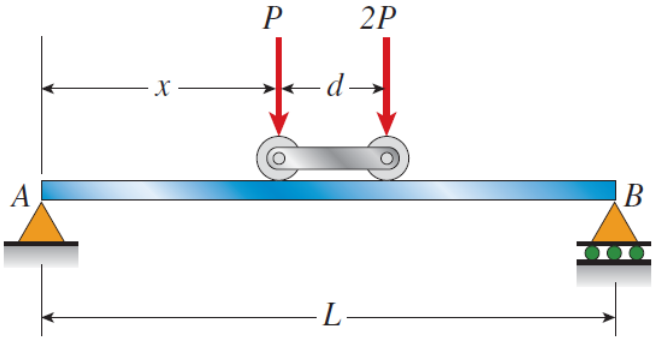
Mechanics of Materials I
Homework assignment # 6
Due: 05/03/93

Problem 1. A simple beam *AB* supports two connected wheel loads *P* and *2P* that are distance *d* apart (see figure). The wheels may be placed at any distance *x* from the left-hand support of the beam.

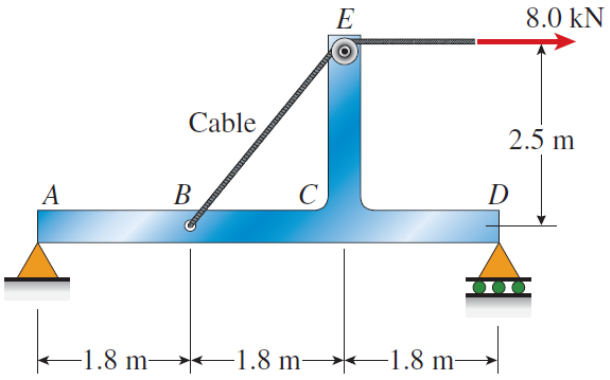
(a) Determine the distance *x* that will produce the maximum shear force in the beam, and also determine the maximum shear force V_{max} .

(b) Determine the distance *x* that will produce the maximum bending moment in the beam, and also draw the corresponding bending-moment diagram. (Assume P = 10 kN, d = 2.4 m, and L = 12 m.)

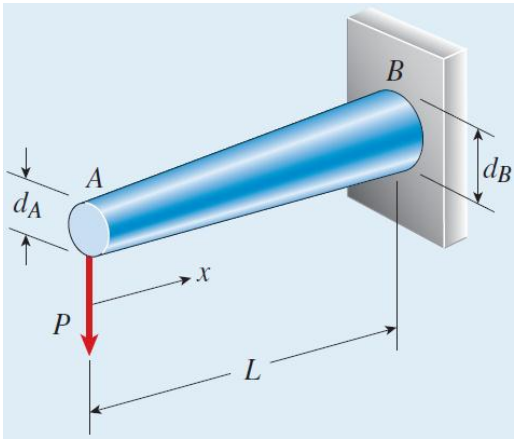


Problem 2. A beam *ABCD* with a vertical arm *CE* is supported as a simple beam at *A* and *D* (see figure). A cable passes over a small pulley that is attached to the arm at *E*. One end of the cable is attached to the beam at point *B*. The tensile force in the cable is *8.0 kN*.

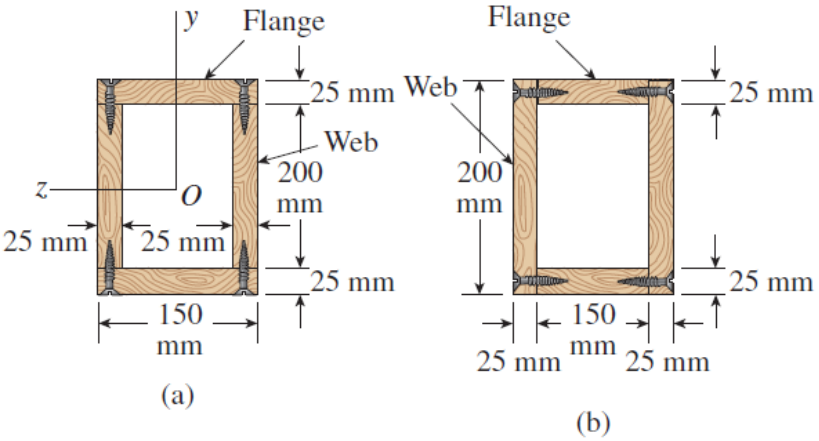
Draw the shear-force and bending-moment diagrams for beam *ABCD*. (Note: Disregard the widths of the beam and vertical arm and use centerline dimensions when making calculations.)



Problem 3. Refer to the tapered cantilever beam of solid circular cross section shown in Figure. (a) Considering only the bending stresses due to the load P, determine the range of values of the ratio d_B/d_A for which the maximum normal stress occurs at the support. (b) What is the maximum stress for this range of values?

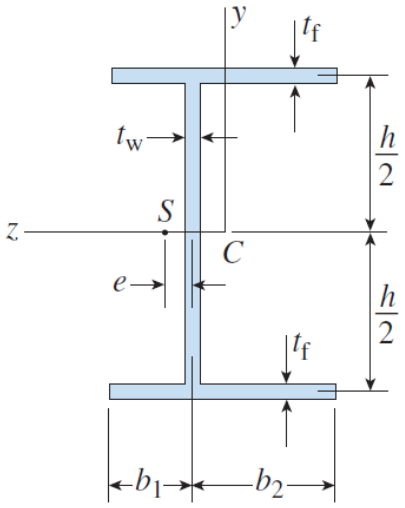


Problem 4. A box beam is constructed of four wood boards as shown in the figure part a. The webs are 200 $mm \times$ 25 mm and the flanges are 150 $mm \times 25$ mm boards (actual dimensions), joined by screws for which the allowable load in shear is $F = 1.1$ kN per screw.
(a) Calculate the maximum permissible longitudinal spacing S_{max} of the screws if the shear force V is 5.3 kN.
(b) Repeat part (a) if the flanges are attached to the webs using a *horizontal* arrangement of screws as shown in the figure part b.



Problem5. The cross section of an unbalanced wide-flange beam is shown in the figure. Derive the following formula for the distance e from the centerline of the web to the shear center S:

$$e = \frac{3t_f(b_2^2 - b_1^2)}{ht_w + 6t_t(b_1 + b_2)}$$



Problem 6. Derive the following formula for the distance *e* from the centerline of the wall to the shear center *S* for the C-section of constant thickness shown in the figure:

$$e = \frac{3bh^2(b + 2a) - 8ba^3}{h^2(h + 6b + 6a) + 4a^2(2a - 3h)}$$