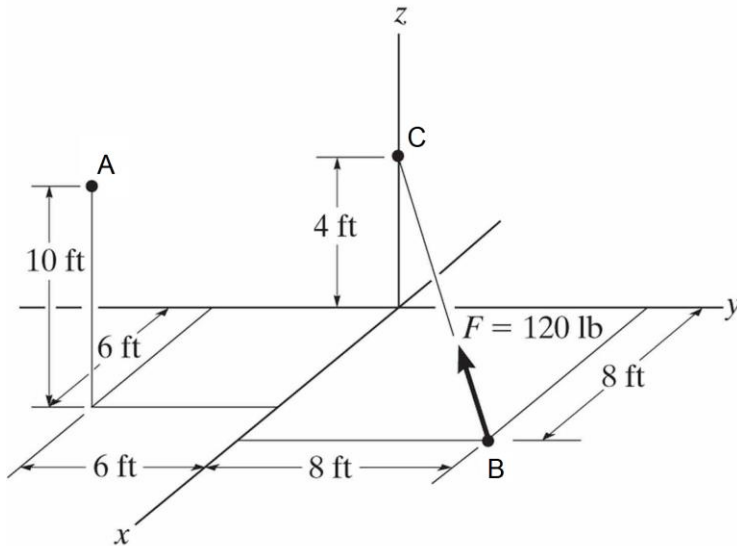


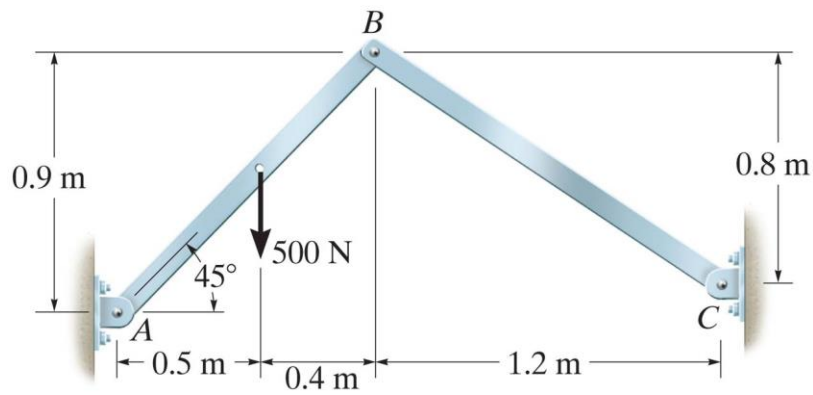
ENSC 2113 – SAMPLE FINAL EXAM #1

EACH PROBLEM IS WORTH 25 PTS. BOX YOUR ANSWERS AND PROVIDE PROPER UNITS, WHERE APPLICABLE. CALCULATIONS AND FREE BODY DIAGRAMS MUST BE SHOWN THAT SUPPORT THE ANSWER TO RECEIVE CREDIT.

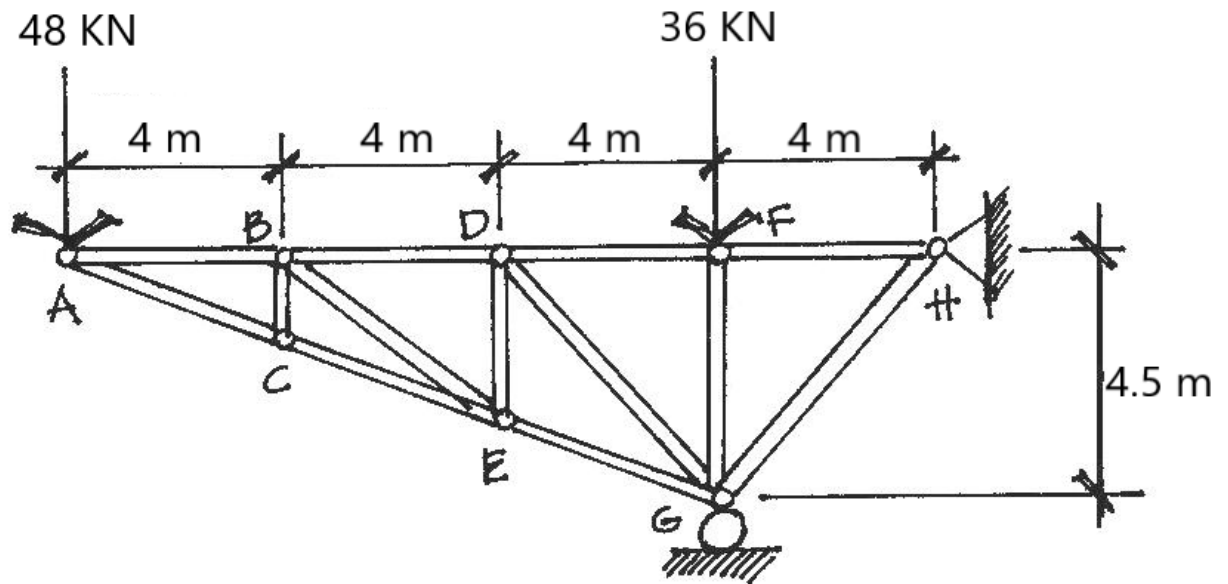
A force follows along a line from B to C. Determine the moment created by the force about point A using the cross-product. Express the result as a Cartesian vector.



