LE 230 Homework : Numerical Differentiation

Please show all details of your solutions.

5-1. Compute the first derivative of the following functions at least 3 points in the specified intervals:

(a) $f(x) = x^3 + 4x - 15; x = [-2,2]; h = \{0.5,0.25,0.125\}$

(b) $f(x) = x^2 \cos x; x = [0,4]; h = \{0.5,0.25,0.125\}$

(c) $f(x) = \tan(x/3); x = [0,4]; h = \{0.5,0.25,0.125\}$

(d) $f(x) = \sin(0.5\sqrt{x})/x; x = [0.5,2]; h = \{0.5,0.25,0.125\}$

(e) $f(x) = e^x + x; x = [-2,2]; h = \{0.5,0.25,0.125\}$

using

(i) Forward difference

(ii) Backward difference

(iii) Central difference

Then compare with the analytic results.

5-2. Repeat problem 5-1 using Richardson extrapolation.

5-3 Compute the second derivative of the functions in problem 5-1 at least 3 points in the specified intervals and compare with the analytic results.