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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 16______________________________Page.no:-_____Class:-______BCS_________

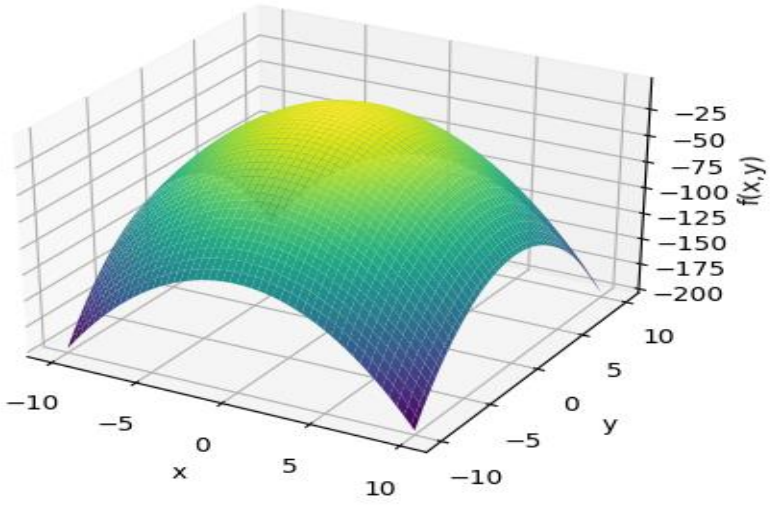
Q1. Attempt any TWO of the following

A) Write a python program to plot the function f(x,y)=-x^2-y^2 when -10≤x,y≤10
-→

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

x = np.linspace(-10, 10, 100)
y = np.linspace(-10, 10, 100)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)

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



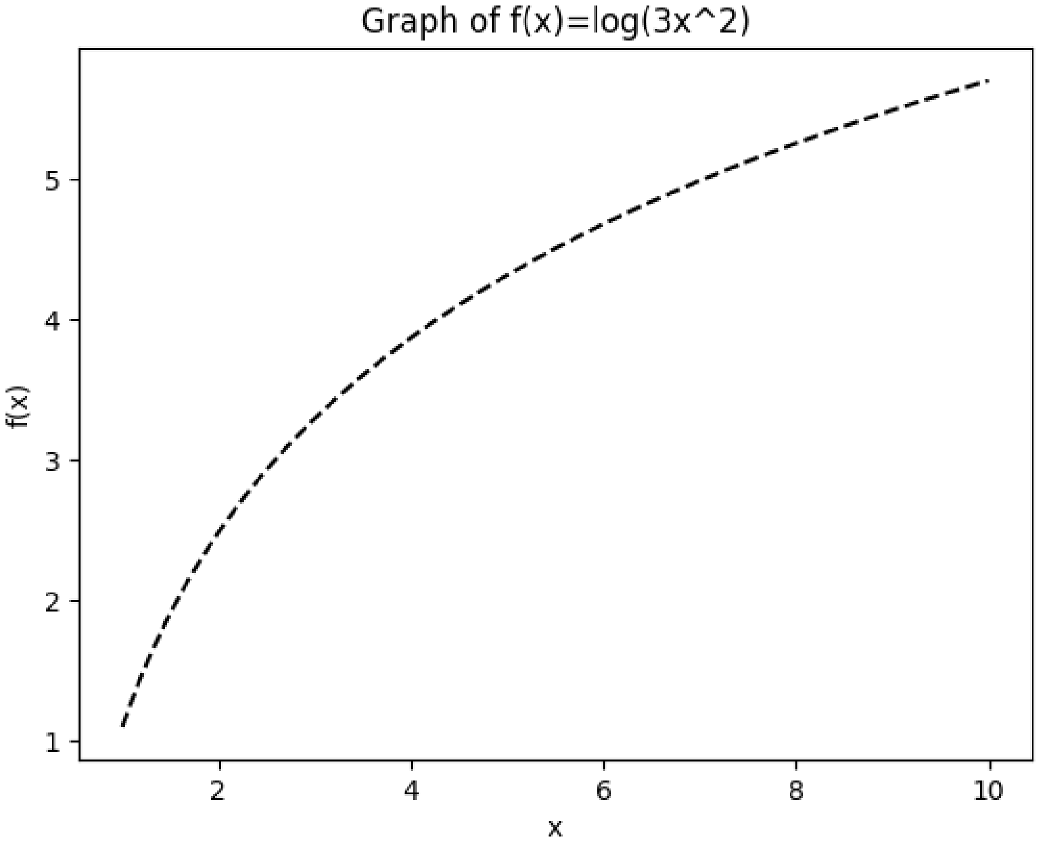
B) Write a python program to plot graph of the function f(x)=log(3x^2) in [1,10] with black dashed points

