

Name _____ Section _____

ES204
Examination III
February 12, 2004

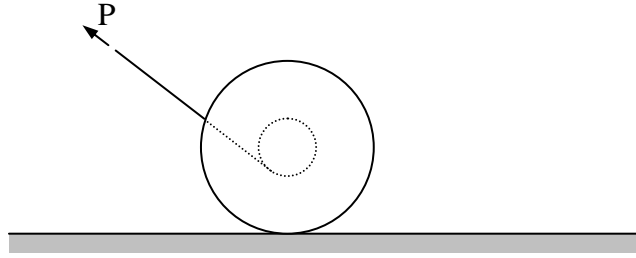
Problem	Score
1	/20
2	/40
3	/40
Total	/100

Show all work for credit
AND
Turn in your signed help sheet

NOTE:
Set up all the equations first and save the solutions to the end.

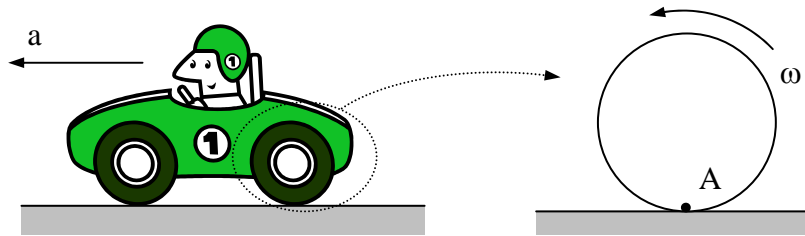
Problem 1.1 Assuming the spool rolls without slipping, what direction would it move when the force P is applied?

- a) left b) right c) it would not move d) up e) down



Problem 1.2 A rear wheel drive car starts from rest and accelerates to the left so that the tires do not slip on the road. What is the direction of the acceleration of the point on the tire in contact with the road, that is, point A?

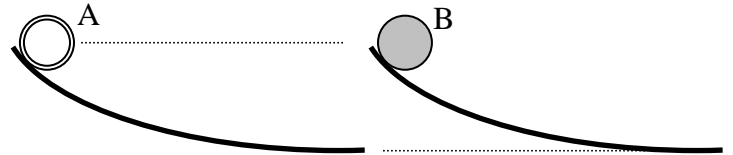
- a) ← b) ↖ c) ↑ d) ↗ e) → f) the acceleration is zero



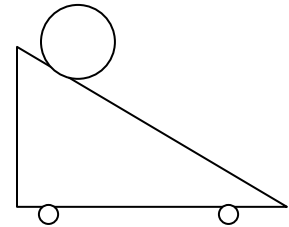
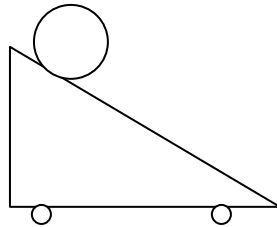
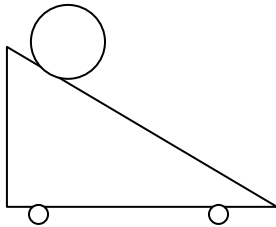
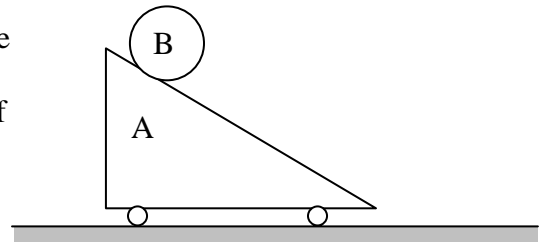
Problem 1.3 After applying conservation of angular momentum to a system you find the angular acceleration is $\alpha = 2.8 \cos\theta$. Determine the angular velocity as a function of θ assuming that $\omega = 0$ at $\theta = 0$.

