1. A linear spring with a spring constant $K$ is attached at the right end of the beam. For the loading shown, write down the 3 fourth order differential equations and the 12 conditions necessary for solving the deflection at any point in the beam. Assume the bending rigidity EI is a constant. Number your equations and conditions. (DO NOT INTEGRATE OR SOLVE).

2. A uniformly loaded simply supported beam is made of elasto-plastic material that has a yield stress of 30 ksi. The beam has the hollow square cross section shown. If point A is at yield stress, determine the intensity $w$ of the uniform load.

3. A cantilever beam is made from a material that has a stress-strain relation given by $\sigma = K \varepsilon^{0.7}$. In terms of $K$, $w$, $a$, and $L$, determine the fiber stress at point A. Point A is just above the bottom flange.

4. The thin cross section shown has a uniform thickness $t$. Determine the location of the shear center with respect to point O. Calculations show that $I_{yy} = 2.821 \, R^3 \, t$, $I_{zz} = 3.571 \, R^3 \, t$, and $I_{yz} = 0$.

5. Using energy methods find the reaction force at B and deflection at A.

IAnswers:

2. $w = 427 \, \text{lb/in}$

3. $\sigma_A = 0.0233 \, wL^2/a^3$ (C)

4. $e = 1.72 \, R$ from point O.

5. $R_B = 17wL/8$, $v_A = -5 \, wL^4/24 \, E$