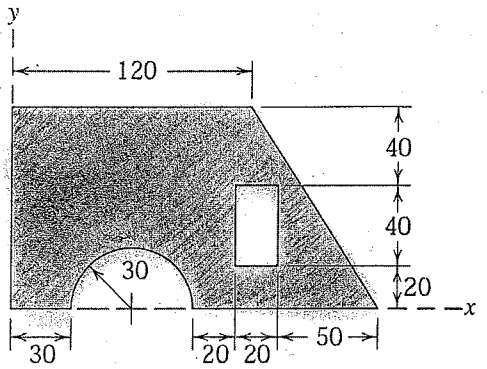
Concordia UNIVERSITY

Faculty of Engineering and Computer Science

Final Examination Questions, Fall 2004
Statics (ENGR 242/2, Sections T, V, X, YY)

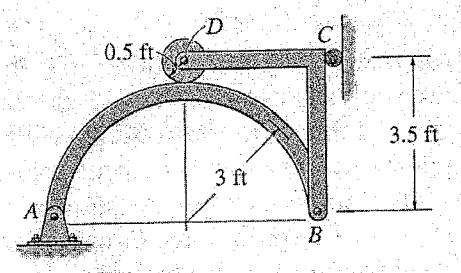
DRAW THE FREE BODY DIAGRAMS WHEN NEEDED ON THE ANSWER BOOK.

(1) Locate the centroid of the shaded area.
Hint: The centroind of the semicircular shape can be computed using the following formula:
$\bar{y} = (4r)/(3\pi)$

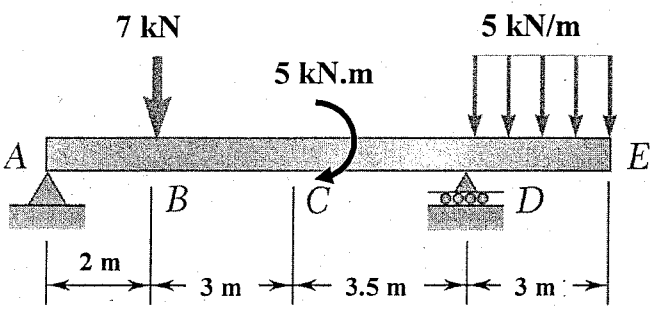


Dimensions in millimeters

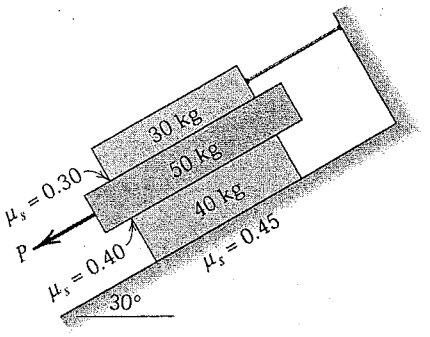
(2) The smooth disk shown is pinned at D and has a weight of 20 lb. Neglecting the weights of the other members, determine the horizontal and vertical components of reaction at pins B and D.



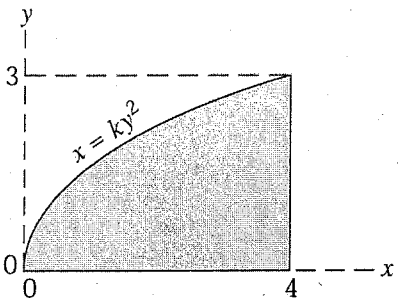
(3) For the beam shown, (a) draw the shear force and bending moment diagrams, and (b) determine the maximum absolute values of shear force and bending moment.



(4) The three flat blocks are positioned on the 30° incline as shown, and a force P parallel to the incline is applied to the middle block. The upper block is prevented from moving by a wire which attaches it to the fixed support. The coefficient of static friction for each of the three pairs of mating surfaces is shown. Determine the maximum value which P may have before any slipping takes place.



(5) Determine the moments of inertia of the shaded area under the parabola about both the x-axis and the y-axis. Solve by using integration.



(6) The welded tubular frame is secured to the horizontal x-y plane by a ball-and-socket joint at A and receives support from the loose-fitting ring at B. The joint at A is capable of exerting force components in the x, y and z directions. Thre ring at B is capable of exerting force components in the x and z directions. Under the action of the 2-kN load, rotation about a line from A to B is prevented by the cable CD, and the frame is stable in the position shown. Neglecting the weight of the frame, determine the tension T in the cable, the reaction components at the ring, and the reaction components at A.