-→

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

x = np.linspace(1, 10, 100)
y = f(x)

plt.plot(x, y, 'k--')
plt.xlabel('x')
plt.ylabel('f(x)')
plt.title('Graph of f(x)=log(3x^2)')
    plt.show()
```



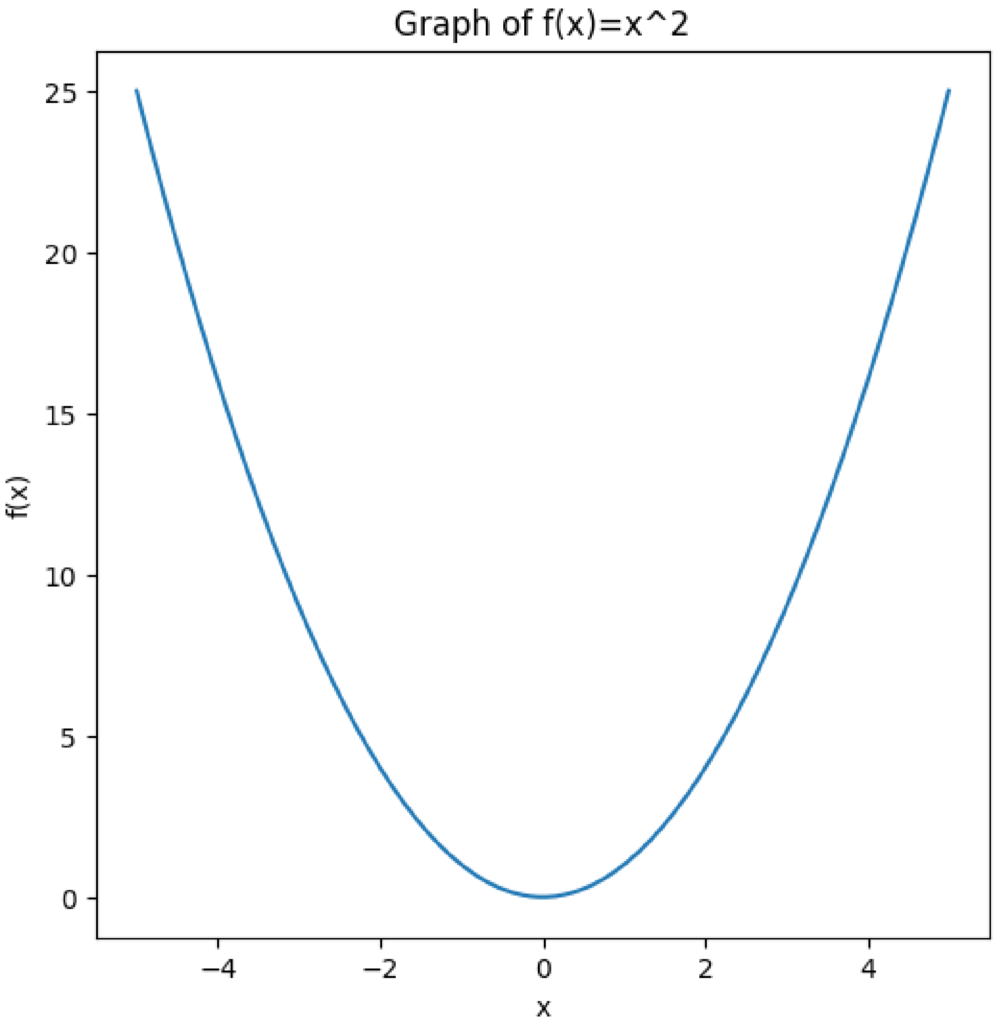
C) Write a python program to generate plot of the function f(x)=x^2 in the interval [-5,5] in figure of size of 6x6 inches

-→

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

x = np.linspace(-5, 5, 100)
y = f(x)

fig = plt.figure(figsize=(6, 6))
plt.plot(x, y)
plt.xlabel('x')
plt.ylabel('f(x)')
plt.title('Graph of f(x)=x^2')
    plt.show()
```



