Solving Differential Equations Using Euler's Method

1 Python Script

```python
import matplotlib.pyplot as plt

# Defining the Euler method function
def euler_method(f, x0, v0, t0, tf, N):
    # Step size
    h = (tf - t0) / N

    # Initializing the arrays for t, x, and v
    t = [t0]
    x = [x0]
    v = [v0]

    for i in range(N):
        x_new = x[i] + h * v[i]
        v_new = v[i] - h * x[i]
        t_new = t[i] + h

        x.append(x_new)
        v.append(v_new)
        t.append(t_new)

    return t, x, v

# Defining the function f for the coupled first-order DEs
def f(t, x, v):
    return [v, -x]

# Initial conditions
x0 = 1
v0 = 0
t0 = 0
tf = 10
N = 1000
```

```python
# Solving the DEs using the Euler method
t, x, v = euler_method(f, x0, v0, t0, tf, N)

# Plotting the results
plt.figure(figsize=(15, 5))

plt.subplot(1, 3, 1)
plt.plot(t, x)
plt.xlabel('t')
plt.ylabel('x')
plt.title('x vs t')

plt.subplot(1, 3, 2)
plt.plot(x, v)
plt.xlabel('x')
plt.ylabel('v')
plt.title('x vs v')

plt.subplot(1, 3, 3)
plt.plot(t, v)
plt.xlabel('t')
plt.ylabel('v')
plt.title('v vs t')

plt.show()
```