

Amit Divekar | Practical 2

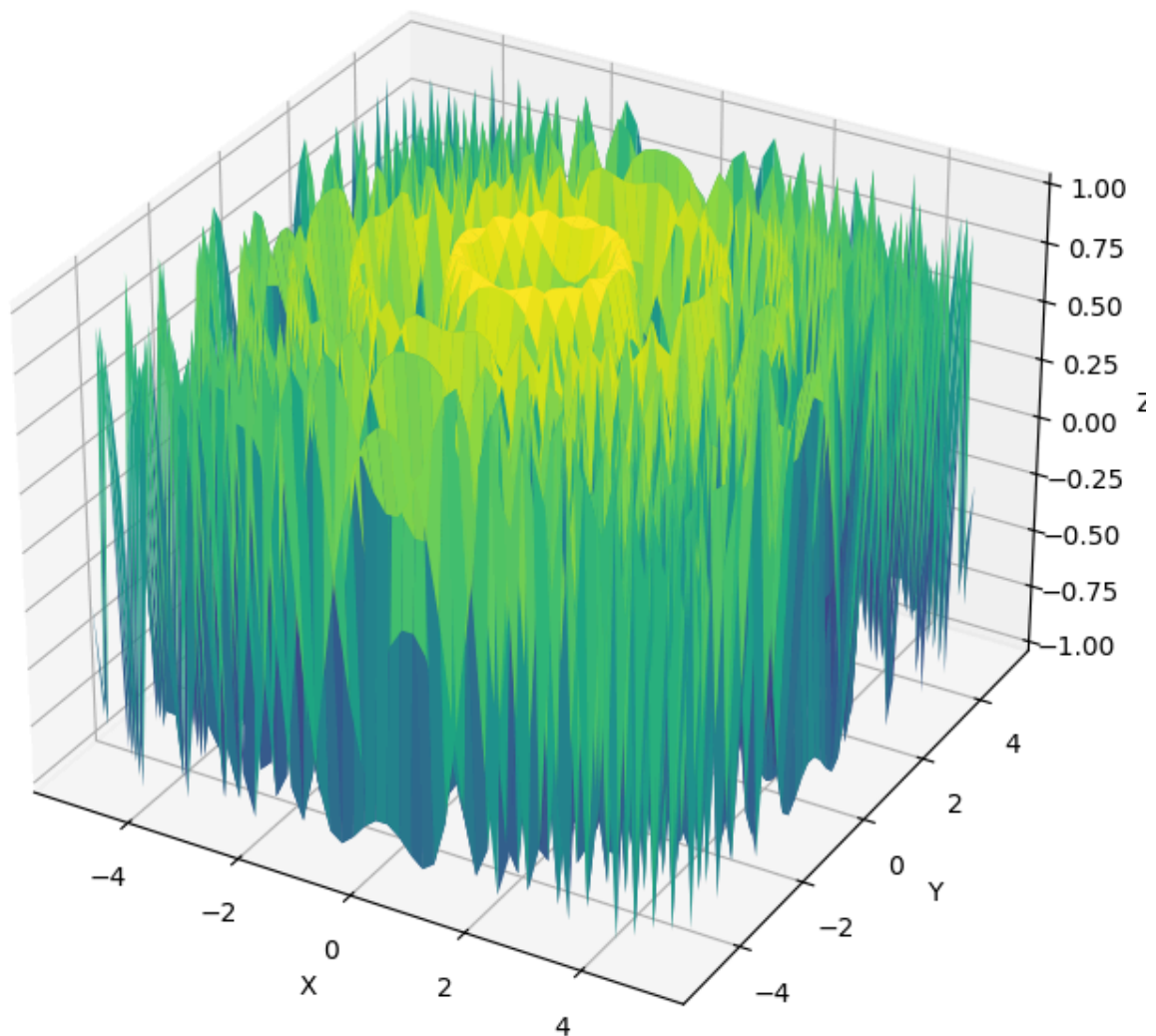
3D Plotting with NumPy and Matplotlib

```
In [1]: import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
```

