# CLL:113-Tut-7(16.12.20)

Q1 A. Develop a user-friendly computer program for multiple segments (a) Trapezoidal and (b) Simpson's 1/3 rule and (c) Simpson's 3/8 rule
Test it by integrating:

$$\int_0^1 x^{0.1}(1.2-x)(1-e^{20(x-1)})dx$$

Use the true value of 0.602298 to compute $\varepsilon_t$
B. For each case, draw the true error as a function of the number of segments. Does the error always decrease with increase in number of segments ?
Part B has to be done in the report

Q2. The following relationships can be used to analyze uniform beams subject to distributed loads,

$$\frac{dy}{dx}=\theta(x),\ \frac{d\theta}{dx}=\frac{M(x)}{EI},\ \frac{dM}{dx}=V(x),\ \frac{dV}{dx}=-w(x)$$

Where x = distance along beam (m), y = deflection (m), θ(x) =slope (m/m), E = modulus of elasticity (Pa = $N/m^2$), I = moment of inertia ($m^4$), M(x) = moment (N m), V(x) = shear (N), and w(x) = distributed load (N/m). For the case of a linearly increasing load, the slope can be computed analytically as

$$\theta(x)=\frac{w_0}{120EIL}\left(-5x^4+6L^2x^2-L^4\right)\ \ldots\ldots\ldots\ldots.(1)$$

Employ (a) numerical integration to compute the deflection (in m) And (b) numerical differentiation to compute the moment (in N m) and shear (in N). Base your numerical calculations on values of the slope computed with Eq. 1 at equally spaced intervals of Δx = 0.125 m along a 3-m beam. Use the following parameter values in your computation: E = 200 GPa, I = 0.0003 $m^4$, and $w_0$ =2.5 kN/cm. In addition, the deflections at the ends of the beam are set at y(0) = y(L) = 0.

part(a) use each of the three numerical integration methods utilized in Q1 to compute the deflection
part(b) for x = 0 -use forward difference
x = 3 -use backward difference
rest all other x -use central difference method