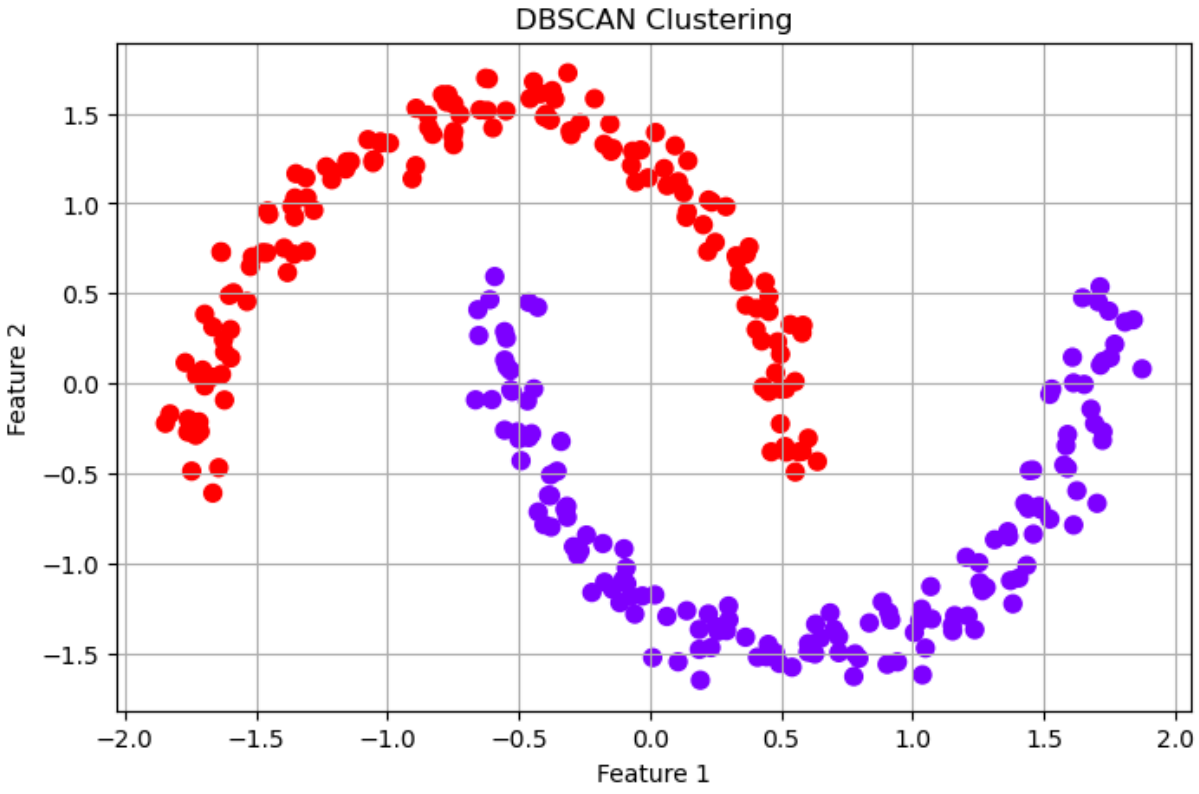
In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_moons
from sklearn.cluster import DBSCAN
from sklearn.preprocessing import StandardScaler
```

In [2]:
```
# Generate synthetic data
X, _ = make_moons(n_samples=300, noise=0.05, random_state=42)
```

In [3]:
```
# Standardize the data
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [4]:
```
# Apply DBSCAN
dbscan = DBSCAN(eps=0.3, min_samples=5)
clusters = dbscan.fit_predict(X_scaled)
```

In [5]:
```
# Plotting the results
plt.figure(figsize=(8, 5))
plt.scatter(X_scaled[:, 0], X_scaled[:, 1], c=clusters, cmap='rainbow', s=50)
plt.title('DBSCAN Clustering')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.grid(True)
plt.show()
```




In [ ]:

In [ ]:

In [6]:
```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.patches import Circle
```

In [7]:
```
# Sample points representing core, border, and noise
core_points = np.array([[2, 2], [3, 2], [2.5, 2.8]])
border_points = np.array([[3.5, 2.2]])
noise_points = np.array([[5, 5]])
```

