Exam 1

1.
Consider the problem of finding the solution of the equation:

$$\frac{d^2u}{dx^2} + u + x = 0, \;\; 0 < x < 1; \;\; u(0) = u(1) = 0$$

a)**(25 points)** Develop the weak form
b)**(25 points)** Assume trial ($u(x)$) and weight ($w(x)$) functions with the following form:

$$u(x) = x(1-x)(\alpha_1 + \alpha_2 x + \cdots \alpha_N x^{N-1}) \quad w(x) = x(1-x)(\beta_1 + \beta_2 x + \cdots \beta_N x^{N-1})$$

and obtain (but don't solve) the equations to determine the unknown coefficients α_i.

2. (25 points)
Book problem 4.9.

3. (25 points)
Repeat book problem 4.4d using a 3 noded element where the trial and weight function approximations are given by the incomplete polynomial (but with a linear complete approximation):

$$\theta^e = \alpha_0^e + \alpha_1^e x + \alpha_2^e x^4$$

Compare the results to the linear approximation.