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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 11_____________________________Page.no:-_____Class:-_______BCS______**

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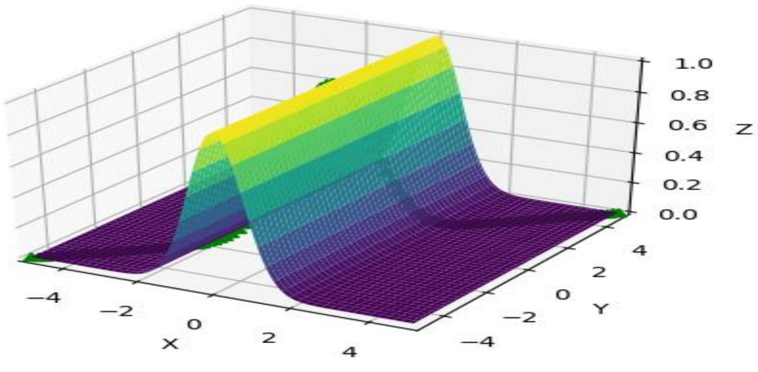
## Q1 Attempt any TWO of the following

**A ) Write a python program to plot 3D graph of the function f(x)=$e^{-x^2}$ in [-5,5] with green dashed points line with upward pointing triangle**

**-→**

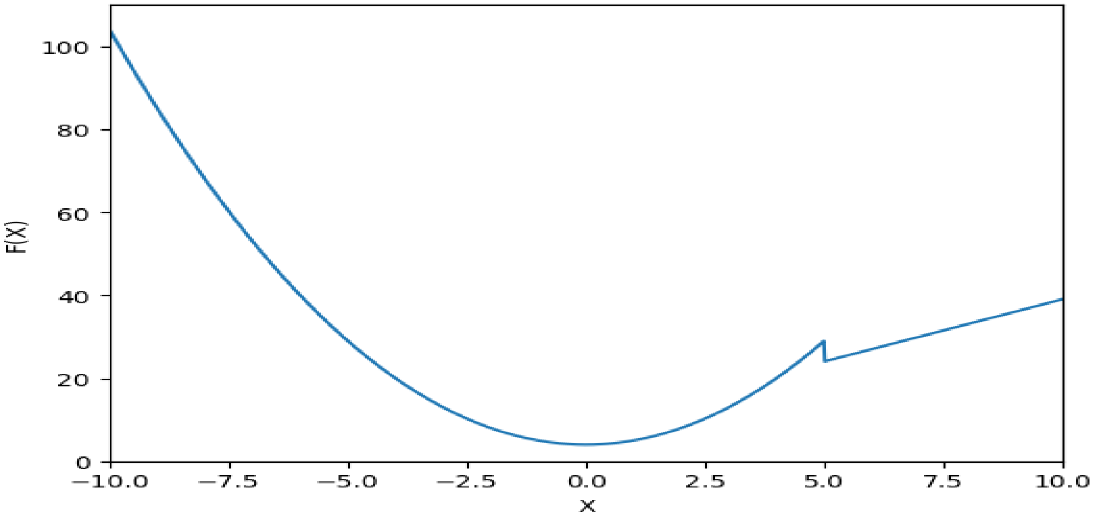
```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
def f(x, y):
   return np.exp(-x**2)

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')
ax.plot_surface(X, Y, Z, cmap='viridis')

ax.plot(x, y, f(x, y), 'g--', marker='^')
ax.set_xlim([-5, 5])
ax.set_ylim([-5, 5])
ax.set_zlim([0, 1])
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
plt.show()
```



**B ) Write a python program to plot the graph of the function using def()**
**$F(x)=\{x^2+4 \text{ if } -10\leq x<5 \text{ , } 3x+9 \text{ if } 5\leq x<10 \}$**

