CLL:113-Tut-7(18.9.19)

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 ε_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?

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), $\theta(x)$ =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

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