

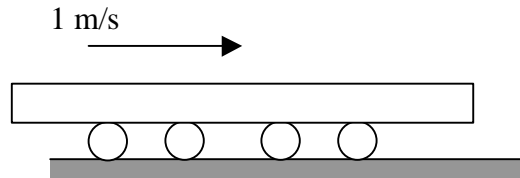
Name _____ Section _____

ES204
Examination II
January 23, 1998

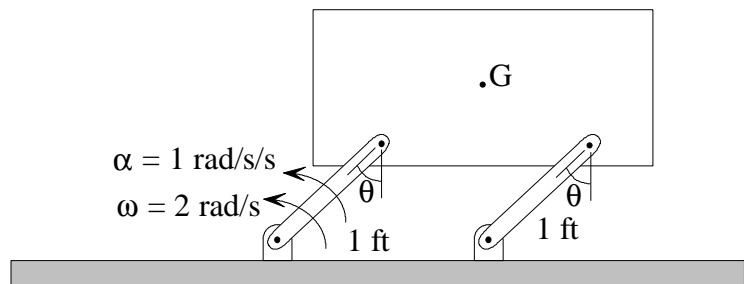
Problem	Score
1	/20
2	/40
3	/40
Total	/100

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

- a) At the instant shown, the velocity of the platen is 1.0 m/s to the right. What is the angular velocity of the bearings assuming they have a radius of 0.02 m and there is no slipping at any of the surfaces.



- b) What is the angular velocity of the plate at the instant shown?



- c) At the instant shown the uniform bar has the following:

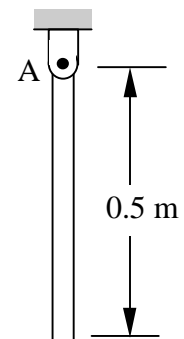
$$I_G = 0.08 \text{ kg}\cdot\text{m}^2$$

$$m = 4 \text{ kg}$$

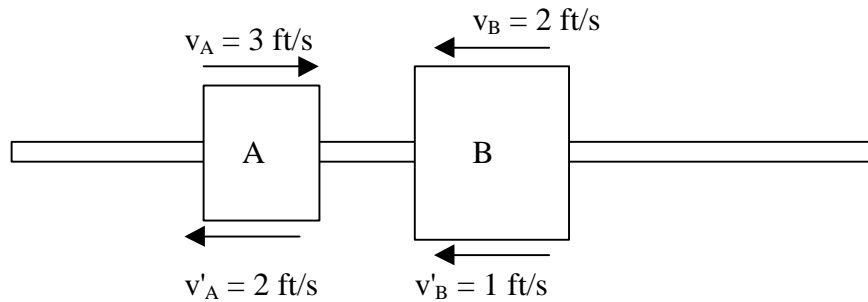
$$\omega = 4 \text{ rad/s}$$

$$\alpha = 0 \text{ rad/s}^2$$

What are the reaction forces at A at this instant?



- d) Given the impact shown, what is the coefficient of restitution between A and B (the primes denote the velocities after the impact)?



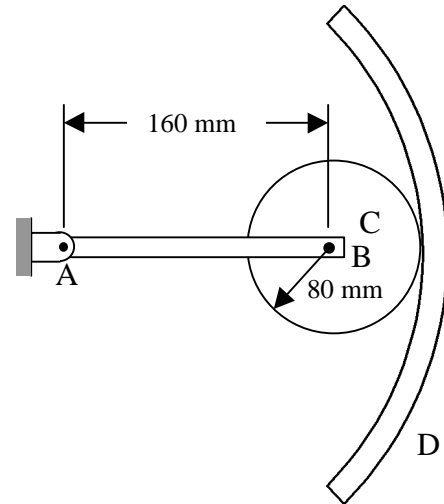
- e) A 30 N-m moment causes an object to rotate through 90 degrees. What is the amount of work done by the moment?

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Problem 2

Jan. 23, 1998
40 pts

Gear C has a mass of 3.2 kg and a centroidal radius of gyration of 0.06 m. The uniform bar AB has a mass of 2.4 kg, and gear D is stationary (only part of gear D is shown). If the system is released from rest in the position shown, determine the equations necessary to solve for the angular velocities of gear C and bar AB after AB has rotated through 90° . NOTE: DO NOT SOLVE THESE EQUATIONS, but make sure they are clearly labeled and you have a list of unknowns.



A student at graduation is so excited he tosses his laptop into the air. When the laptop reaches its maximum height it has an angular velocity of 6 rad/s and a disgruntled student (who was dropped from the institute for academic misconduct) shoots the laptop with a high powered rifle as shown below. The bullet strikes the laptop with a speed of 1500 ft/s and exits with a speed of 800 ft/s . Assume the bullet leaves at the same angle it enters the laptop. The bullet weighs approximately 1-oz (0.002 slugs), the laptop weighs 10 lbs (0.31 slugs) and has a mass moment of inertia about its center of gravity of $0.0256 \text{ slug}\cdot\text{ft}^2$. Determine:

- the angular velocity of the laptop after the bullet has passed through it (35 pts)
- the location of the instantaneous center of velocity immediately after impact (5 pts)