In [8]:
```
# Epsilon neighborhood radius
epsilon = 1.0
```

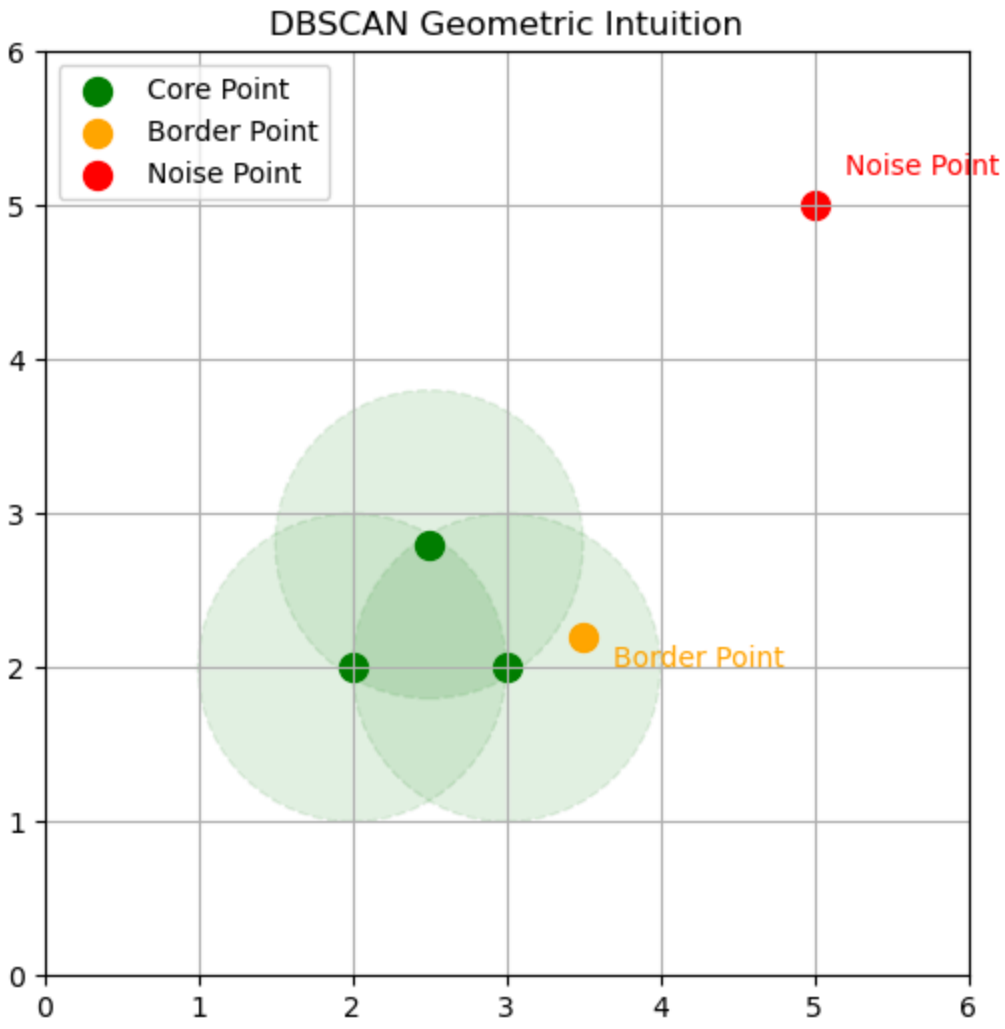
In [15]:
```
# Plotting
fig, ax = plt.subplots(figsize=(8, 6))
# Plot core points with circles for point in core_points:
ax.scatter(core_points[:, 0], core_points[:, 1], c='green', s=100, label='Core Poin

for point in core_points:
    circle = Circle(point, epsilon, color='green', alpha=0.1, linestyle='--')
    ax.add_patch(circle)

# Plot border points
ax.scatter(border_points[:, 0], border_points[:, 1], c='orange', s=100, label='Bord

# Plot noise points
ax.scatter(noise_points[:, 0], noise_points[:, 1], c='red', s=100, label='Noise Poi

# Annotations
ax.annotate("Noise Point", noise_points[0] + np.array([0.2, 0.2]), color='red')
ax.annotate("Border Point", border_points[0] + np.array([0.2, -0.2]), color='orange
# Plot settings
ax.set_xlim(0, 6)
ax.set_ylim(0, 6)
ax.set_aspect('equal')
ax.set_title('DBSCAN Geometric Intuition')
ax.legend()
ax.grid(True)
plt.show()
```


DBSCAN Geometric Intuition
Core Point
Border Point
Noise Point
Noise Point
Border Point
0
1
2
3
4
5
6