University of California, Merced

ENGR 057 Statics and Dynamics: Assignment #6

Summer - 2022

Due: August 11, 2022

Problem 1. The 25-lb block has an initial speed of $v_0 = 10$ ft/swhen it is midway between springs A and B. After striking spring B it rebounds and slides across the horizontal plane toward spring A, etc. If the coefficient of kinetic friction between the plane and the block is $\mu_k = 0.4$, determine the total distance traveled by the block before it comes to rest.
Hint: Assume that the block bounces and stops without striking A.
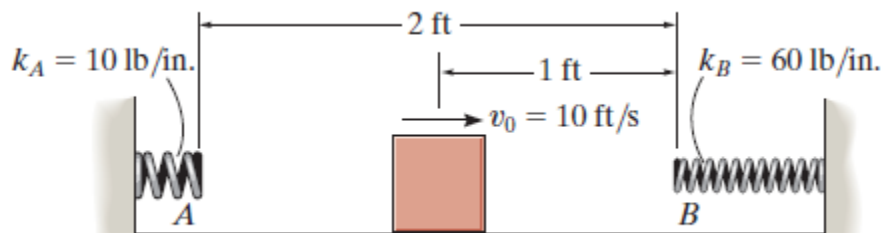
Problem 2. When the 150-lb skier is at point A he has a speed of 5 ft/s. Determine his speed when he reaches point B on the smooth slope. For this distance the slope follows the cosine curve shown. Also, what is the normal force on his skis at B and his rate of increase in speed? Neglect friction and air resistance.

Hint: Use normal-tangential coordinates to find the angle θ, the radius of curvature, apply the principle of work and energy to find velocity, and apply equations of motion.

y

A

B

$$y = 50 \cos \left(\frac{\pi}{100} x \right)$$

x

35 ft
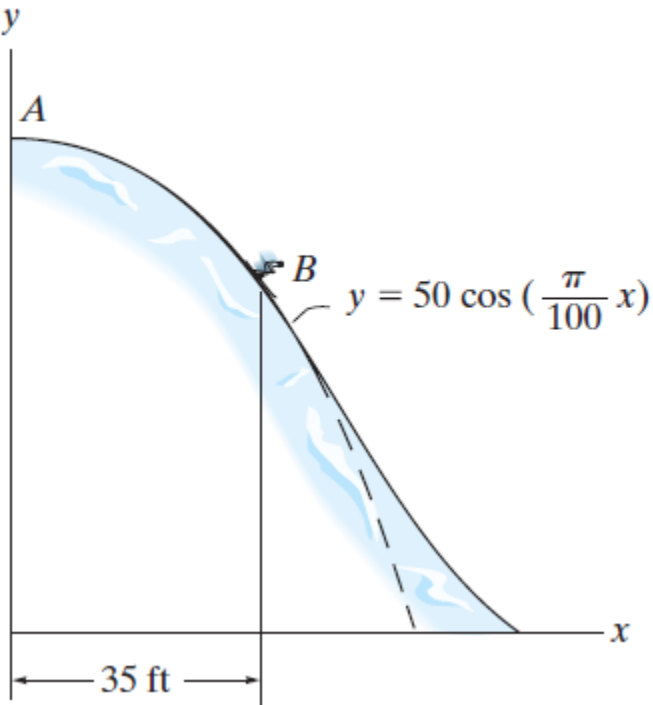
Problem 3. The 50-lb crate is given a speed of 10 ft/s in $t = 4$ s starting from rest. If the acceleration is constant, determine the power that must be supplied to the motor when $t = 2$ s. The motor has an efficiency $\varepsilon = 0.65$. Neglect the mass of the pulley and cable.
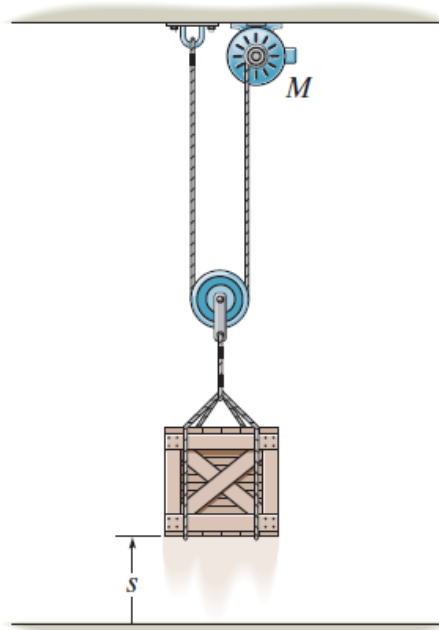
Problem 4. The girl has a mass of 40 kg and center of mass at *G*. If she is swinging to a maximum height defined by $\theta = 60°$, determine the force developed along each of the four supporting posts such as *AB* at the instant $\theta = 0$. The swing is centrally located between the posts.
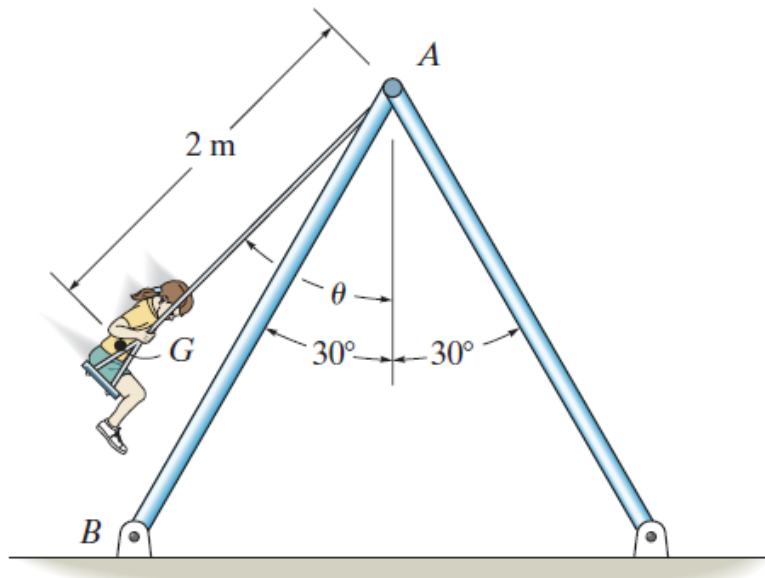
Problem 5. Ball A has a mass of 3 kg and is moving with a velocity of 8 m/s when it makes a direct collision with ball B, which has a mass of 2 kg and is moving with a velocity of 4 m/s. If e = 0.7, determine the velocity of each ball just after the collision. Neglect the size of the balls.

