

Name (print): \_\_\_\_\_ KEY \_\_\_\_\_

Section \_\_\_\_\_ Table \_\_\_\_\_

Honor Code: I have neither given nor received unauthorized aid on this test

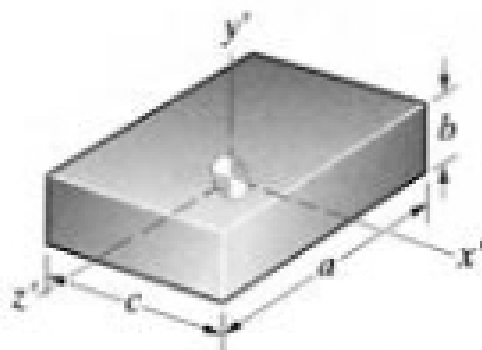
Signature: \_\_\_\_\_

## ME 201 Test #2

Fall 2008

### NOTES:

- Sign and provide identifying info on every sheet.
- Use proper vector notation in all cases where vectors are used.
- In cases involving Newton's Laws, you are **REQUIRED** to draw complete and correct **FBDs** and when the problem is dynamics, you must also draw complete and correct **KDs**. Then use these to develop your governing equations.
- If you use your calculator to perform any calculus that might involve trig or similar functions, set your calculator to the radian mode first.
