

chapter 2, rootfinding

1. Consider $f(x) = x^3 - 2$. Since $f(1) < 0$ and $f(2) > 0$, it follows that $f(x)$ has a root p in the interval $[1, 2]$.

- Compute an approximation to the root by taking 4 steps of the bisection method.
- Repeat using fixed-point iteration with $g_1(x) = 2/x^2$ and $g_2(x) = x - f(x)/3$.
- Repeat using Newton's method. Take $x_0 = 1.5$ for the starting value.

Take $x_0 = 1.5$ as the starting value for each method. Present the results in the form of a table with columns as below. Present at least 8 decimal digits in the results.

- column 1 : n (step)
- column 2 : x_n (approximation)
- column 3 : $f(x_n)$ (residual)
- column 4 : $|p - x_n|$ (error)

2. In class we discussed the example, "Volume of Chlorine Gas" on page 102. This example uses Newton's method to compute the volume of a gas given by van der Waal's equation of state, where the initial guess V_0 is given by the ideal gas law. By comparing V_1 and V_2 , we saw that V_1 has 5 correct digits. How many correct digits does V_2 have?

3. Consider the following system of nonlinear equations.

$$f(x, y) = 2x^2 - 2xy + 2y^2 - x - y = 0$$

$$g(x, y) = 4x - y + 2 = 0$$

Find an approximate solution by taking one step of Newton's method starting from $(x_0, y_0) = (2, 0)$. Present the iterates (x_i, y_i) and residual values $f(x_i, y_i), g(x_i, y_i)$ for $i = 0, 1$.

chapter 3, linear algebra

4. page 148, problem 4a,b , 7a (matrix operations)

5. page 149, problem 14b (hint: show that $AA^{-1} = I$)

6. Let A be a 3×3 matrix. Express the following operations in the form EA for a suitable matrix E .

- multiply row 2 by 5 and subtract the result from row 1
- interchange row 2 and row 3

7. page 157, problem 1 (Gaussian elimination)

8. page 159, problem 13 (electric circuit)

announcement

The 1st midterm exam will be on Thursday Oct 16 in class. A review sheet with sample problems will be distributed before the exam. Calculators are not allowed, but you may use one sheet of notes (i.e. one side of one page, 8.5 in \times 11 in). Exam booklets will be provided.