter of ∆ABC where A(0,0),B(5,0),C(3,3)

-→

```
from math import sqrt
A = (0, 0)
B = (5, 0)
C = (3, 3)
AB = sqrt((B[0]-A[0])**2 + (B[1]-A[1])**2)
BC = sqrt((C[0]-B[0])**2 + (C[1]-B[1])**2)
CA = sqrt((A[0]-C[0])**2 + (A[1]-C[1])**2)

perimeter = AB + BC + CA
s = perimeter / 2
area = sqrt(s*(s-AB)*(s-BC)*(s-CA))
print("Perimeter of triangle ABC:", perimeter)
print("Area of triangle ABC:", area)
```

output :

```
Perimeter of triangle ABC: 12.848191962583275
Area of triangle ABC: 7.5000000000000036
```

Q 3) 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
c = [-150, -75]
A = [[4, 6], [5, 3]]
b = [24, 15]
x_bounds = (0, None)
y_bounds = (0, None)
result = linprog(c, A_ub=A, b_ub=b, bounds=[x_bounds, y_bounds])

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

output :

```
Solution status: Optimization terminated successfully. (HiGHS Status 7: Optimal)
Optimal value of x: 3.0
Optimal value of y: 0.0
Optimal value of Z: 450.0
```

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=4x+y+3z+5w

Subject to 4x+6y-4z+w≥20

-3x-2y+4z+w≤10

-8x-3y+3z+2w≤20

X,y,z,w≥0

-→

```
from scipy.optimize import linprog
c = [-4, -1, -3, -5]
A = [[4, 6, -4, 1], [-3, -2, 4, 1], [-8, -3, 3, 2]]
b = [20, 10, 20]
```

```
x_bounds = (0, None)
y_bounds = (0, None)
z_bounds = (0, None)
w_bounds = (0, None)

result = linprog(c, A_ub=A, b_ub=b, bounds=[x_bounds, y_bounds,
z_bounds, w_bounds])

print("Solution status:", result.message)
print("Optimal value of x:", result.x[0])
print("Optimal value of y:", result.x[1])
print("Optimal value of z:", result.x[2])
print("Optimal value of w:", result.x[3])
print("Optimal value of Z:", -result.fun)
```

output :

```
Solution status: Optimization terminated successfully. (HiGHS Status 7: Optimal)
Optimal value of x: 30.0
Optimal value of y: 0.0
Optimal value of z: 25.0
Optimal value of w: 0.0
Optimal value of Z: 195.0
```

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 & 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
point = np.array([-2, 4])
A = np.array([[1, 0], [7, 1]])
```

```
B = np.array([[7/2, 0], [0, 5]])
C = np.array([[1, 4], [7, 1]])

theta = np.radians(60)
D = np.array([[np.cos(theta), -np.sin(theta)], [np.sin(theta),
np.cos(theta)]])
transformed_point_a = np.dot(A, point)
transformed_point_b = np.dot(B, point)
transformed_point_c = np.dot(C, point)
transformed_point_d = np.dot(D, point)

print("Original point: ", point)
print("Transformed point after A: ", transformed_point_a)
print("Transformed point after B: ", transformed_point_b)
print("Transformed point after C: ", transformed_point_c)
print("Transformed point after D: ", transformed_point_d)
```

output :

```
Original point:  [-2  4]
Transformed point after A:  [ -2 -10]
Transformed point after B:  [-7. 20.]
Transformed point after C:  [ 14 -10]
Transformed point after D:  [-4.46410162  0.26794919]
```

II) Write a python program to find combined transformation of the line segment between the points A[5,3] & B[1,4] for the following sequence of transformation

A) Rotation about origin through an angle $\frac{\pi}{2}$

B) Uniform scaling by -3.5 units

C) Scaling in Y-axis by 5 units

D) Shering in X and Y direction by 3 and 4 units respectively

→

```
import numpy as np
line_segment = np.array([[5, 3], [1, 4]])

theta_a = np.pi/2
A = np.array([[np.cos(theta_a), -np.sin(theta_a)], [np.sin(theta_a), np.cos(theta_a)]])
B = np.array([[-3.5, 0], [0, -3.5]])
C = np.array([[1, 0], [0, 5]])
D = np.array([[1, 3], [4, 1]])

combined_transform = np.dot(D, np.dot(C, np.dot(B, A)))
transformed_line_segment = np.dot(combined_transform, line_segment.T).T

print("Original line segment: ")
print(line_segment)
print("Transformed line segment after A, B, C, and D: ")
print(transformed_line_segment)
```

output :

```
Original line segment:
[[5 3]
 [1 4]]
Transformed line segment after A, B, C, and D:
[[-252.   -45.5]
 [ -38.5   38.5]]
```