**Class 11** – **Root Finding – Open Methods (Chp. 6)**

ChE310\_Sec1\_F2019 / 10.1.2019

<http://www.reuelgroup.org/numerical-methods-che-310.html>

Announcements:

* Midterm 1 – Oct 3, 2019 in class
* Phase 1 of project (Memo to Reuel TODAY)

**Warm Up Group Activity:** submit to SLACK by 2:25pm.

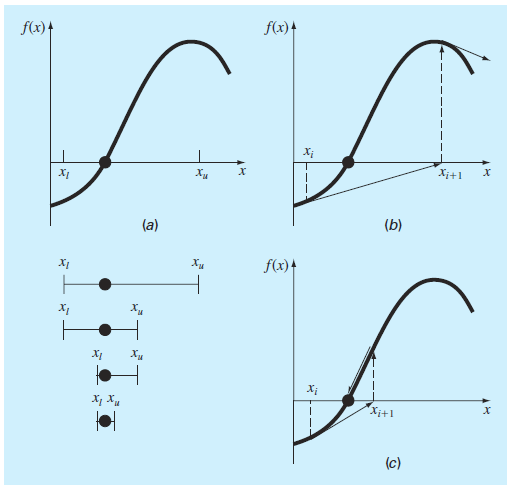
For the function f(x) = sin(x)\*cos(x)/(x2), find the first root > 0 using the following methods:

* Graphical
* Incremental search
* Bisection

Comment on which method is most efficient.

**Outline for Class 11 Lecture**

1. Bracket vs. Open [analogy: robots]

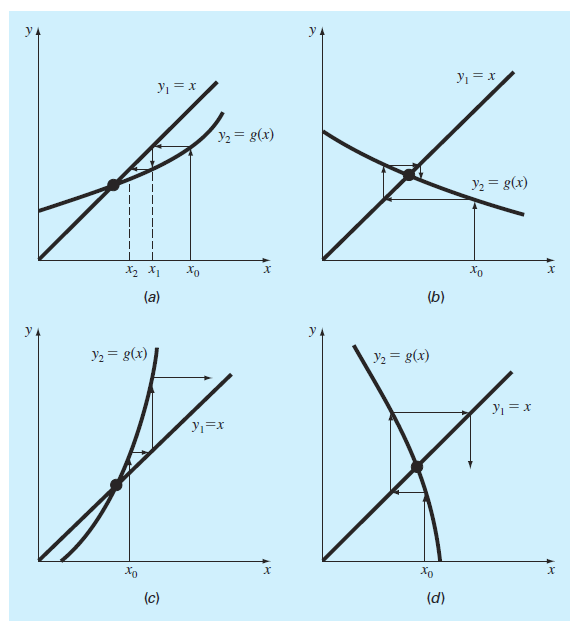


Bracket: Two points, converges, not efficient

Open: One point, Potential to diverge (fig b), much more efficient

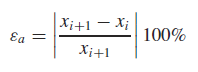
1. Fixed Point Iteration (successive subst.)

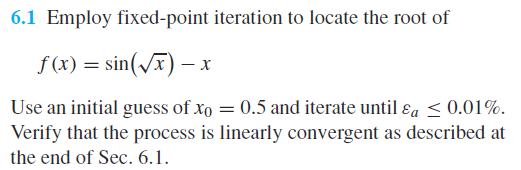
Rearrange *f(x) = 0* to a form of *x = g(x)* (see picture)



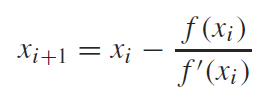
a, c = monotone / b,d = spiral/oscillating

|g’| > 1 it will diverge

End criteria needed: 



1. Newton Raphson Method (use analytical slope)

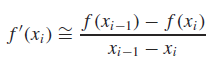


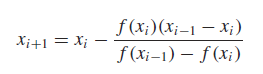
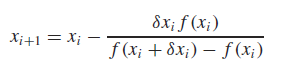
* Accuracy doubles with every iteration
* Can diverge (see picture)
* Pick good initial point, close to root



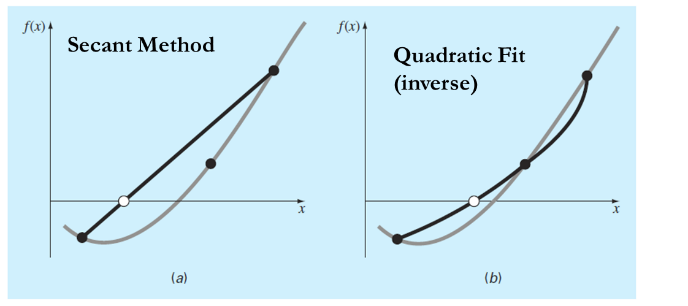
1. Secant Methods

* Approximate first derivative with BackFinDif

 and sub in NRM

* [two guesses]
* [one guess]
* Useful for code based functions

1. Brent’s method (hybrid bracket and open)



* Inverse quadratic interpolation

Bracket🡪Open, if diverge🡪Bisect, then go to open

Written by Cleve Moler [2004]

1. Matlab built in functions [show with 6.9]
   1. **fzero**
   2. **roots** (coeff🡪roots)
   3. **poly** (roots🡪coeff)
2. Example of Excel Solver for root finding