Problem 1.4 A homogeneous thin ring, A, and a solid disk, B, of equal mass and radius are released from rest at the same time and roll without slipping down identical hills. Air resistance is negligible. If both are to travel an equal distance down the hills circle the correct outcome to the “race”.

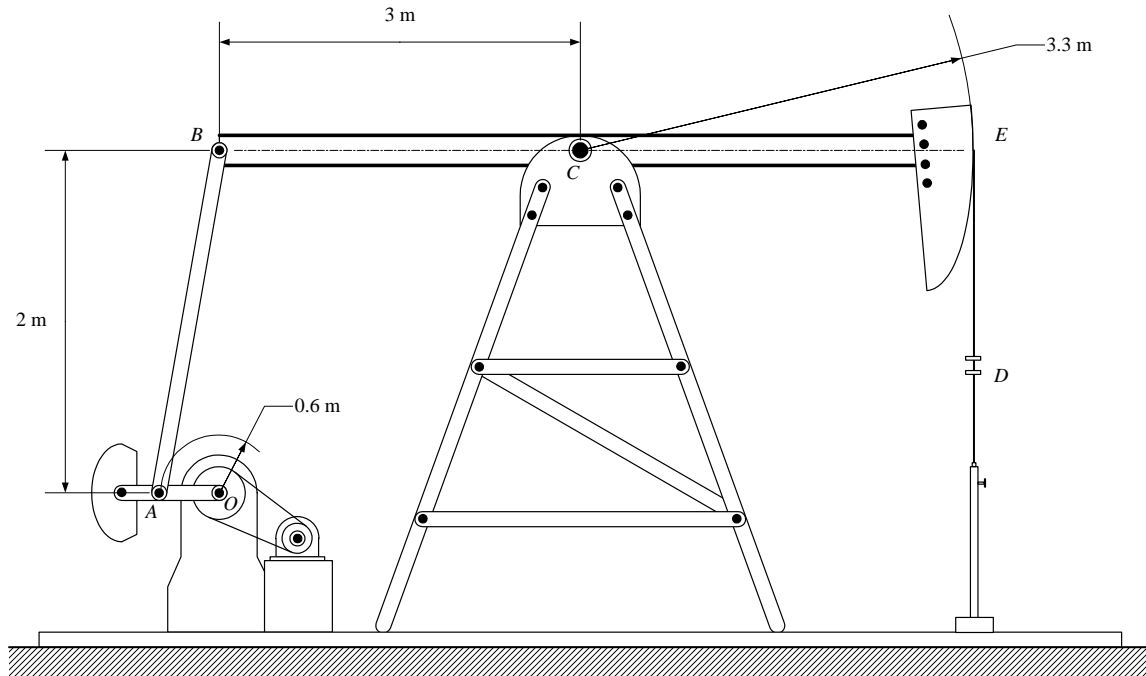
- a) The ring, A, wins
- b) The solid disk, B, wins
- c) They tie
- d) You need to be given more information



Problem 1.5 A sphere is released from rest at the top of a wedge as shown. To determine the velocity of the sphere when it has reached the bottom you would need to use the finite time form of conservation of linear and angular momentum. Complete the impulse momentum diagrams shown below.



An oil pump rig is shown in the figure below. The link AB causes the beam BCE to oscillate as the weigh crank OA revolves. If OA has a constant clockwise angular velocity of 1 rad/s determine the equations necessary to find the acceleration of point D in the position shown. **DO NOT SOLVE THE EQUATIONS.** You should have a list of SCALAR equations (not vector equations) and a clear list of unknowns.



A bar is attached to a uniform cylinder by a square pin, P, as shown. The mass of the cylinder is m_c and the mass of the bar is m_b . Assume the cylinder rolls without slipping down the incline and at the instant shown the cylinder has an angular velocity of ω .

- Determine the equations necessary to determine the **forces and the moment** at the pin, P. Your answer should consist of a clear list of equations and unknowns.
- How would you check to see if your assumption of no slipping is correct?

