Instruction: Write your answers clearly and show all relevant work including details. You may use a calculator for the work.

Exercise Set for Section 1-3 (pp. 36 – 37):
1. (8 pts.) Find the rate of convergence for each of the following question:
   (a) \( \lim_{n \to \infty} n \ln(1 + \frac{1}{2n}) \), using the big-O notation in terms of the parameter \( n \).
   (b) \( \lim_{h \to 0} \frac{1 + \sin h - e^h}{2h} \), using the big-O notation in terms of the parameter \( h \).

Exercise Set for Section 2-1 (pp. 51 – 52):
2. (6 pts.) Apply the Bisection method to find a solution accurate to within \( 10^{-5} \) for the equation \( x^2 \cos x + x - 1 = 0, 1 \leq x \leq 3 \), by using the Java program of Algorithm 2.1 posted at the textbook’s website (http://www.as.ysu.edu/~faire/Numerical-Analysis/DiskMaterial/programs/Java/JavaPrograms.htm) for the calculations. In addition, use Theorem 2.1 of the textbook to estimate how many iterations are needed to achieve this level of accuracy.

Exercise Set for Section 2-2 (pp. 61 – 63):
3. (10 pts.) Define \( g(x) = 1.5 + \sin x - x \). Answer all parts given below:
   (a) Use Theorem 2.2 to show that \( g(x) = 1.5 + \sin x - x \) has a unique fixed point on [0.5, 1.5].
   (b) Sketch the graph for \( y = g(x) \) over the interval [0.5, 1.5].
   (c) Use fixed-point iteration and the initial approximation \( p_0 = 1.0 \) to find an approximation to the fixed point that is accurate to within \( 10^{-7} \) by using the Java program Algorithm 2.2 posted at the textbook’s website http://www.as.ysu.edu/~faire/Numerical-Analysis/DiskMaterial/programs/Java/JavaPrograms.htm.
   (d) Use Corollary 2.4 to estimate the number of iterations required to achieve the accuracy of \( 10^{-7} \), and compare this theoretical estimate to the number actually needed from Part (c).

4. (6 pts.) Define \( g(x) = \frac{x + 2}{x + 1} \). Answer all parts given below:
   (a) Use Theorem 2.3 to determine an interval \([a, b]\) so that \( g(x) \) has a fixed point and that the fixed-point iteration algorithm 2.2 converges. (Hint: Choose an interval around a fixed point found in Part (b)).
   (b) Determine the exact value of the fixed point (or points) by solving the equation \( g(x) = x \).