

AOSC 652: Analysis Methods in AOSC

Assignment #7: Root Finding

Due: Monday, 17 October 2016 (at the start of class)

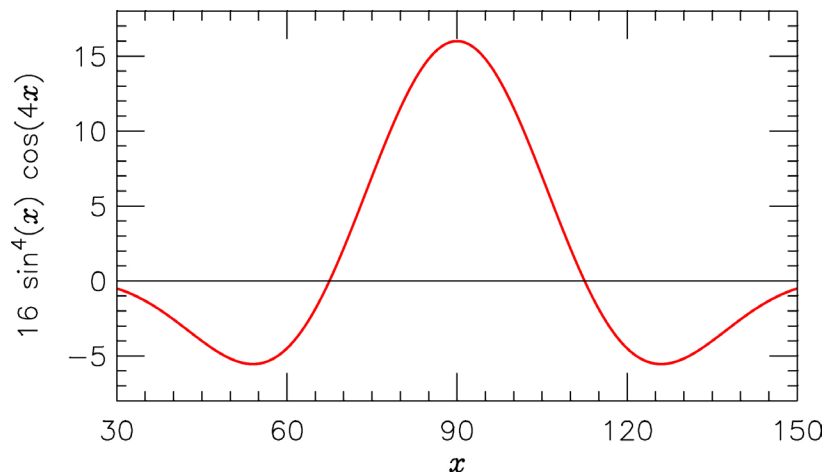
Name: _____

40 points total

Late penalty: 8 pts per day

1. This assignment provides practice in using a FORTRAN code that uses the Secant Method to find the roots of a function. No program development is required to complete this exercise, although perhaps some well placed “write statements” will help you understand the behavior of the code ☺. Please note that the **Secant Method** is a version of the **Newton Raphson** method, for which the derivative of the function can be evaluated *numerically* rather than *analytically*.

File `~rjs/aosc652/week_07/secant.f` contains a FORTRAN code that uses the Secant Method to find the roots of the function $16 \sin^4(x) \cos(4x)$, where x is in degrees. A plot of this function is given below:



Use program `secant.e` to find the two roots of this equation to a tolerance of 1×10^{-4} :

a) Root #1 is _____

b) Root #2 is _____

c) Run the program multiple times to explore the relationship between the values of the start and end points of the search interval and the convergence, or lack thereof, of the algorithm.

What are the **three** conditions that can cause the code to fail to find a root (i.e., what are the three reasons for non-convergence)?

For the conditions noted above that results in FORTRAN variable nconv being assigned a value of 1, explain in a moderate amount of detail specifically what is happening that causes the code to not be able to find a root. For this example, please state specific numerical values of the starting and end points of the search, and please add write statements to the code to trace the behavior. Please also use an example for which:

Start Point lies between 30 and 150

End Point lies between 30 and 150 and is larger than the Start Point

Start Point does not equal End Point