FRA640 Homework #9

1. A uniform beam is subjected to linearly increasing distributed load. The equation for the resulting elastic curve is

$$y = \frac{w_0}{120EIL}(-x^5 + 2L^2x^3 - L^4x)$$

We are interested in determining the location of maximum deflection and the value of the maximum deflection. Use the following parameter values in your computation:

$$L = 450\ cm, E = 50{,}000\ \ kN/cm^2\ , I = 30{,}000\ cm^4, w_0 = 1.75\ \ kN/cm$$

Write a computer program that finds the maximum deflection point using the Newton-Raphson method.

(1) Use an initial guess, $x_0 = 250$, and terminate the iteration when the absolute value of the approximate relative error $|\varepsilon_a|$ becomes smaller than 0.0001%.

To show that your program is properly implemented, the program has to generate a report file, report.txt, that shows in each line: (1) the number of iteration, (2) an estimated root in each iteration, (3) the approximate relative error in each iteration.

(2) Try different initial values in your Newton-Raphson code, and find an initial value that leads to no convergence or converges to a wrong root.

2. Write a computer program that find the root of $f(x) = -x^3 + 22x^2 - 2809x + 61798$ by using simple fixed-pointed method with $x_0 = 30$ and terminate the program when approximated relative error $\varepsilon_a \leq 0.1\%$. the program must generate a report file, report.txt, that shows in each line: (1) the number of iterations, (2) an estimated root in each iteration, (3) the approximate relative error in each iteration.