1. Determine by direct integration the moment of inertia of the shaded area with respect to the x axis. 15%

2. A 120-lb girl is walking up a 48-lb uniform beam. The coefficient of friction is 0.2 at all surfaces. Determine how far up the beam the girl can walk before the beam starts to slip. 15%

3. An elastic bar of variable cross section, held at both ends, is loaded as shown in the figure. The flexibilities of the bar segments are $f/2$, $f$, and $f$ as shown. Determine the reactions at both ends. 20%
4. An aluminum pole for a street light weighs 4600N and supports an arm that weighs 600N (see figure). The center of gravity of the arm is 1.2m from the axis of the pole. The outside diameter of the pole (at its base) is 225mm and its thickness is 18mm. Determine the maximum tensile and compressive stresses $\sigma_t$ and $\sigma_c$, respectively, in the pole (at its base) due to the weights. 20%

5. A wide-flange beam of unbalanced cross section has the dimensions shown in the figure. Determine the plastic moment $M_p$ if $\sigma_y = 36$ksi. 15%

6. Determine the critical load $P_{cr}$ for the structure. The structure consists of two rigid bars with pinned connections and linear elastic springs. 15%