Name _____ Section _____

ES204
Examination III
February 8, 2002

Problem	Score
1	/20
2	/40
3	/40
Total	/100

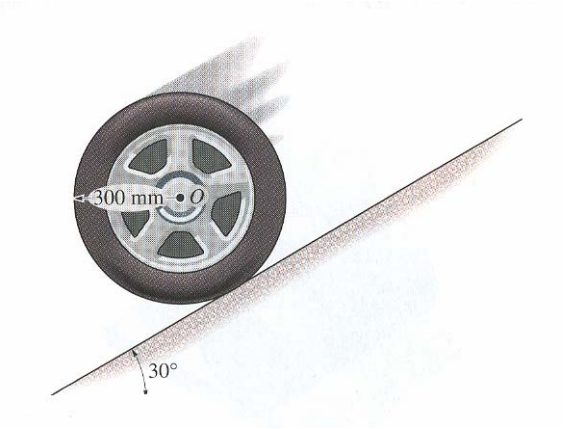
Show all work for credit
AND
Turn in your signed help sheet
AND
Stay in your seat until the end of class

NOTE:
Set up all the equations first and save the solutions to the end (the actual numerical answers will only be worth 2 pounts).

Name _____ 20 pts

ES204 Examination III **Problem 1** Feb. 8, 2002

1.1-1.2 The wheel at right is accelerating down the ramp



1.1) Draw the FBD and KD for the wheel

KD FBD

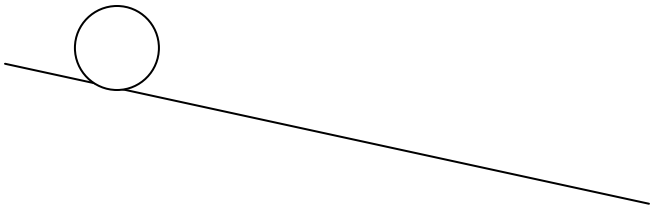
1.2) Relate α and a_G for rolling with no slipping.

1.3 A hoop, a sphere and a solid cylinder race down an incline as shown Assuming the objects roll without slipping. Which one will win the race. (You do not need to show work for full credit). Briefly explain your reasoning.

$$I_{G_{hoop}} = mr^2$$

$$I_{G_{sphere}} = \frac{2}{5}mr^2$$

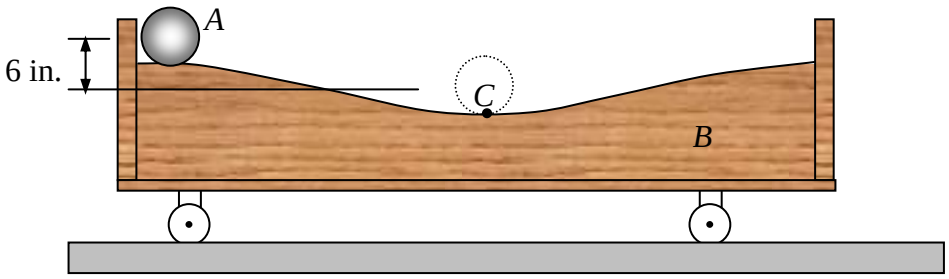
$$I_{G_{solid\,cylinder}} = \frac{1}{2}mr^2$$



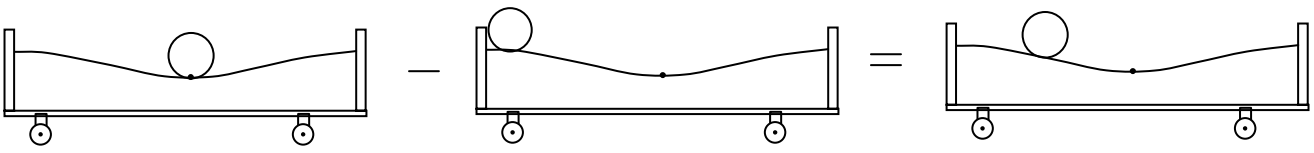
1.4 A sphere rolls without slipping down a curved path onto a horizontal surface as shown. What is the magnitude and direction of the friction force at point A, if the cylinder has an angular velocity of 2 rad/s at A?

a) -3 lb $\hat{i}$ b) -5 lb $\hat{i}$ c) 0 lb $\hat{i}$ d) 3 lb $\hat{i}$ e) not enough information given

1.5 A cylinder *A* (m_A, I_{GA}) and wooden cart *B* (m_B, I_{GB}) are at rest in the position shown below when the cylinder is given a slight nudge, causing it to roll without sliding along the top surface of the cart. Assume the friction between the cart and the ground is negligible. Complete the impulse-momentum diagrams required to determine the velocity of the cart as the cylinder passes through the lowest point of the surface at *C*.



Impulse-Momentum Diagrams:

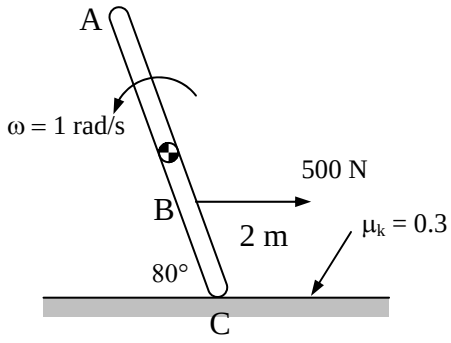


After Before During

Name _____ 40 pts

ES204 Examination III **Problem 2** Feb. 8, 2002

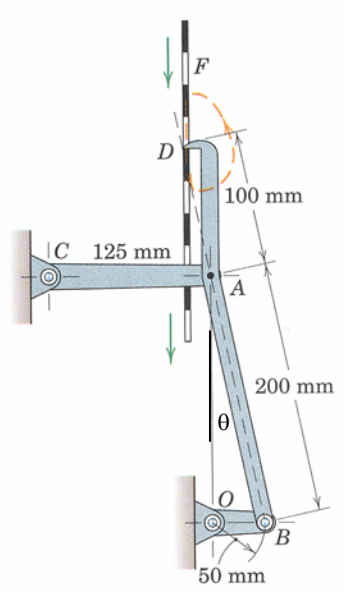
At the instant shown, the 6 m long, uniform 50-kg pole ABC has an angular velocity of 1 rad/s counter-clockwise and point C is sliding to the right. If the coefficient of friction between the pole and the gound is 0.3 determine the equations necessary to find the acceleration of the center of gravity and the normal force **at this instant**. DO NOT SOLVE THESE EQUATIONS. Your solution should consist of a clearly labeled set of equations and a list of unknown.



Name _____ /40 pts

ES204 Examination III **Problem 3** Feb. 8, 2002

An intermittent-drive mechanism for a perforated tape F consists of the link DAB driven by the crank OB. The trace of the motion of the finger at D is shown by the dashed line. **Determine the equations necessary to obtain the acceleration of A** at the instant shown when both OB and CA are horizontal. Crank OB has a constant clockwise angular velocity of 150 rpm (5π rad/s). The angle given is θ = 14.5°



Do not solve these equations - your solution should consist of a clearly labeled set of equations and list of unknowns.