-→

```
import matplotlib.pyplot as plt
import numpy as np
def F(x):
    if -10 <= x < 5:
        return x**2 + 4
    elif 5 <= x < 10:
        return 3*x + 9

x = np.linspace(-10, 10, 1000)
y = [F(i) for i in x]

plt.plot(x, y)
plt.xlim([-10, 10])
plt.ylim([0, 110])
plt.xlabel('X')
plt.ylabel('F(X)')
plt.show()
```

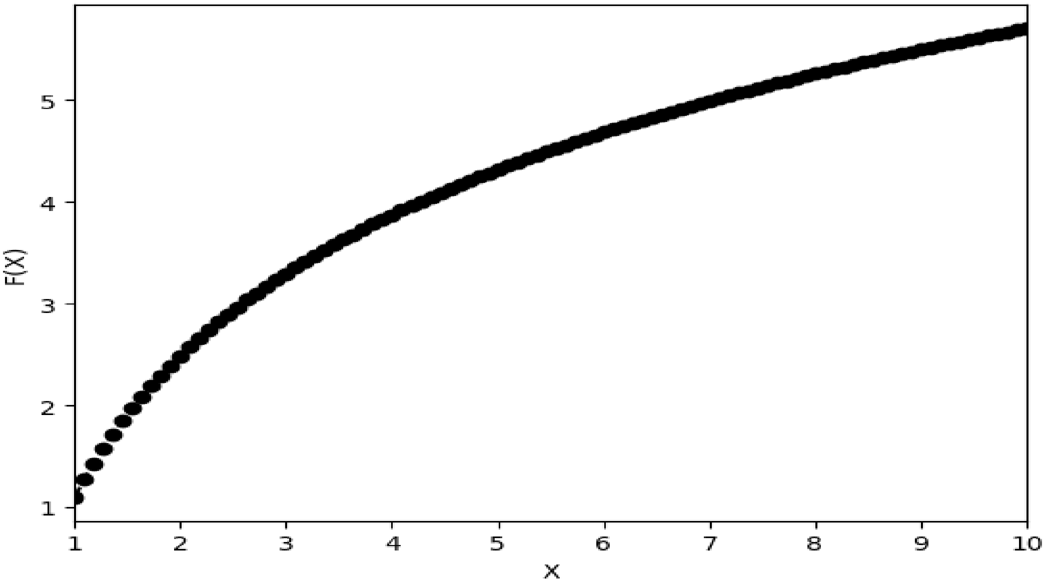


**C ) Write a python program to plot graph of the function $f(x)=\log(3x^2)$, in[1,10] with black dashed points**

-→

```
import numpy as np
import matplotlib.pyplot as plt
def f(x):
    return np.log(3*x**2)

x = np.linspace(1, 10, 100)
```

```
y = f(x)
plt.plot(x, y, 'k--o')
plt.xlim([1, 10])
plt.xlabel('X')
plt.ylabel('F(X)')
plt.show()
```