Q1. Write a Python program using NumPy and Matplotlib to plot a 3-D wireframe graph of a mathematical function. $z = \sin(x^2 + y^2)$

```
In [2]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-5, 5, 50)
y = np.linspace(-5, 5, 50)
x, y = np.meshgrid(x, y)
z = np.sin(x**2 + y**2)
fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(x, y, z, cmap='viridis')
ax.set_title("3D Surface Plot")
ax.set_xlabel("X")
ax.set_ylabel("Y")
ax.set_zlabel("Z")
plt.show()
```

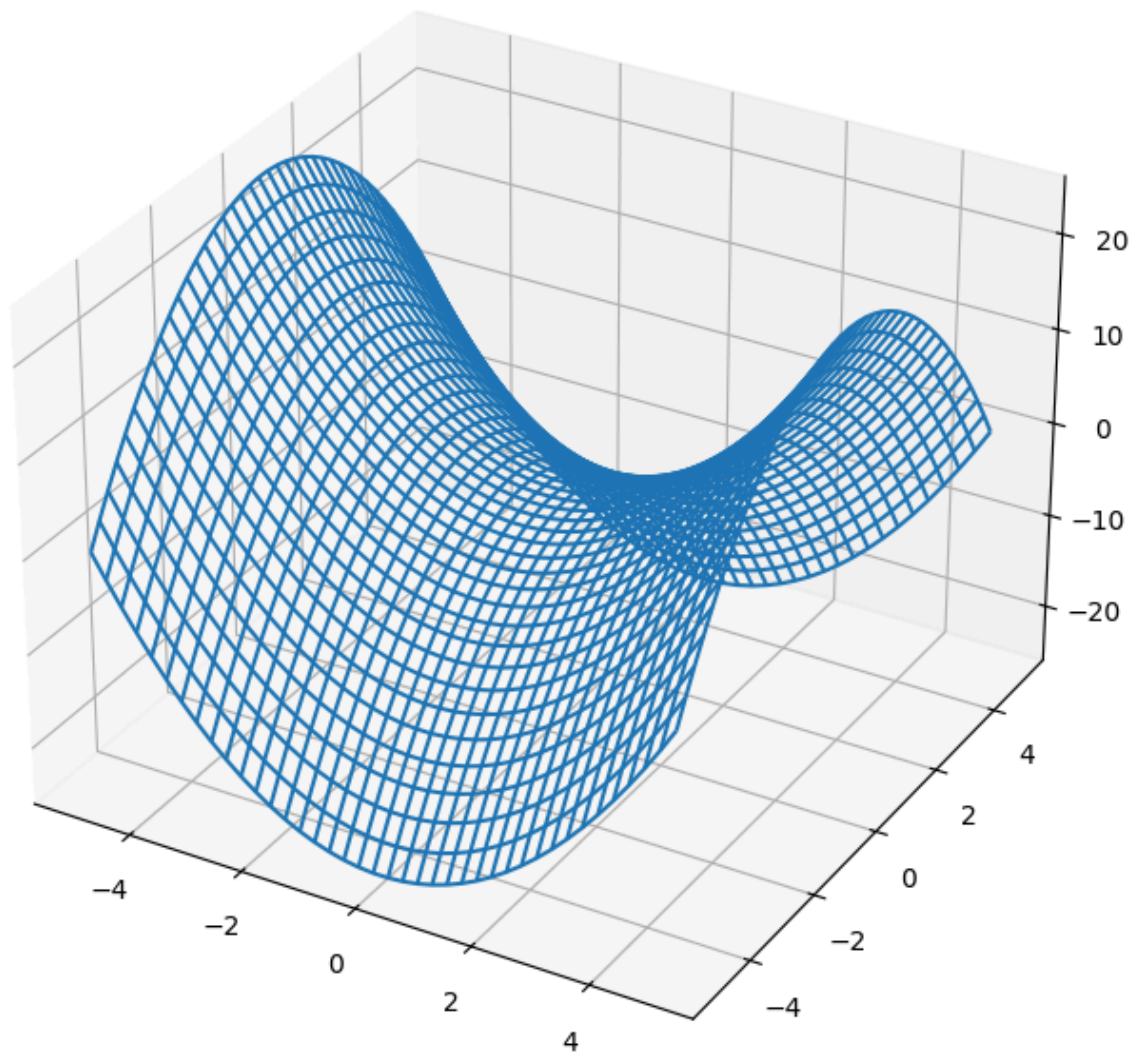
3D Surface Plot



Q2. Write a Python program using NumPy and Matplotlib to plot a 3-D wireframe graph of a mathematical function. $z = x^2 - y^2$

