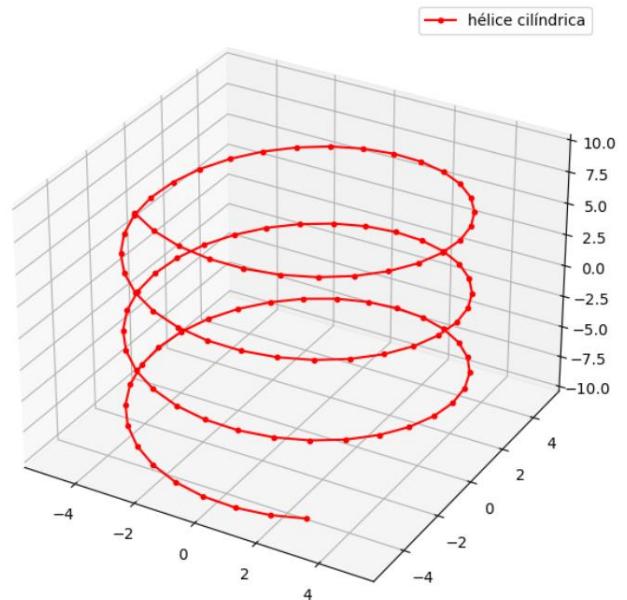
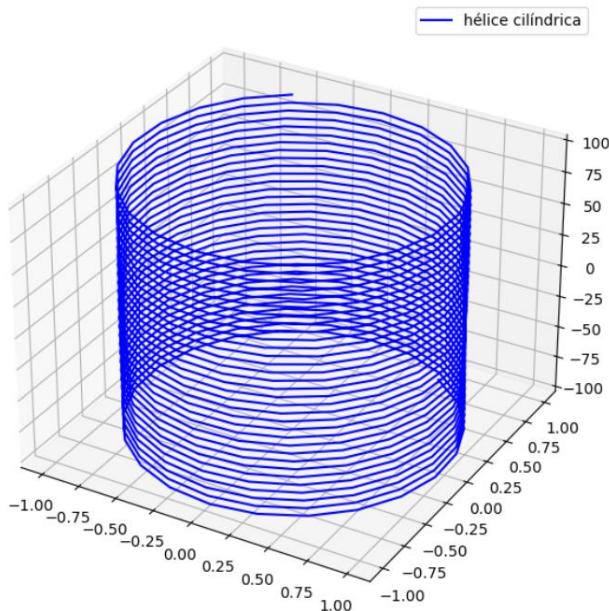


Exercício 2.1

```
import matplotlib.pyplot as plt
import numpy as np

plt.figure(figsize=(12, 6))
plt.subplot(1, 2, 1, projection='3d')
d1 = 1
z1 = np.linspace(-100, 100, 700)
x1 = d1 * np.sin(z1)
y1 = d1 * np.cos(z1)
plt.plot(x1, y1, z1, 'b-', label='hélice cilíndrica')
plt.legend()

plt.subplot(1, 2, 2, projection='3d')
d2 = 5
z2 = np.linspace(10, -10, 100)
x2 = d2 * np.sin(z2)
y2 = d2 * np.cos(z2)
plt.plot(x2, y2, z2, 'r.-', label='hélice cilíndrica')
plt.legend()
plt.tight_layout()
plt.show()
```