Q2) Attempt any TWO of the following

A) Write a python program to declare the line segment passing through the points A(0,7) , B(5,2) . also find the length and midpoint of the line segment passing through points A and B

-→

```
import math
Ax, Ay = 0, 7
Bx, By = 5, 2
slope = (By - Ay) / (Bx - Ax)

y_intercept = Ay - slope * Ax
print("Equation of the line: y = {}x + {}".format(slope, y_intercept))

length = math.sqrt((Bx - Ax)**2 + (By - Ay)**2)
print("Length of the line segment: {:.2f}".format(length))

midpoint_x = (Ax + Bx) / 2
midpoint_y = (Ay + By) / 2
print("Midpoint of the line segment: ({}, {})".format(midpoint_x, midpoint_y))
```

output :

```
Equation of the line: y = -1.0x + 7.0
Length of the line segment: 7.07
Midpoint of the line segment: (2.5, 4.5)
```

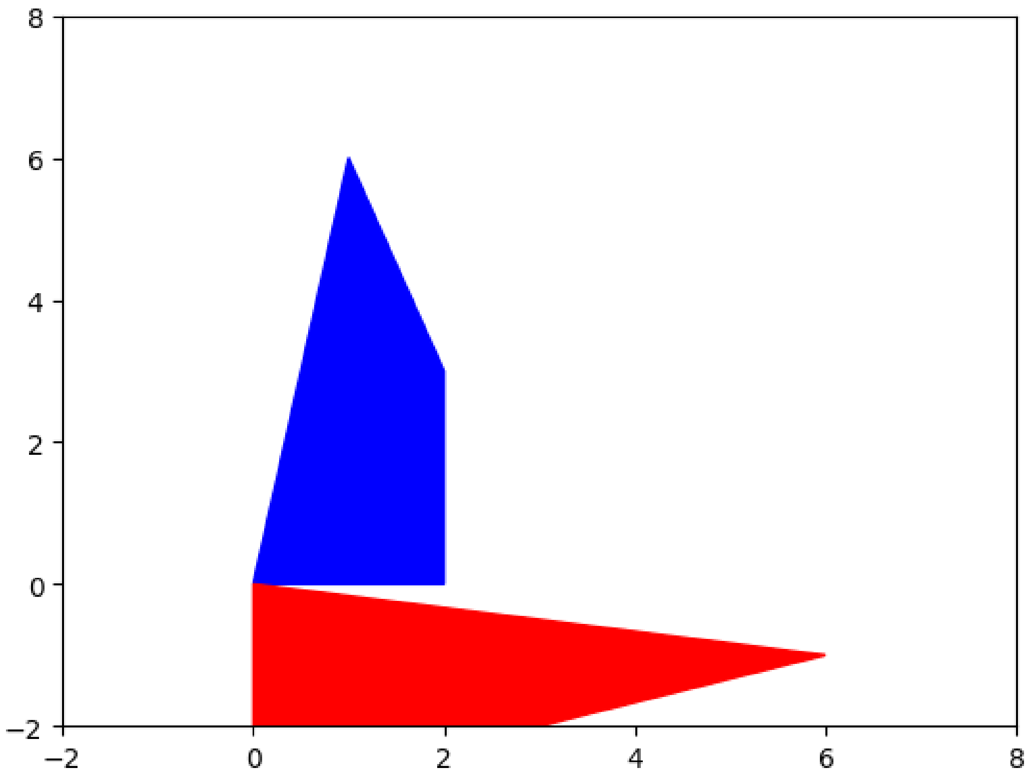
B) Write a python program to draw a polygon with vertices (0,0),(2,0),(2,3),(1,6) and rotate it by 90◦

-→

```
import matplotlib.pyplot as plt
import numpy as np
vertices = np.array([[0, 0], [2, 0], [2, 3], [1, 6]])
fig, ax = plt.subplots()

polygon = plt.Polygon(vertices, color='blue')
ax.add_patch(polygon)
ax.set_xlim(-2, 8)
ax.set_ylim(-2, 8)

rotation_angle = 90
rotation_matrix = np.array([[np.cos(np.radians(rotation_angle)), -
np.sin(np.radians(rotation_angle))],
                    [np.sin(np.radians(rotation_angle)),
np.cos(np.radians(rotation_angle))]])
vertices_rotated = np.dot(vertices, rotation_matrix)
polygon_rotated = plt.Polygon(vertices_rotated, color='red')
ax.add_patch(polygon_rotated)
 plt.show()
```