- In all cases, remember to show results with magnitude, direction, units and put your answer in a box.



Rectangular prism

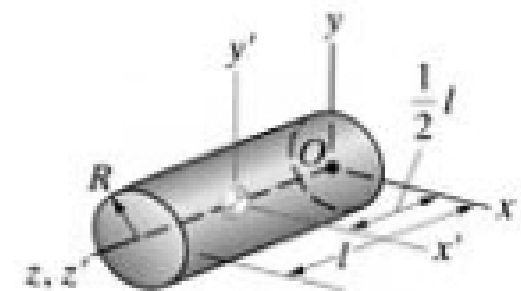
$$\text{Volume} = abc$$

$$I_{x' \text{ axis}} = \frac{1}{12}m(a^2 + b^2), \quad I_{y' \text{ axis}} = \frac{1}{12}m(a^2 + c^2),$$

$$I_{z' \text{ axis}} = \frac{1}{12}m(b^2 + c^2),$$

$$\text{Volume} = \pi R^2 l$$

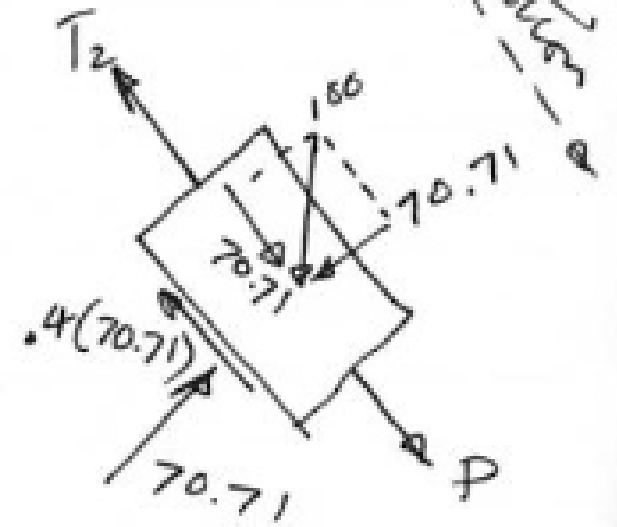
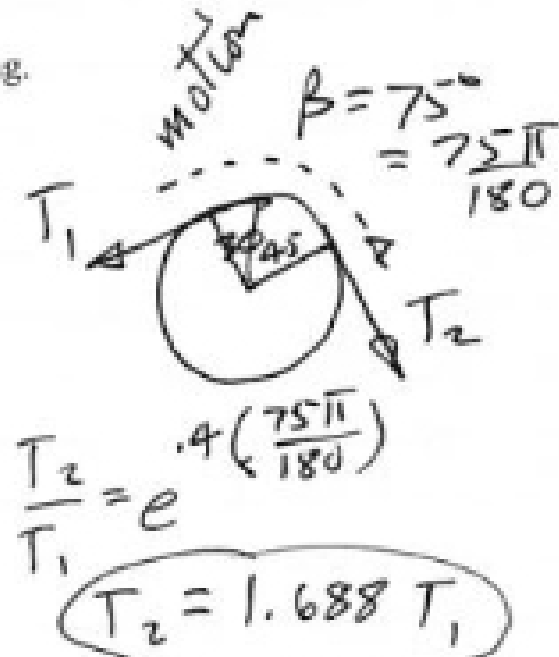
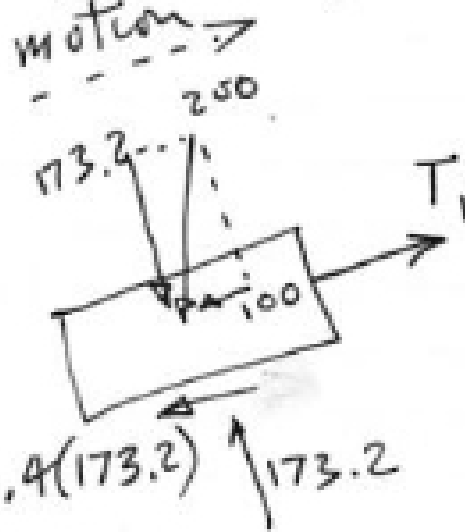
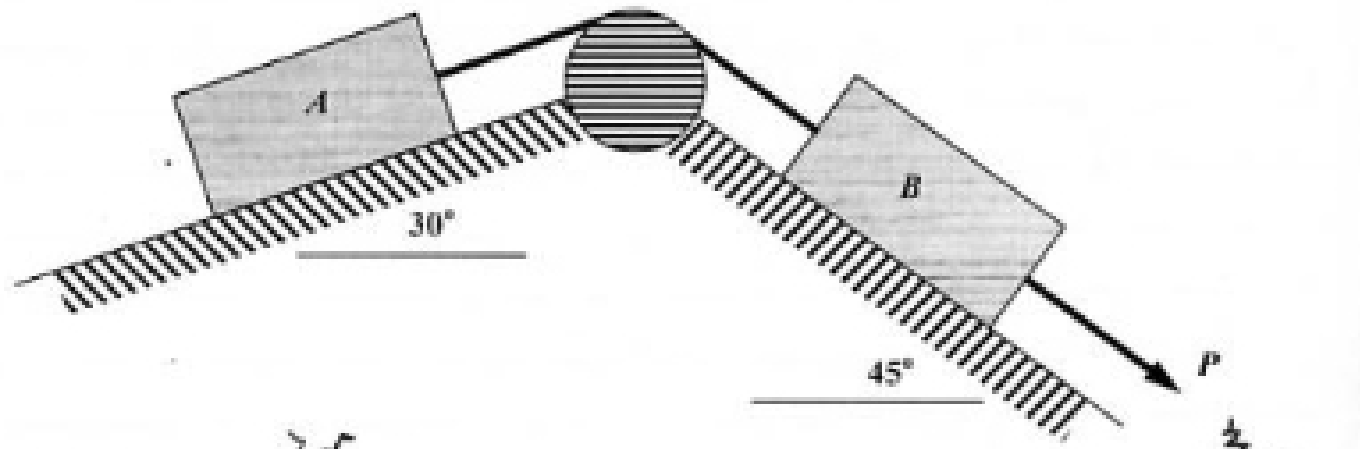
$$I_{x \text{ axis}} = I_{y \text{ axis}} = m\left(\frac{1}{3}l^2 + \frac{1}{4}R^2\right), \quad I_{z \text{ axis}} = \frac{1}{2}mR^2,$$



