

Name \_\_\_\_\_

Section (circle one): 0810 0910

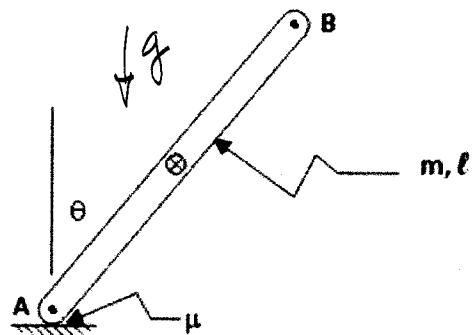
**ME 212 – Quiz 4**  
Winter 2012

Solve the problems below on this paper in the spaces provided. In your solutions you need to show not only the answers but the steps or rationale you used to arrive at the answer. If you perform special actions on your calculator (like a SOLVE or a cross product), write out the steps you used and precisely what you entered into the calculator. Your answers need to be complete enough to make your work *checkable*. Box your final answers. If you need more space, you may attach a paper with the continued part of the problem clearly designated as the continued part.

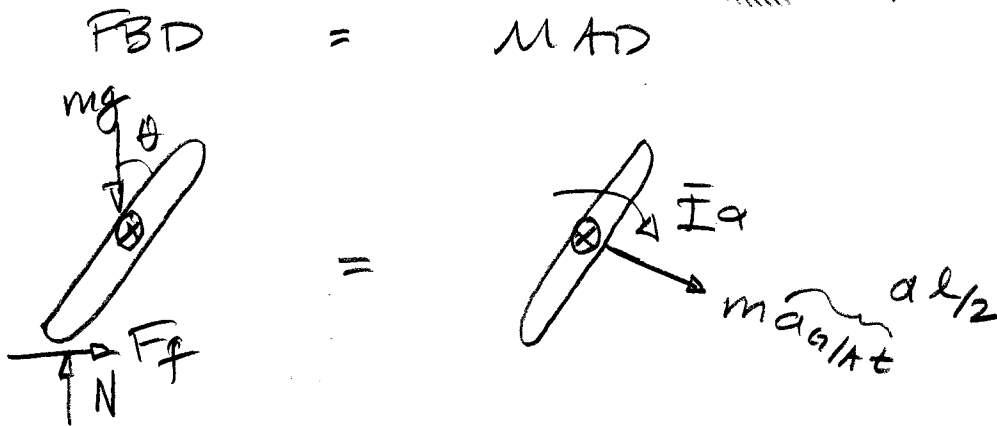
1.

The bar shown at right has the parameters enumerated given. It is released from rest at the given angle. I want you to analyze two different cases.

Case 1:  $\mu$  is great enough that the bar does not slip on the surface at A.



a. Draw the FBD and MAD for this case.



b. Find  $\alpha$ , the angular acceleration of the bar upon being released. Give its value in terms of the given variables and also its direction. Do not include variables that are not in *diag above*.

$$\sum M_A: \cancel{mg} \frac{l}{2} \sin \theta = \bar{I} \alpha + \cancel{\mu} \alpha \left(\frac{l}{2}\right)^2$$

$L \frac{1}{12} \mu l^2$

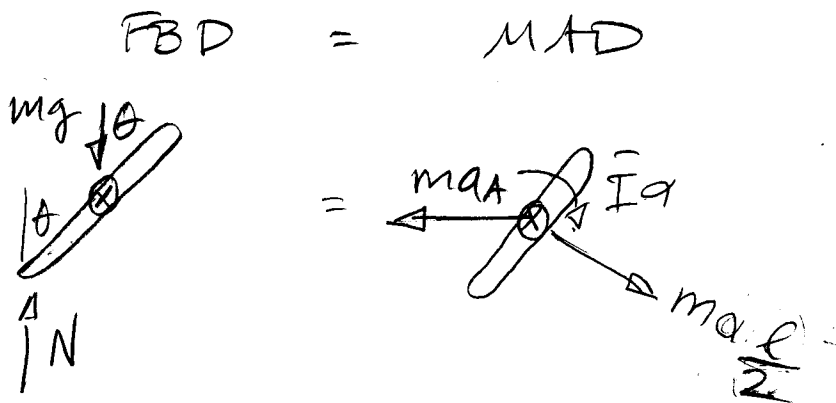
$$\alpha = \frac{g l \sin \theta}{2 \left( \frac{1}{12} l^2 + \frac{l^2}{4} \right)} = \frac{3}{2} \frac{g \sin \theta}{l}$$

Continued on back...



Case 2:  $\mu = 0$ .

c. Draw the FBD and MAD for this case.



d. Find  $\alpha$ , the angular acceleration of the bar upon being released. Give its value in terms of the given variables and also its direction. Do not include...

$$\rightarrow \sum M_A: \quad mg \frac{l}{2} \sin \theta = -ma_A \frac{l}{2} \cos \theta + ma \left(\frac{l}{2}\right)^2 \alpha + I \alpha$$

$$I = \frac{1}{12} ml^2$$

$$\frac{g}{2} \sin \theta = -\frac{a_A}{2} \cos \theta + \underbrace{\frac{al}{4} + \frac{al}{12}}_{al/3}$$

$$\rightarrow \sum F_x: \quad 0 = -ma_A + ma \frac{l}{2} \cos \theta$$

$$a_A = a \frac{l}{2} \cos \theta$$

$$\frac{g}{2} \sin \theta = -a \frac{al}{4} \cos^2 \theta + al/3$$

$$\boxed{a = \frac{g \sin \theta}{2l \left( \frac{1}{3} - \frac{\cos^2 \theta}{4} \right)}}$$