C) Write a python program to generate vector x in the interval [0,15] using numpy package with 100 subintervals

-→

```
import numpy as np
x_min, x_max = 0, 15
num_intervals = 100
x = np.linspace(x_min, x_max, num_intervals)
print(x)
```

output

```
[ 0.          0.15151515  0.3030303   0.45454545  0.60606061  0.75757576
  0.90909091  1.06060606  1.21212121  1.36363636  1.51515152  1.66666667
  1.81818182  1.96969697  2.12121212  2.27272727  2.42424242  2.57575758
  2.72727273  2.87878788  3.03030303  3.18181818  3.33333333  3.48484848
  3.63636364  3.78787879  3.93939394  4.09090909  4.24242424  4.39393939
  4.54545455  4.6969697   4.84848485  5.          5.15151515  5.3030303
  5.45454545  5.60606061  5.75757576  5.90909091  6.06060606  6.21212121
  6.36363636  6.51515152  6.66666667  6.81818182  6.96969697  7.12121212
  7.27272727  7.42424242  7.57575758  7.72727273  7.87878788  8.03030303
  8.18181818  8.33333333  8.48484848  8.63636364  8.78787879  8.93939394
  9.09090909  9.24242424  9.39393939  9.54545455  9.6969697   9.84848485
 10.         10.15151515 10.3030303  10.45454545 10.60606061 10.75757576
 10.90909091 11.06060606 11.21212121 11.36363636 11.51515152 11.66666667
 11.81818182 11.96969697 12.12121212 12.27272727 12.42424242 12.57575758
 12.72727273 12.87878788 13.03030303 13.18181818 13.33333333 13.48484848
 13.63636364 13.78787879 13.93939394 14.09090909 14.24242424 14.39393939
 14.54545455 14.6969697  14.84848485 15.        ]
```

Q 3) 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 $3x+5y\leq15$

$6x+2y\geq24$

$X,y\geq0$

-→

```
import numpy as np
from scipy.optimize import linprog
obj = np.array([-5, -3])
lhs_eq = np.array([[3, 5], [-6, -2]])
rhs_eq = np.array([15, -24])
bnd = [(0, None), (0, None)]
res = linprog(c=obj, A_eq=lhs_eq, b_eq=rhs_eq, bounds=bnd, method='simplex')

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

output :

```
x =  3.75
y =  0.75
Z =  21.0
```

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

Min Z=3.5x+2y

Subject to x+y≥5

x≥5

y≤2

x,y≥0

-→

```
import numpy as np
from scipy.optimize import linprog
obj = np.array([3.5, 2])
lhs_eq = np.array([[-1, -1], [-1, 0], [0, 1]])
rhs_eq = np.array([-5, -5, 2])
bnd = [(5, None), (0, 2)]
res = linprog(c=obj, A_ub=lhs_eq, b_ub=rhs_eq, bounds=bnd, method='simplex')