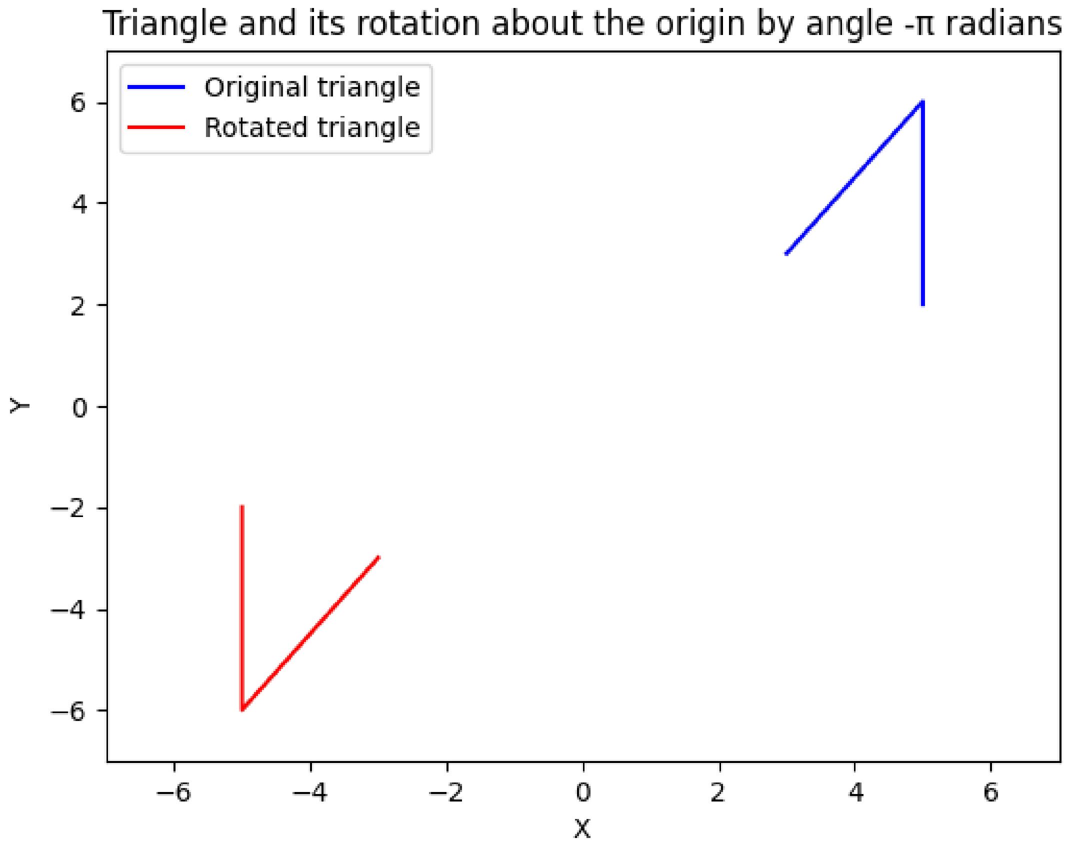


**Q2 ) Attempt any TWO of the following**

**A )Write a python program to plot triangle with vertices[3,3],[5,6],[5,2] and its rotation about the origin by angle –π radians**

**-🡒**

```
import numpy as np
import matplotlib.pyplot as plt
vertices = np.array([[3,3], [5,6], [5,2]])
theta = -np.pi
R = np.array([[np.cos(theta), -np.sin(theta)],
            [np.sin(theta), np.cos(theta)]])
rotated_vertices = np.dot(vertices, R)
plt.plot(vertices[:,0], vertices[:,1], 'b', label='Original triangle')
plt.plot(rotated_vertices[:,0], rotated_vertices[:,1], 'r', label='Rotated triangle')

plt.xlim([-7, 7])
plt.ylim([-7, 7])
plt.xlabel('X')
plt.ylabel('Y')
plt.title('Triangle and its rotation about the origin by angle -π radians')
plt.legend()
plt.show()
```



**B ) Write a python program to generate vector x in the interval [-22,22] using numpy package with 80 subintervals**

**-→**

```
import numpy as np
num_subintervals = 80
interval = [-22, 22]
subinterval_size = (interval[1] - interval[0]) / num_subintervals
x = np.arange(interval[0], interval[1] + subinterval_size, subinterval_size)
print(x)
```