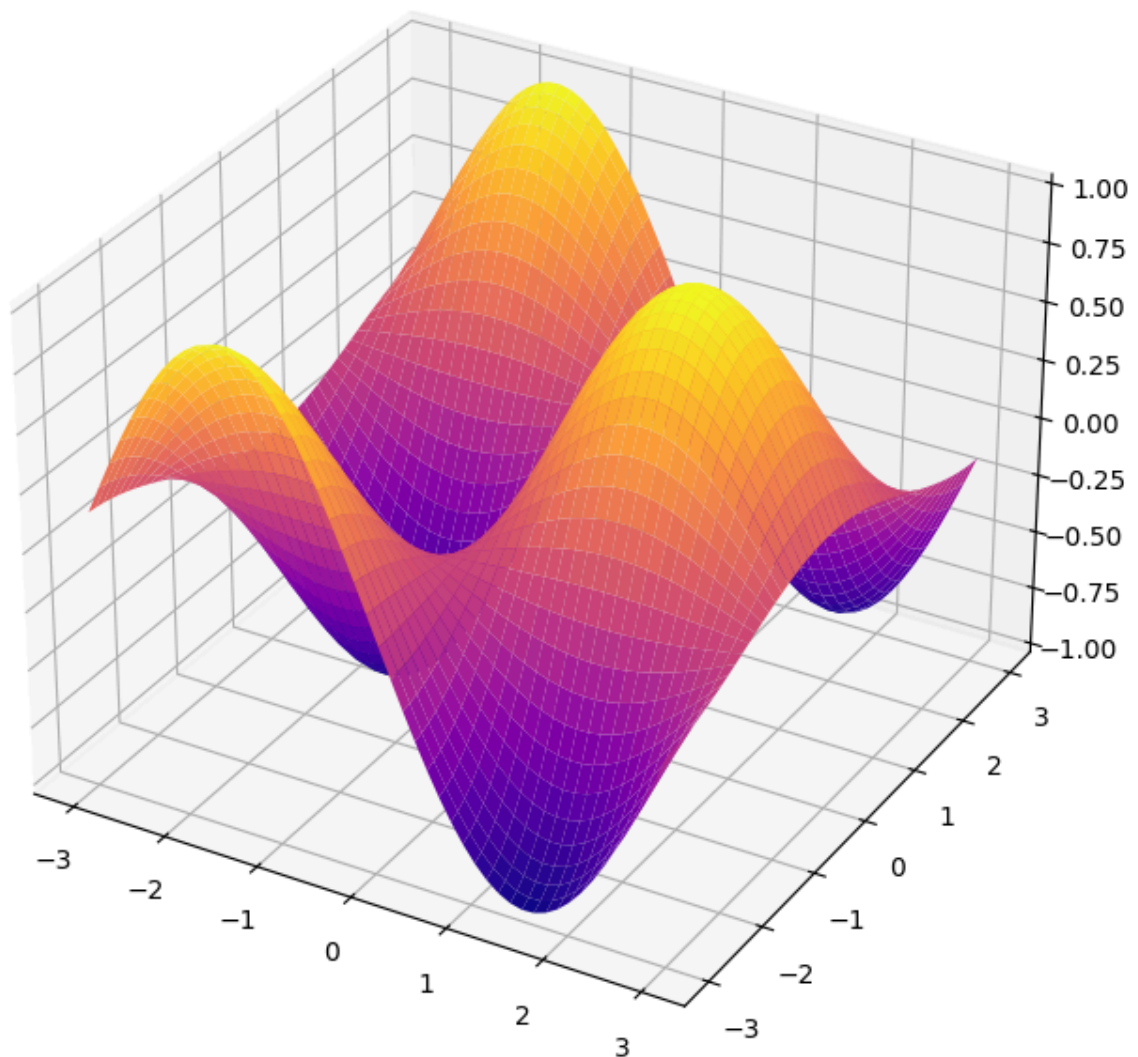
```
In [3]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-5, 5, 40)
y = np.linspace(-5, 5, 40)
x, y = np.meshgrid(x, y)
z = x**2 - y**2
fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')
ax.plot_wireframe(x, y, z)
ax.set_title("3D Wireframe Plot")
plt.show()
```