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

output :

```
x =  5.0
y =  0.0
Z =  17.5
```

B) Attempt any ONE of the following

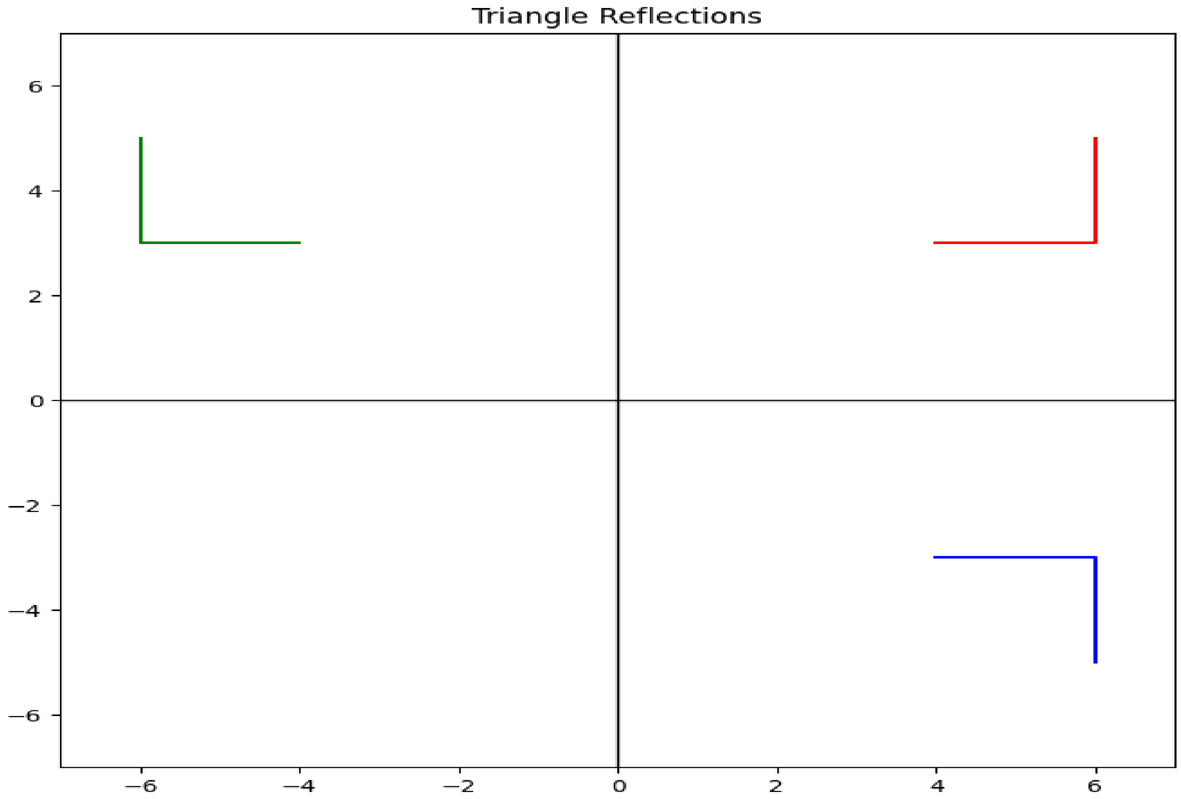
I) Write a python program to plot the tringle with vertices at [4,3],[6,3],[6,5] and its reflections through 1) X-axis 2) Y-axis . All the figures must be in different colors , also plot the two axes

-→

```
import matplotlib.pyplot as plt
import numpy as np
triangle = np.array([[4, 3], [6, 3], [6, 5]])
rx = np.array([[1, 0], [0, -1]])
ry = np.array([[-1, 0], [0, 1]])
tri_rx = np.dot(triangle, rx)
tri_ry = np.dot(triangle, ry)
```

```
fig, ax = plt.subplots(figsize=(8, 8))

ax.axhline(0, color='black', lw=1)
ax.axvline(0, color='black', lw=1)
ax.plot(triangle[:,0], triangle[:,1], color='red')
ax.plot(tri_rx[:,0], tri_rx[:,1], color='blue')
ax.plot(tri_ry[:,0], tri_ry[:,1], color='green')
ax.set_xlim(-7, 7)
ax.set_ylim(-7, 7)
ax.set_title('Triangle Reflections')
plt.show()
```



II) Write a python program to plot the triangle with vertices at [3,3],[3,6],[0,6] and its reflection through line y=x and y-axis. Also plot the mirror lines