output :

```
[-2.20000000e+01 -2.14500000e+01 -2.09000000e+01 -2.03500000e+01
 -1.98000000e+01 -1.92500000e+01 -1.87000000e+01 -1.81500000e+01
 -1.76000000e+01 -1.70500000e+01 -1.65000000e+01 -1.59500000e+01
 -1.54000000e+01 -1.48500000e+01 -1.43000000e+01 -1.37500000e+01
 -1.32000000e+01 -1.26500000e+01 -1.21000000e+01 -1.15500000e+01
 -1.10000000e+01 -1.04500000e+01 -9.90000000e+00 -9.35000000e+00
 -8.80000000e+00 -8.25000000e+00 -7.70000000e+00 -7.15000000e+00
 -6.60000000e+00 -6.05000000e+00 -5.50000000e+00 -4.95000000e+00
 -4.40000000e+00 -3.85000000e+00 -3.30000000e+00 -2.75000000e+00
 -2.20000000e+00 -1.65000000e+00 -1.10000000e+00 -5.50000000e-01
  2.84217094e-14  5.50000000e-01  1.10000000e+00  1.65000000e+00
  2.20000000e+00  2.75000000e+00  3.30000000e+00  3.85000000e+00
  4.40000000e+00  4.95000000e+00  5.50000000e+00  6.05000000e+00
  6.60000000e+00  7.15000000e+00  7.70000000e+00  8.25000000e+00
  8.80000000e+00  9.35000000e+00  9.90000000e+00  1.04500000e+01
  1.10000000e+01  1.15500000e+01  1.21000000e+01  1.26500000e+01
  1.32000000e+01  1.37500000e+01  1.43000000e+01  1.48500000e+01
  1.54000000e+01  1.59500000e+01  1.65000000e+01  1.70500000e+01
  1.76000000e+01  1.81500000e+01  1.87000000e+01  1.92500000e+01
  1.98000000e+01  2.03500000e+01  2.09000000e+01  2.14500000e+01
  2.20000000e+01]
```

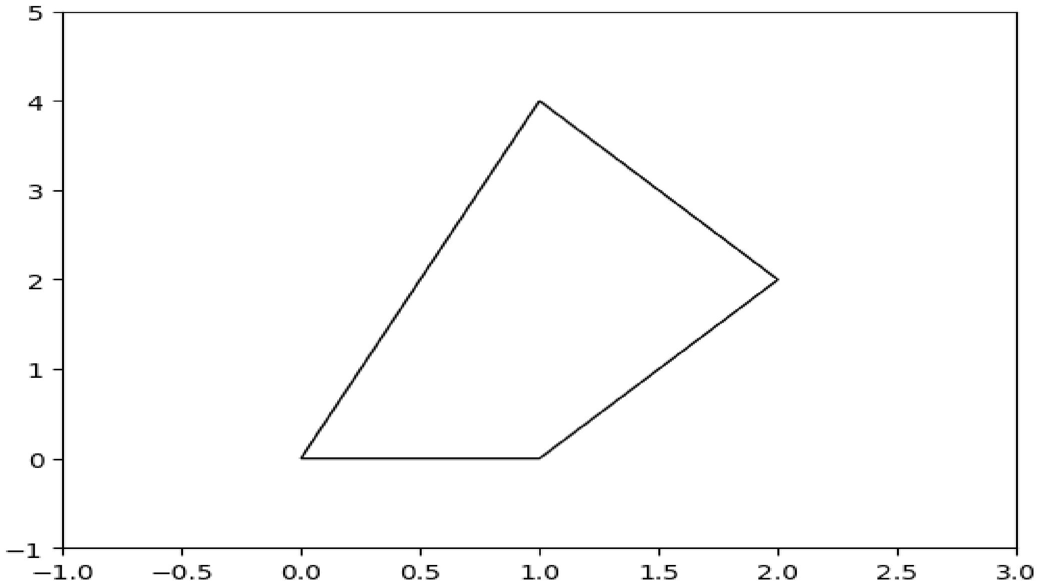
**C )Write a python program to draw a polygon with vertices (0,0),(1,0),(2,2),(1,4) also find area and perimeter of the polygon**

