PH307: Introduction to Numerical Analysis
Tutorial Sheet 1

Note: Problem 5 below will have to done during the lab.

1. For large x or small ϵ what will be the problems with the evaluation of following functions? Rearrange the functions so that the problems go away:
(a) $\tan(x+\epsilon) - \tan(x)$ (b) $\frac{1}{x+1} - \frac{2}{x} + \frac{1}{x-1}$ (c) $e^{\epsilon} - 2 + e^{-\epsilon}$

2. Use a calculator to solve the following equations by the Newtons method. Starting guesses are indicated next to the equation concerned.

   (a) $\tan^{-1}(x) = 1$, with $x_1 = 1$

   (b) $x^3 + 2x^2 + 10x - 20 = 0$, with $x_1 = 1$

   (c) $\cos x = x$, with $x_1 = 0$

   (d) $\tan x = \frac{1}{1+x^2}$, with $x_1 = 0$

3. Use a calculator to solve the equations of exercise 2 by bisection method. The root lies between the following limits.

   (a) $x_L = 0,\ x_R = 4$

   (b) $x_L = 1,\ x_R = 1.5$

   (c) $x_L = 0,\ x_R = \pi/2$

   (d) $x_L = 0,\ x_R = 1.3$

4. Use a calculator to solve the equations of exercise 3 by the false position method.

5. Write a single computer program, which will solve all the four equations of exercise 2 using: (a) Newton's method, (b) Bisection method, or (c) Modified false position method. Thus your program should prompt the user for: (i) which method to use, and (ii) which equation to solve, besides things such as the starting guess, convergence threshold etc. Use structured programming techniques, i.e., use different subroutines/functions for different tasks.