PHYS 410 - Homework 1

Question 1: Hybrid method for roots in one variable

Write a code that combines bi-section for the first few steps, with a Newton method once we get close enough to the root. Demonstrate the method with finding all the roots of the polynomial

$$P_8(x) = \frac{6425x^8 - 12012x^6 + 6930x^4 - 1260x^2 + 35}{128}$$

in the interval $-1 < x < 1$.

Question 2: Newton method for two variables

Solve the simultaneous equations discussed in class

$$
\begin{aligned}
f_1(x,y) &= x^2 - 2x - y + 0.5 = 0 \\
f_2(x,y) &= x^2 + 4y^2 - 4 = 0
\end{aligned}
$$

Write code for the Newton method for any number of variables, assuming as input functions that evaluate the functions f_1, f_2 and their derivatives. Find all roots by plotting the functions, observing an approximate location for any root, and improving that initial estimate using the Newton method.