Circular cylinder

$$I_{x' \text{ axis}} = I_{y' \text{ axis}} = m\left(\frac{1}{12}l^2 + \frac{1}{4}R^2\right), \quad I_{z' \text{ axis}} = \frac{1}{2}mR^2,$$

1. (25 pts) The slopes and the curved surface are stationary. The cable connecting A and B is inextensible and has negligible weight. The coefficient of static friction between all three contact surfaces is 0.4. Block A weighs 200 lb and Block B weighs 100 lb. Find the largest force P that could be applied before the system starts moving.



$$\sum F_x = 0 = T_1 - 4(173.2) - 100$$

$$T_1 = 169.28 \text{ lb}$$

$$\frac{T_2}{T_1} = e^{0.4 \left( \frac{75\pi}{180} \right)}$$

$$T_2 = 1.688 T_1$$

$$\sum F_x = T_2 - 70.71 + 4(70.71) - P$$

$$T_2 = P + 70.71 - 4(70.71)$$

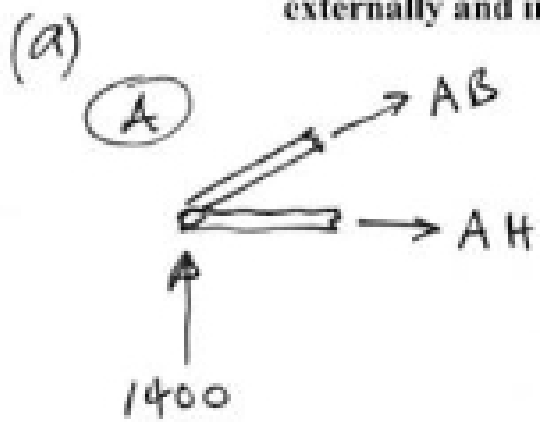
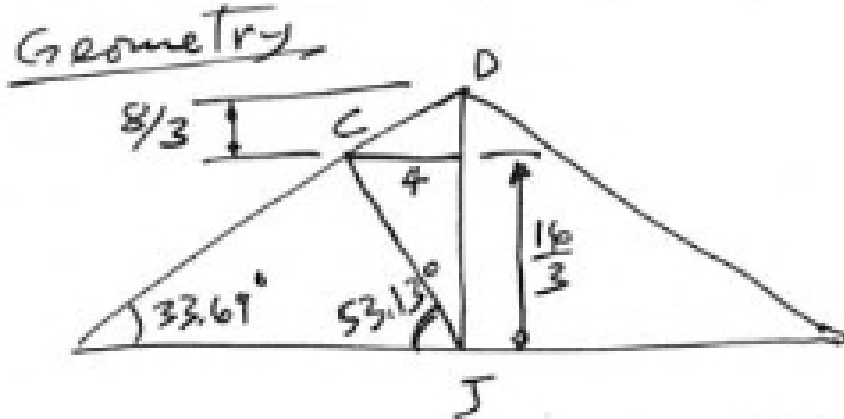
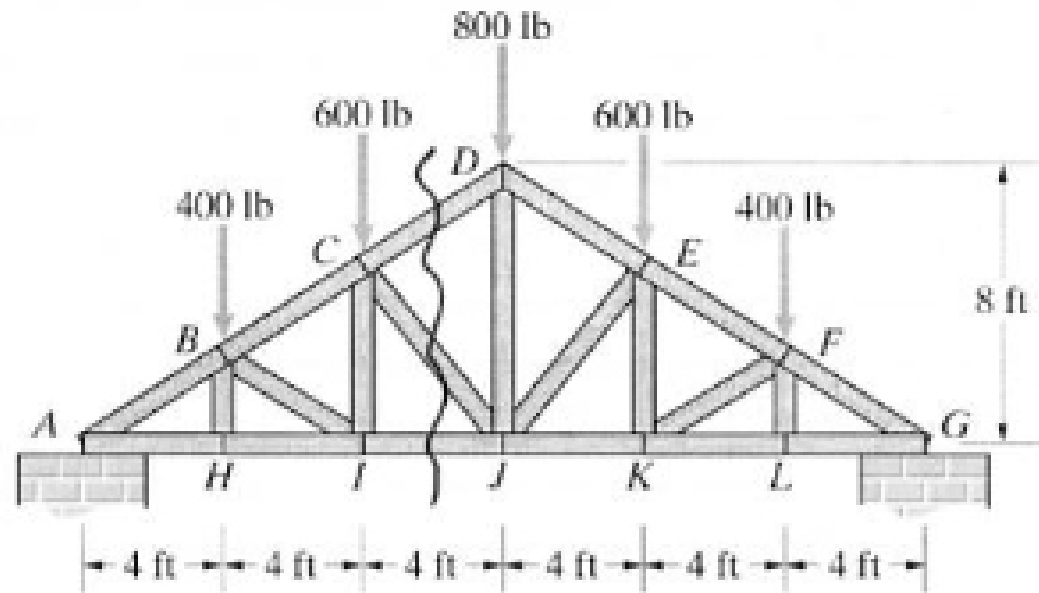
solve

$$T_2 = 285.76 \text{ lb}$$

$$\therefore P = 243.3 \text{ lb}$$

2. (25 pts) The structure shown may be treated as a truss. Consider the supports at A and G to be a pin and a roller, respectively.

- Find the forces in members AB and AH.
- Find the forces in members CD, CJ, IJ.
- If this structure were considered to be constructed with rigid connections at the joints and the supports were considered to be rigid (fixed) connections to the brick walls, what would be the degrees of static indeterminacy externally and internally?



$$+\uparrow \sum F_y = 1400 - AB \sin 33.69 = 0$$

$$AB = -2523.9$$

$$AB = 2523.9 \text{ lb compr}$$

$$+\rightarrow \sum F_x = AH + AB \cos 33.69 = 0$$

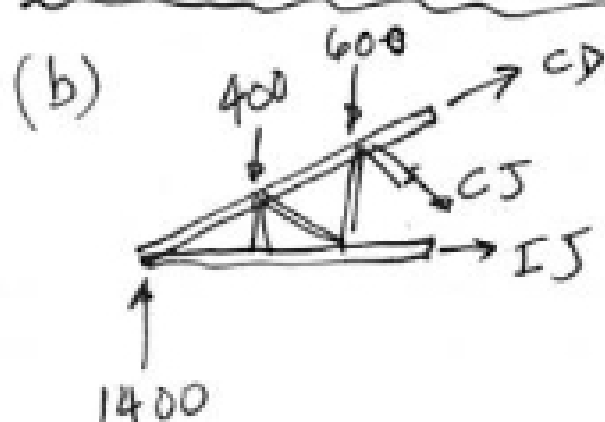
$$AH = 2100.0 \text{ lb tens}$$

(c) 3 deg. indet. externally

+ 10 closed loops  $\therefore$

30 deg. indet. internally

33 total



$$\curvearrowright \sum M_C = 0 = 400(4) - 1400(8) + IJ \left(\frac{16}{3}\right)$$

$$IJ = 1800 \text{ lb tens}$$

$$\sum F_x = 0 = IJ + CD \cos 33.69 + CJ \cos 53.13$$

$$0 = 1800 - 1400 + CJ \cos 53.13$$

$$CJ = -666.7 = 666.7 \text{ lb compr}$$

$$\curvearrowright \sum M_J = 0 = 600(4) + 400(8) - 1400(12) - (CD \cos 33.69)(8)$$

$$CD = -1682.6 = 1682.6 \text{ lb compr}$$