

University of Regina
Software Systems Engineering

Winter term, March 2019
Lab 3

ENSE-350

Problem 1, 40 Points

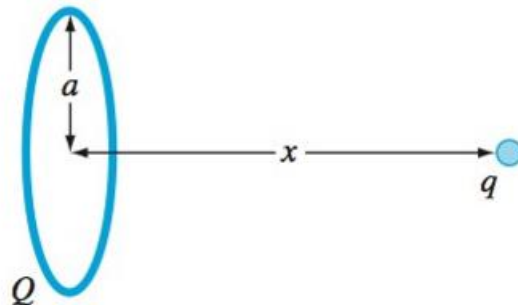
Write a computer program that will compute the distance x in the following question using Newton-Raphson method. You should print the value of x at each iteration. The absolute relative approximate error should be less than 0.01% when you stop.

8.32 A total charge Q is uniformly distributed around a ring-shaped conductor with radius a . A charge q is located at a distance x from the center of the ring (Fig. P8.32). The force exerted on the charge by the ring is given by

$$F = \frac{1}{4\pi\epsilon_0} \frac{qQx}{(x^2 + a^2)^{3/2}}$$

where $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/(\text{N m}^2)$. Find the distance x where the force is 1N if q and Q are $2 \times 10^{-5} \text{ C}$ for a ring with a radius of 0.9 m.

FIGURE P8.32



Acknowledgement: Problem 1 is taken from *Numerical Methods for Engineers, 7th Edition*. By Steven Chapra and Raymond Canale. McGraw-Hill Higher Education

Problem 2 [2 X 30 Points],

The fourth-degree polynomial:

$$f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

Has two real roots, one in $[-1,0]$ and the other in $[0,1]$. Write a computer program that will approximate (both) these roots using.

- (a) The Bisection method
- (b) The Secant method

The absolute relative approximate error of your solution should be less than 0.01%.