```python
#!/usr/bin/env python3
# -*- coding: utf-8 -*-

## Solving x^2 = 4 by Newton's Method

import numpy as np
import matplotlib.pyplot as plt

# A quadratic polynomial
def f(x):
    return x**2 - 4

# Derivative of f
def df(x):
    return 2*x

i_max = 20 # maximum number of iterations (no infinite loops)
x = -1 # initial guess
res = abs(f(x)) # residual

i = 0
while (res > 1e-8):

    print( i, x, f(x) )
    x = x - f(x)/df(x)
    res = abs(f(x))
    i += 1

    if (i > i_max):
        print('Iteration did not converge.')
        break

#%%
x_plt = np.linspace(-4, 4, 201)

plt.figure()
plt.plot([-4, 4], [0,0], 'k--')
plt.plot(x_plt, f(x_plt), 'b-')
plt.plot(x, f(x), 'go', markersize=8)
plt.plot(2, 0, 'ro', markerfacecolor='none', markersize=8)
plt.plot(-2, 0, 'ro', markerfacecolor='none', markersize=8)
plt.xlabel('x')
plt.ylabel('$f(x)$')
plt.title('A Polynomial Equation')
plt.show()
```