Tutorial Root Finding

A. Bisection method

1. Consider finding the root of $f(x) = x^2 - 3$. Let $\varepsilon_{step} = 0.01$, $\varepsilon_{abs} = 0.01$ and start with the interval [1, 2].

2. Consider finding the root of $f(x) = e^{-x}(3.2 \sin(x) - 0.5 \cos(x))$ on the interval [3, 4], this time with $\varepsilon_{step} = 0.001$, $\varepsilon_{abs} = 0.001$.

3. Find the root of $f(x)=x^6-x-1=0$ accurate to within $\varepsilon=0.001$. Given that $x_a=1$ and $x_b=2$.

4. Use 3 iterations of the bisection method to determine the root of $f(x)=x^3-7.5x^2+17.75x-13.125$. Employ initial guesses of $x_a=1.2$ and $x_b=2$.

5. Find the root of $f(x)=x^2-x-2=0$ accurate to within $\varepsilon=0.002$. Given $x_a=1$, $x_b=4$.

B. Newton's method

6. Find the value of x if $x^3=20$ using Newton-Rhapson method for three iterations.

7. $f(x) = x - 2 + \ln x$ has a root near $x = 1.5$. Use the Newton-Raphson method to obtain a better estimate.

8. The function $f(x) = x - \tan x$ has a simple root near $x = 4.5$. Use one iteration of the Newton-Raphson method to find a more accurate value for the root.

9. Estimate the root of $f(x)= 0.9x^2+1.7x-5$ employing an initial guess of $x_0=1$ accurate to within $\varepsilon=0.001$.

10. Estimate the root of $f(x)=e^{-x}-x$ employing an initial guess of $x_0=0$ accurate to within $\varepsilon=0.001$.

C. Secant method

11. Find the value of x if $x^3=20$ using Secant method for three iteration, where $x_0=4$ and $x_1=5.5$.

12. Use the secant method to estimate the root of $f(x) = e{-}x - x$. Start with initial estimates of $x{-}1 = 0$ and $x0 = 1.0$.