3D Wireframe Plot



Q3. Write a Python program using NumPy and Matplotlib to generate a 3-D surface plot for the function $z = \sin(x) \cdot \cos(y)$

```
In [4]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-3, 3, 50)
y = np.linspace(-3, 3, 50)
x, y = np.meshgrid(x, y)
z = np.sin(x) * np.cos(y)
fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(x, y, z, cmap='plasma')
ax.set_title("Surface Plot: sin(x)*cos(y)")
plt.show()
```

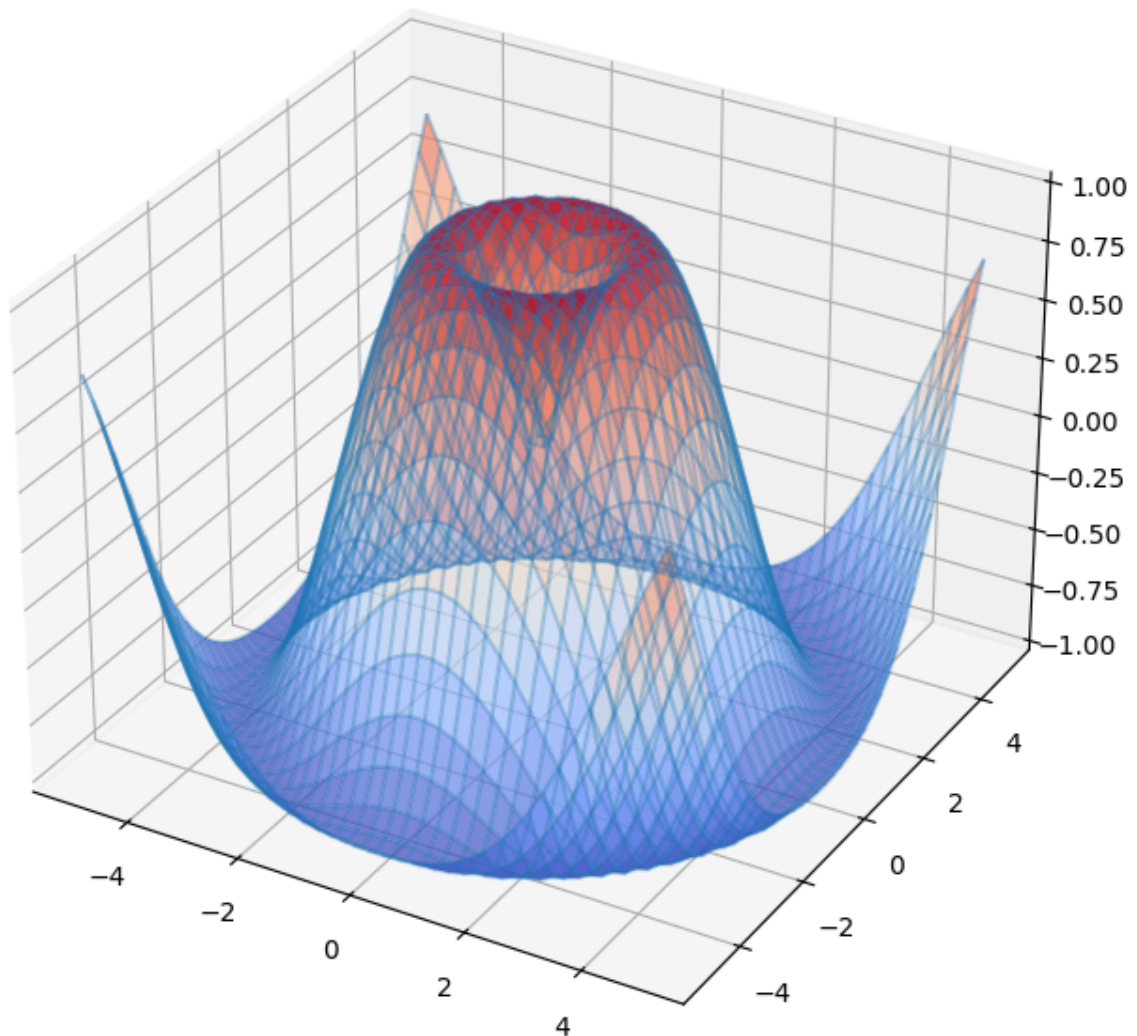
Surface Plot: $\sin(x)\cos(y)$ 

Q4. Write a Python program using NumPy and Matplotlib to draw a combined 3-D surface plot and wireframe plot for a mathematical function.
 $z = \sin\sqrt{x^2 + y^2}$

```
In [5]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-5, 5, 40)
y = np.linspace(-5, 5, 40)
x, y = np.meshgrid(x, y)
z = np.sin(np.sqrt(x**2 + y**2))
fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(x, y, z, cmap='coolwarm', alpha=0.7)
ax.plot_wireframe(x, y, z, alpha=0.3)
```

```
ax.set_title("Surface + Wireframe Plot")  
plt.show()
```

Surface + Wireframe Plot

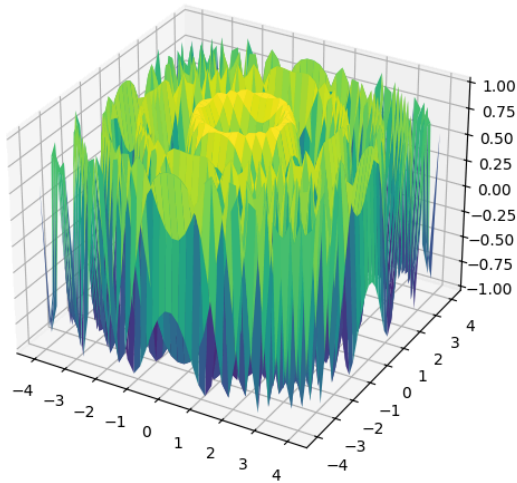


