MTH 351 – Lab 2

1. Consider the following two Taylor's series:

$$\log(1-x) = -\sum_{k=1}^{\infty} \frac{x^k}{k} \tag{1}$$

$$\log\left(\frac{1+x}{1-x}\right) = 2\sum_{k=1}^{\infty} \frac{x^{2k-1}}{2k-1} \tag{2}$$

   (Note: `log` in Matlab means the natural logarithm, base e, `log10` is the log base 10. The above are meant to be the natural logarithm.)

   (a) To get $\log(1.9)$, what value of x must be used in (1)?

   (b) Write a script in Matlab to demonstrate how many terms are necessary to achieve ten digits of accuracy.

   (c) Do the same as (a) for series (2).

   (d) Do the same as (b) for series (2).

   (e) Which of (1) or (2) is more "efficient" for computing $\log(1.9)$? Briefly explain your reasoning.

2. Write a script in Matlab to create a table of values (similar to Table 2.7) obtained by evaluating a given function as it is written, and also as a reformulation designed to eliminate *loss-of-significance* errors. Choose x from 10^{-1} to 10^{-20} decreasing by 0.1.

   (a) Apply your script to the function

$$f(x) = \frac{\sqrt{4+x}-2}{x}$$

   and an appropriate reformulation of f. Comment on what is happening and why.

   (b) Apply your script to the function

$$f(x) = \frac{1-e^{-x}}{x}$$

   and an appropriate reformulation of f. Comment on what is happening and why.