**-➔**

```
import matplotlib.pyplot as plt

vertices = [(0,0), (1,0), (2,2), (1,4)]
polygon = plt.Polygon(vertices, closed=True, fill=None, edgecolor='black')

fig, ax = plt.subplots()
ax.add_patch(polygon)
ax.set_xlim(-1, 3)
ax.set_ylim(-1, 5)

perimeter = 0
for i in range(len(vertices)-1):
    perimeter += ((vertices[i][0]-vertices[i+1][0])**2 + (vertices[i][1]-
vertices[i+1][1])**2)**0.5
perimeter += ((vertices[-1][0]-vertices[0][0])**2 + (vertices[-1][1]-
vertices[0][1])**2)**0.5

area = 0
for i in range(len(vertices)-1):
    area += vertices[i][0]*vertices[i+1][1] - vertices[i+1][0]*vertices[i][1]
area += vertices[-1][0]*vertices[0][1] - vertices[0][0]*vertices[-1][1]
area = abs(area) / 2
```

```
print('Perimeter:', perimeter)
print('Area:', area)
plt.show()
```

```
Perimeter: 9.595241580617241
Area: 4.0
```



**Q3 ) Attempt the following**

**A ) Attempt any ONE of the following**

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

**Min Z=3.5x+2y**
**Subject to x+y≥5**
**x≥4**
**y≥2**
**x,y≥0**

**-→**

```
import numpy as np
from scipy.optimize import linprog
c = np.array([3.5, 2])
A = np.array([[1, 1],
            [1, 0],
            [0, 1]])
b = np.array([5, 4, 2])

bounds = [(0, None), (0, None)]
```

```
res = linprog(c, A_ub=A, b_ub=b, bounds=bounds, method='simplex')

print("Status:", res.message)
print("x =", res.x[0])
print("y =", res.x[1])
print("Z =", res.fun)
```

output :

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

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

**Min $Z=x+y$**<br>
**Subject to $x\geq 6$**<br>
**$y\geq 6$**<br>
**$x+y\leq 11$**<br>
**$x,y\geq 0$**

**-→**

```
import numpy as np
from scipy.optimize import linprog
c = np.array([1, 1])
A = np.array([[-1, 0],
            [0, -1],
            [1, 1]])
b = np.array([-6, -6, 11])
bounds = [(0, None), (0, None)]
res = linprog(c, A_ub=A, b_ub=b, bounds=bounds, method='simplex')

print("Status:", res.message)
print("x =", res.x[0])
print("y =", res.x[1])
print("Z =", res.fun)
```

output :

```
x = 6.0
```

```
y = 6.0
Z = 12.0
```

**B ) Attempt any ONE of the following**

**I ) Apply python program in each of the following transformation on the points P[3,-1]**
**A ) reflection through X-axis**
**B ) Scaling in X-coordinate 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([3, -1])
P_reflected = np.array([P[0], -P[1]])
print("Reflection through X-axis:", P_reflected)

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

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

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

output :

```
Reflection through X-axis: [3 1]
Scaling in X-coordinate by factor 2: [ 6 -1]
Scaling in Y-coordinate by factor 1.5: [ 3.  -1.5]
Reflection through the line y=x: [-1  3]
```

**II )Find the combined transformation of the line segment between the points A[4,-1] & B[3,0] by using python program  for the following sequence of transformation**
**A ) Rotation about origin through an angle π**
**B ) Shering in Y-direction by 4.5 units**
**C ) Scaling in X-coordinate by 3 units**
**D ) Reflection through the line y=x**
**-→**

```
import numpy as np
A = np.array([4, -1])
```

```
B = np.array([3, 0])

R = np.array([[-1, 0], [0, -1]])
A_rotated = np.dot(R, A)
B_rotated = np.dot(R, B)
S = np.array([[1, 0], [4.5, 1]])
A_sheared = np.dot(S, A_rotated)
B_sheared = np.dot(S, B_rotated)

Sx = np.array([[3, 0], [0, 1]])
A_scaled = np.dot(Sx, A_sheared)
B_scaled = np.dot(Sx, B_sheared)
R_line = np.array([[0, 1], [1, 0]])
A_reflected = np.dot(R_line, A_scaled)
B_reflected = np.dot(R_line, B_scaled)

print("Transformed point A:", A_reflected)
print("Transformed point B:", B_reflected)
```

output :

```
Transformed point A: [-17. -12.]
Transformed point B: [-13.5  -9. ]
```