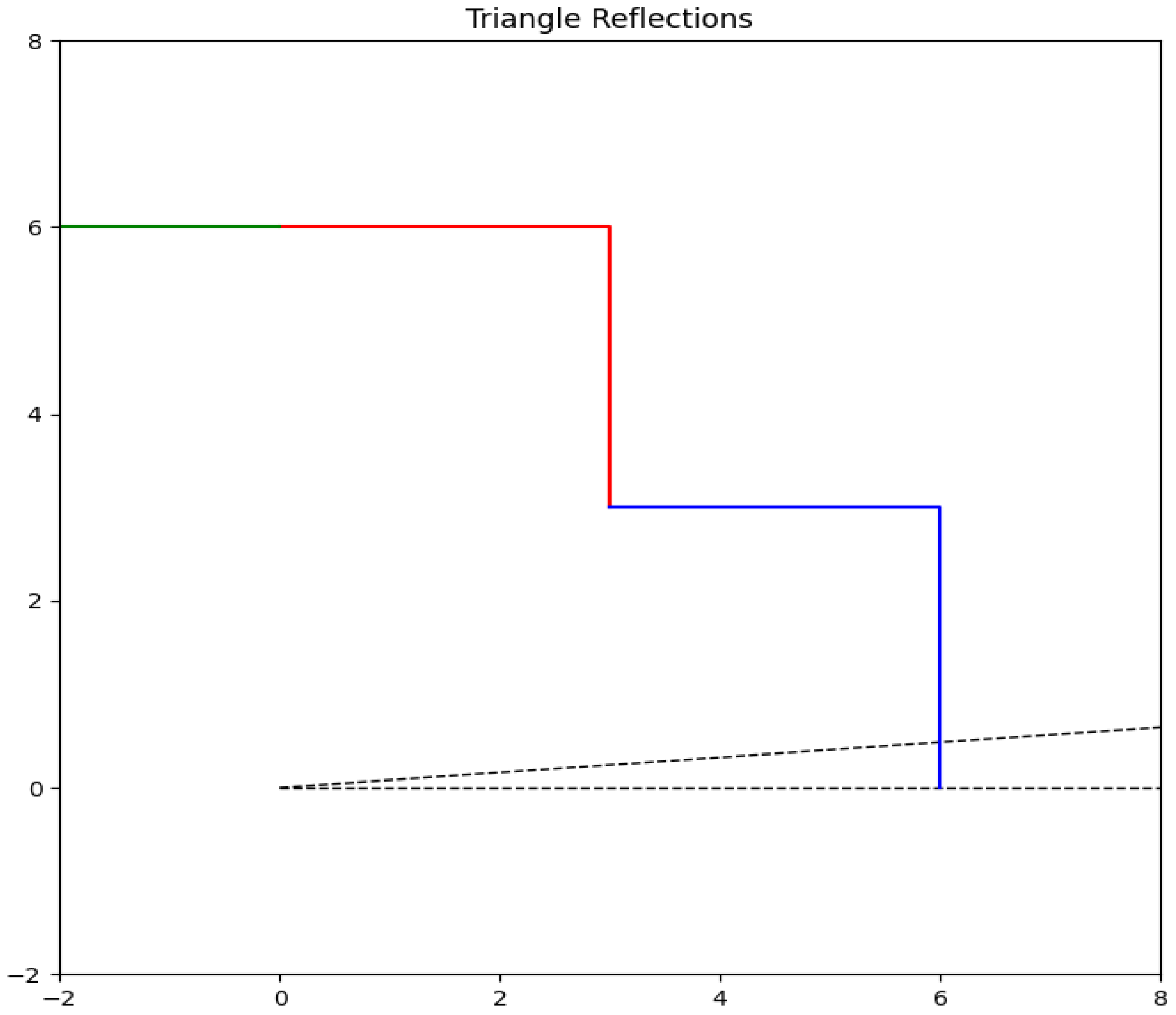
-→

```
import matplotlib.pyplot as plt
import numpy as np
triangle = np.array([[3, 3], [3, 6], [0, 6]])
y_x = np.array([[0, 1], [1, 0]])
y_axis = np.array([[-1, 0], [0, 1]])
tri_y_x = np.dot(triangle, y_x)
```

```
tri_y_axis = np.dot(triangle, y_axis)

x_eq_y = np.linspace(0, 8, 100)
y_eq_0 = np.zeros_like(x_eq_y)
y_eq_x = x_eq_y
fig, ax = plt.subplots(figsize=(8, 8))

ax.plot(x_eq_y, y_eq_0, color='black', linestyle='--', linewidth=1)
ax.plot(y_eq_x, color='black', linestyle='--', linewidth=1)
ax.plot(triangle[:,0], triangle[:,1], color='red')
ax.plot(tri_y_x[:,0], tri_y_x[:,1], color='blue')
ax.plot(tri_y_axis[:,0], tri_y_axis[:,1], color='green')
ax.set_xlim(-2, 8)
ax.set_ylim(-2, 8)
ax.set_title('Triangle Reflections')
plt.show()
```


Triangle Reflections