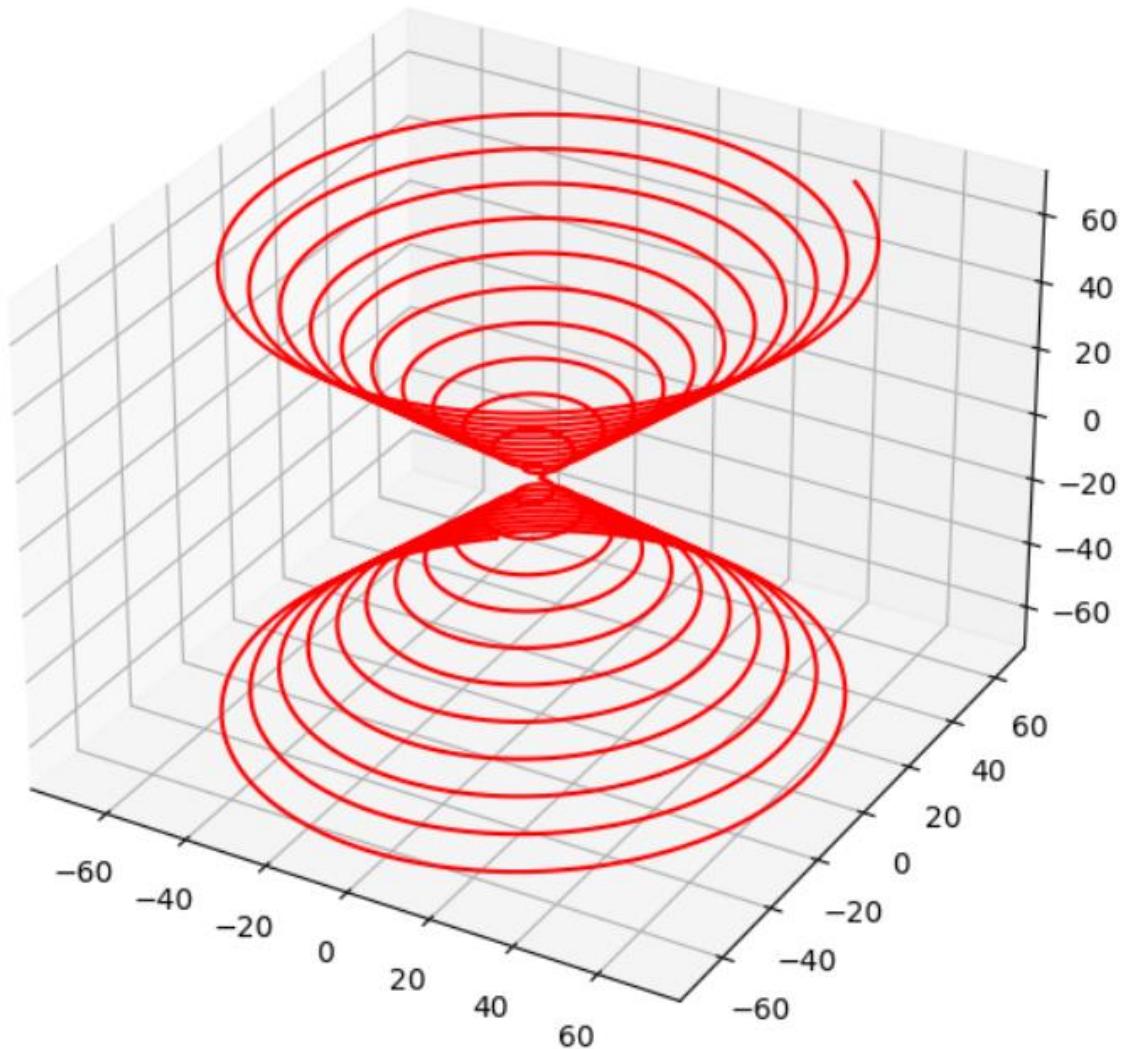
Exercício 2.2

```
import matplotlib.pyplot as plt
import numpy as np

plt.figure(figsize=(6, 6))
plt.subplot(1, 1, 1, projection='3d')
a = 1
z2 = np.linspace(-70, 70, 10000)
x2 = a * z2 * np.cos(z2)
y2 = a * z2 * np.sin(z2)
plt.plot(x2, y2, z2, 'r-', label='Hélice cônica')
plt.legend()
plt.title('Hélice Cônica')
plt.tight_layout()
plt.show()
```

Hélice Cônica

— Hélice cônica



Exercício 2.3

```
import matplotlib.pyplot as plt
import numpy as np

fig = plt.figure(figsize=(12, 4))

ax1 = fig.add_subplot(131, projection='3d')
d1 = 5
z1 = np.linspace(2*np.pi, 0, 50)
x1 = d1 * np.sin(z1)
y1 = d1 * np.cos(z1)
ax1.plot(x1, y1, z1, 'g-', label='Hélice cilíndrica')
ax1.legend()
ax1.stem(x1, y1, z1, bottom=-8, orientation='x')
ax1.set_title('Orientação X')

ax2 = fig.add_subplot(132, projection='3d')
d2 = 5
z2 = np.linspace(2*np.pi, 0, 50)
x2 = d2 * np.sin(z2)
y2 = d2 * np.cos(z2)
ax2.plot(x2, y2, z2, 'r-', label='Hélice cilíndrica')
ax2.legend()
ax2.stem(x2, y2, z2, bottom=8, orientation='y')
ax2.set_title('Orientação Y')

ax3 = fig.add_subplot(133, projection='3d')
d3 = 5
z3 = np.linspace(2*np.pi, 0, 50)
x3 = d3 * np.sin(z3)
y3 = d3 * np.cos(z3)
ax3.plot(x3, y3, z3, 'm-', label='Hélice cilíndrica')
ax3.legend()
ax3.stem(x3, y3, z3, bottom=-10, orientation='z')
ax3.set_title('Orientação Z')

plt.tight_layout()
plt.show()
```