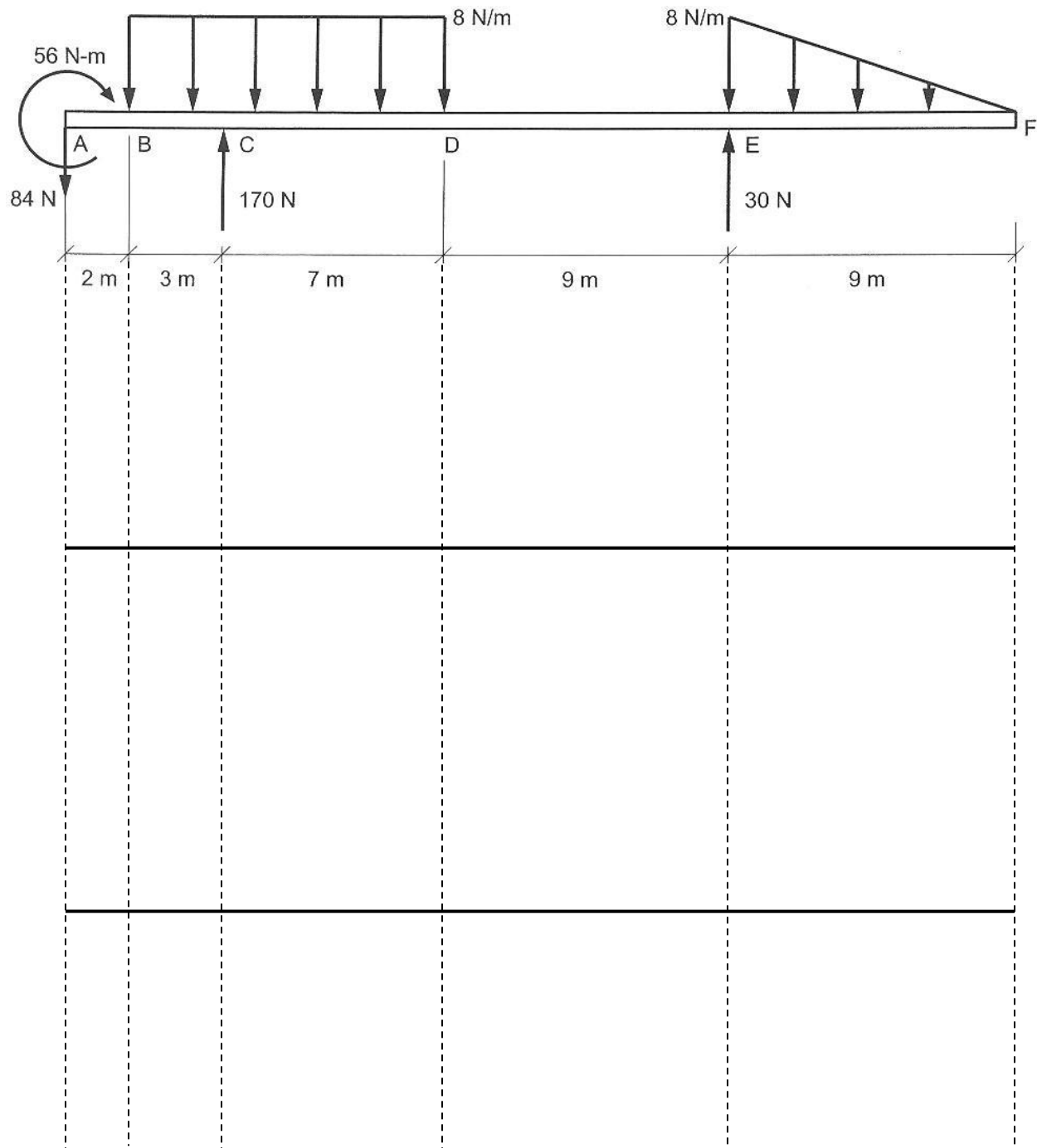
Determine the external support reactions for the pins at A and C. Member AB is pinned to member BC with an internal pin at point B. NOTE: A and C are not aligned vertically. Draw all pertinent free-body diagrams and indicate direction with arrows in your answer.



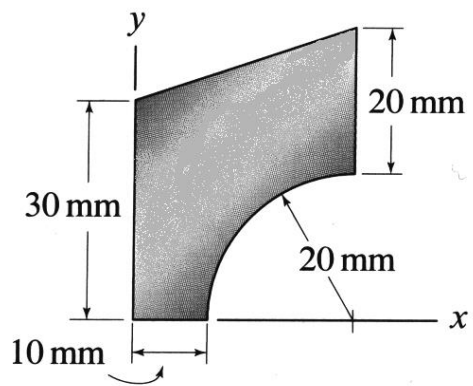
Determine the axial force in truss members DF, DG and EG by the method of sections and the force in member AC by method of joints. Indicate if the member is in tension or compression. List all zero force members and draw all pertinent free-body diagrams. Point H is a pin and point G is a roller.



