Assignment 15

Q1. Brute-force 'auto-detection' of roots via Newton-Ralpson Module

Develop a 'brute-force' auto detection code that can automatically obtain all roots of a continuous function $f(x)$ in any given interval $[a, b]$ that uses a DIY Newton-Ralpson Module for root-finding. Test it out for the following cases:

i. $f(x) = 10 + x^3 - \sin x \sinh x$, $[a, b] = [2,10]$.

ii. $f(x) = x - \text{Tanh } x$, for all x.

iii. $f(x) = x^3 + 2x^2 - 3x - 1$, for all x

iv. $f(x) = (1/x) \sin x$, for $-3\pi \leq x \leq 3\pi$.

v. $f(x) = \tan(\pi x) - x - 6$, for $-3\pi \leq x \leq 3\pi$.

Q2: Stochastic integration

- Write a code to evaluate the following integral using stochastic method. z is a constant set to 1.
- Let the integration limits be from x_0=-2.5 to x_1=+5.0. You should verify you answer by comparing it to the standard one obtained using the command **NIntegrate**[ ]. Note that $f(x)$ is not entirely positive in $[x_0, x_1]$.

$$f(x) = \frac{x}{(z^2 + x^2)^{3/2}}$$

$$\int_{x_0}^{x_1} f(x)dx = ?$$

Q3: Stochastic integration

- Given two functions,
- $y_1(x) = -(x-4)^2 + 10$,
- $y_2(x) = (x-1)^2 - 2$, defined in $[x_0, x_1] = [-5,10]$.
- Write a code using stochastic integration approach to obtain the shaded area between the two curves as shown. You should verify you answer by comparing it to the standard one obtained using the command **NIntegrate**[ ]. The correct value is 469.365.