LAB-3

Q1) • To obtain an accuracy upto 4 digits, 3 iterations are needed which finally gives us the answer 0.5191.

• The iteration scheme is : $x_{n+1} = x_n - \frac{f(x_n)}{fd(x_n)}$

, where $fd(x_n) = \frac{f(x_n + f(x_n)) - f(x_n)}{f(x_n)}$

Q2) • To obtain root close to 4.4 we set initial point as 4.4. After 50 iterations we obtain result 4.4934

• Similarly for root close to 7.7, $x_0 = 7.7$. After 50 iterations we obtain the result 7.7253.

Q3) • On following the iteration scheme, uptill 7 iterations the answer converges with $x = 7.7253$ and $x_0 = 7.7$ and $x_1 = 7.71$.

- After 7 iterations, the answer diverges. This is because the ~~[illegible] term~~ denominator term : $\frac{f(x + f(x)) - f(x)}{f(x)}$ tends to 0, hence the overall term tends to infinity. Hence we can perform only 7 iterations.

Q4) The 2 functions that are considered are :

i) $f_1(x) = \sqrt{\frac{4 - 6e^{-x}}{2}}$ ii) $f_2(x) = -1 \times \ln\left(\frac{4 - 2x^2}{6}\right)$

- On taking 50 iterations and $x_0 = 1$, we obtain a converging root by $f^n 1 \rightarrow 0.8381$, but a diverging root $\rightarrow 0.6154 - 0.0001i$

- On taking 10 iterations and $x_0 = 1$, fn ① converges to the right answer but function 2 again gives us a complex root

- On taking 50 iterations and $x_0 = 0.5$, f^n 1 gives us a complex root (i.e. complex root), whereas fn 2 converges to the correct answer.

- In general for convergence both $f_1(x)$ & $f_2'(x)$, let them be named as $g(x)$. If $g(x)$ & $g'(x)$ are continuous throughout the interval and if $|g'(x)| < 1$ for all x in the interval, then the answer will converge.