

Name : \_\_\_\_\_

**TO RECEIVE FULL CREDIT YOU MUST SHOW ALL YOUR WORK (Unless otherwise stated).**

1. State the advantages/disadvantages of the methods listed below when used to determine the zeros of a given nonlinear function  $f(x)$ .
  - the Bisection method
  
  
  
  
  
  
  
  
  
  
  - the Newton-Raphson method
  
  
  
  
  
  
  
  
  
  
  - the Secant method
  
2. How many steps of the bisection method are needed to determine the root with an error of at most  $\frac{1}{2} \times 10^{-8}$ , if the starting interval is  $[0.1, 1.0]$ ?
  
  
  
  
  
  
  
  
  
  
3. Every polynomial of degree  $n$  has  $n$  zeros (counting multiplicity) in the complex plane.
  - Does every real polynomial have  $n$  real zeros?
  
  
  
  
  
  
  
  
  
  
  - Does every *polynomial of infinite degree*  $f(x) = \sum_{n=0}^{\infty} a_n x^n$  have infinitely many zeros?

4. Compute the zero of  $f(x) = x^3 - 3x + 1$  on  $[0, 1]$  using the Bisection method. Carry out just three steps.

5. If Newton's method is used on  $f(x) = x^3 - x + 1$  starting with  $x_0 = -2$ , what will  $x_3$  be?

6. If we use the secant method on  $f(x) = x^3 - 2x + 2$  starting with  $x_0 = 0$  and  $x_1 = 1$ , what is  $x_3$ ?