

# MANE 4240 & CIVL 4240 – Introduction to Finite Elements

Rensselaer Polytechnic Institute

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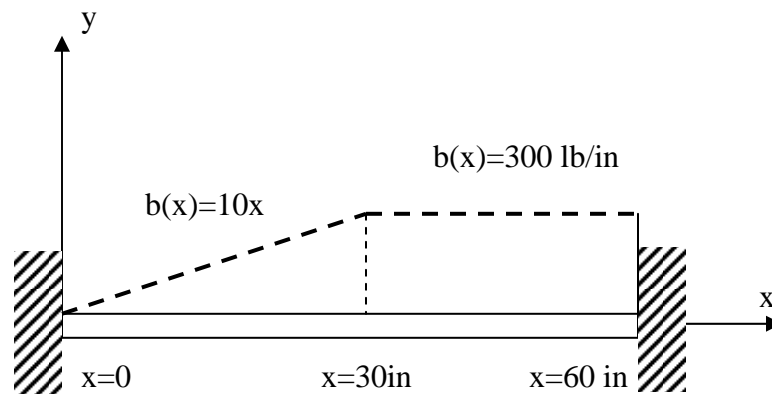
## Problem Set # 3

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Total points : 35

Answer all questions

1. (10 pts) Solve problem 2.20
2. (10 pts) Solve problem 2.21 (i.e., solve problem 2.10 using the potential energy approach)
3. (15 pts) A steel rod is attached to the rigid walls at each end and is subjected to distributed load  $b(x)$  as shown below



$$E=30 \times 10^6 \text{ psi}; \quad A = 2 \text{ in}^2$$

- (a) (2 pts) Write the expression for the potential energy
- (b) (10 pts) Determine the displacement  $u(x)$  using the Rayleigh-Ritz method.  
Assume a displacement field  $u(x) = a_0 + a_1x + a_2x^2$  Plot  $u$  versus  $x$ .
- (c) (3 pts) Plot the stress in the bar  $\sigma$  as a function of  $x$