REVIEW QUESTIONS
Module 5: Roots of Functions

1. What is meant by saying that x_0 is a root of a function $f(x)$?
   Verify that $x=-1$ is a root of the function $f(x)=3x^3-2x^2-7x-2$. Use this result to find all the roots of the function.

2. Describe any mathematical problem whose solution requires finding the roots of an associated function.

3. Explain, giving a typical mathematical problem, why numerical methods are needed in solving the root-finding problem.

4. List at least three numerical methods for approximating roots of functions. In each case, discuss briefly the essential assumptions on the function involved and on the choice of starting value(s) for the method to perform well.

5 Derive the bisection method for approximating an isolated root of a function and prove that convergence of the method is guaranteed.

6. Derive the secant method for approximating roots of functions and point out its similarities and difference with the Regula Falsi method.

7. What are the similarities between the bisection method and the Regula Falsi method? Why is the Regula Falsi thought of as a better method than the bisection method dispite their similarities?

8 .Derive geometrically the Newton Raphson method, and point out the necessary conditions for the method to perform well.

9. Given the function $f(x)=x^3+x^2-3$

   (a) Verify that $f(x)$ has a root inside the interval $1<x<2$.
   (b) Starting with the two values $x_0=1,\ x_1=2$, calculate three additional approximations of the root in three iterations using the

      (i) The bisection method
      (ii) The Regula Falsi, and
      (iii) The Secant method

   (c) Starting with $x_0=1$ perform three iterations with the Newton Raphson method to obtain better approximations of the root.