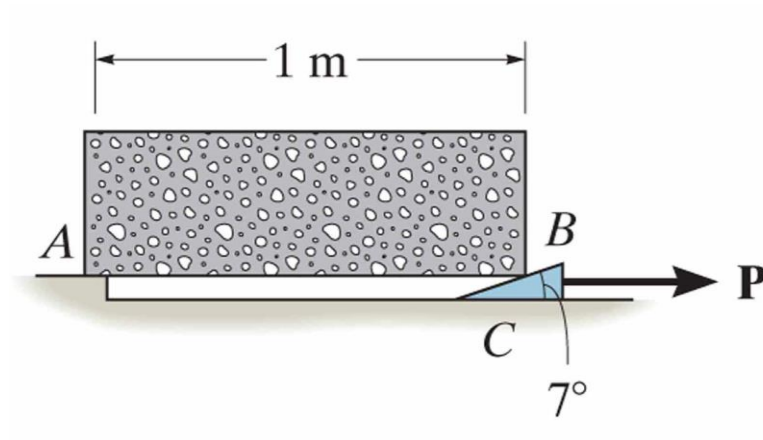
Draw the shear and bending moment diagrams for the loading condition below. Label the diagrams appropriately (title, units, order of slope, etc.).



Using tabular form, calculate the moment of inertia about the centroidal x-axis, x' , for the object below. The centroid of the shape is (13.24 mm, 21.52 mm).

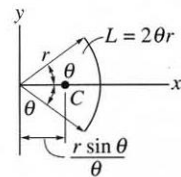


Determine the force required to move the wedge to the right as the 100 kg block remains in equilibrium. The static coefficient of friction between the block and the wedge and the wedge and the floor is 0.25. Neglect the size and weight of the wedge. Draw all pertinent free-body diagrams.



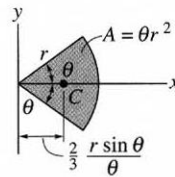
Geometric Properties of Line and Area Elements

Centroid Location



Circular arc segment

Centroid Location

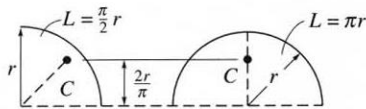


Circular sector area

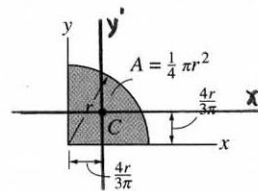
Area Moment of Inertia

$$I_x = \frac{1}{4} r^4 (\theta - \frac{1}{2} \sin 2\theta)$$

$$I_y = \frac{1}{4} r^4 (\theta + \frac{1}{2} \sin 2\theta)$$



Quarter and semicircle arcs

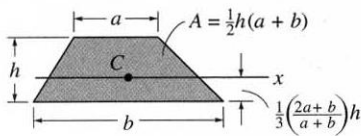


Quarter circle area

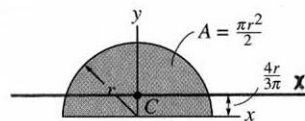
$$I_x' = I_y' = .05488 r^4$$

$$I_x = \frac{1}{16} \pi r^4$$

$$I_y = \frac{1}{16} \pi r^4$$



Trapezoidal area

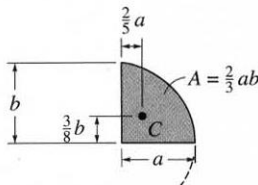


Semicircular area

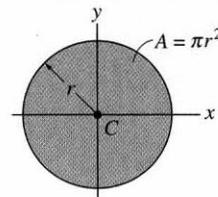
$$I_x' = .1098 r^4$$

$$I_x = \frac{1}{8} \pi r^4$$

$$I_y = \frac{1}{8} \pi r^4$$



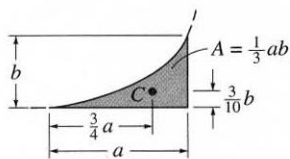
Semiparabolic area



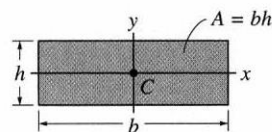
Circular area

$$I_x = \frac{1}{4} \pi r^4$$

$$I_y = \frac{1}{4} \pi r^4$$



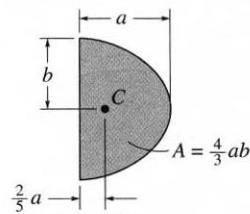
Exparabolic area



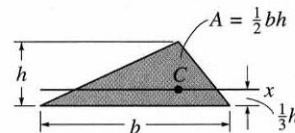
Rectangular area

$$I_x = \frac{1}{12} b h^3$$

$$I_y = \frac{1}{12} h b^3$$



Parabolic area



Triangular area

$$I_x = \frac{1}{36} b h^3$$

$$I_y = \frac{h b^3}{36}$$