Q5. Write a Python program using NumPy and Matplotlib to generate two 3-D surface plots in a single figure using subplots $Z_1 = \sin(x^2 + y^2)$ $Z_2 = \cos(x^2 + y^2)$

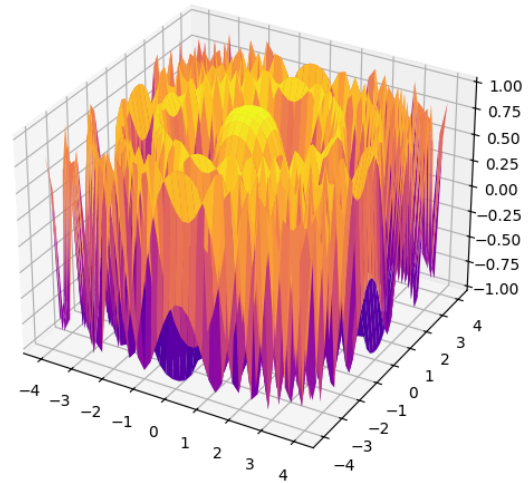
```
In [6]: import numpy as np  
import matplotlib.pyplot as plt  
x = np.linspace(-4, 4, 40)  
y = np.linspace(-4, 4, 40)  
x, y = np.meshgrid(x, y)  
z1 = np.sin(x**2 + y**2)  
z2 = np.cos(x**2 + y**2)  
fig = plt.figure(figsize=(14, 6))
```

```
ax1 = fig.add_subplot(121, projection='3d')
ax1.plot_surface(x, y, z1, cmap='viridis')
ax1.set_title("Surface Plot 1")
ax2 = fig.add_subplot(122, projection='3d')
ax2.plot_surface(x, y, z2, cmap='plasma')
ax2.set_title("Surface Plot 2")
plt.show()
```

Surface Plot 1



Surface Plot 2



Q6. Write a Python program using NumPy and Matplotlib to plot a 3D wireframe graph. $Z = x + y$

```
In [7]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-10, 10, 50)
y = np.linspace(-10, 10, 50)
x, y = np.meshgrid(x, y)
z = x + y
fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')
ax.plot_wireframe(x, y, z)
ax.set_title("3D Wireframe Plot Example")
plt.show()
```


3D Wireframe Plot Example