Problem 6. The "stone" *A* used in the sport of curling slides over the ice track and strikes another "stone" *B* as shown. If each "stone" is smooth and has a weight of 47 lb, and the coefficient of restitution between the "stones" is $e = 0.8$, determine their speeds just after the collision. Initially, *A* has a velocity of 8 ft/s and B is at rest. Neglect friction.
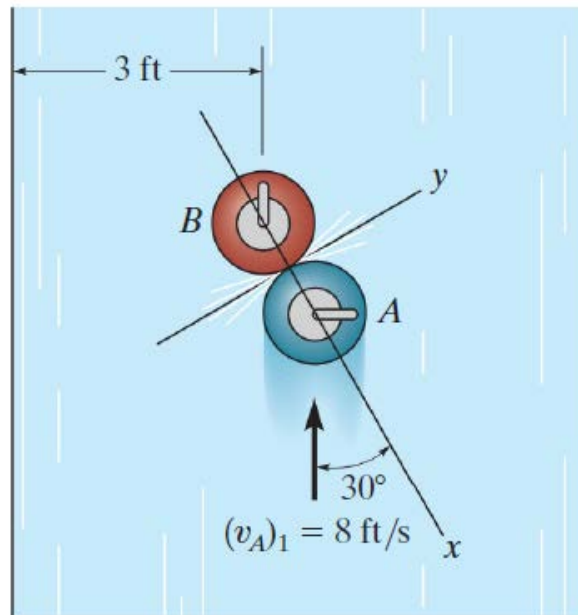
Problem 7. The assembly is made of the slender rods that have a mass per unit length of 3 kg/m. Determine the mass moment of inertia of the assembly about an axis perpendicular to the page and passing through point O.

0.4 m

0.8 m — 0.4 m
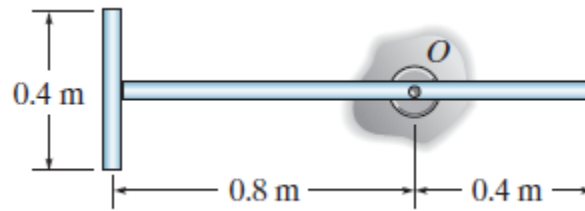
Problem 8. The door has a weight of 200 lb and a center of gravity at G. Determine the constant force **F** that must be applied to the door to push it open 12 ft to the right in 5 s, starting from rest. Also, find the vertical reactions at the rollers A and B.