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# Matthew Pahayo
# 2/11/2021
# computational methods
# hw 1
# question 2
# secant method
# q2.py

import numpy as np

def f(x):
    return np.cosh(x)*np.cos(x)+1

# define tol, guess a_0 and a_1
# a_0 != 0, because of stopping criteria
tol = 10**-6
a_0 = 7
a_1 = 8

# declare lists
a1 = [a_0, a_1]
f1 = [f(a_0), f(a_1)]
dal = []

# secant method
# evaluates function at a_n
n = 0
while (abs(a1[n+1]-a1[n])/abs(a1[n])) > tol:
    a_np1 = a1[n+1] - f(a1[n+1])/(f(a1[n+1])-f(a1[n]))*(a1[n+1]-a1[n])
    a1.append(a_np1)
    f1.append(f(a1[n]))
    n += 1

# defines dal list
for k in range(len(a1)-1):
    dal.append(a1[k+1]-a1[k])

i=0
data_f1 = open("f1.txt", "a")
data_a1 = open("a1.txt", "a")
for i in range(len(a1)):
    data_a1.write(str(a1[i]) + "\n")
    data_f1.write(str(f1[i]) + "\n")
data_a1.close()
data_f1.close()

i = 0
data_dal = open("dal.txt", "a")
for i in range(len(dal)):
    data_dal.write(str(dal[i]) + "\n")

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data_dal.close()
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print("a = " + str(a_np1))  
print("total iterations = " + str(n))  
print("final delta a = " + str(dal[n-1]))
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