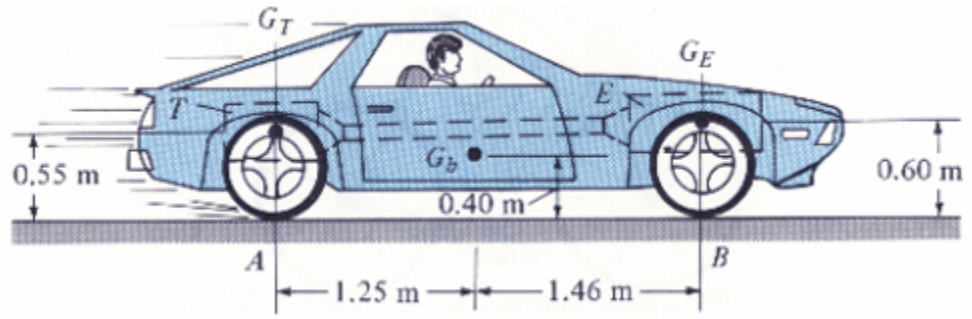
Engineering Dynamics
Homework 6

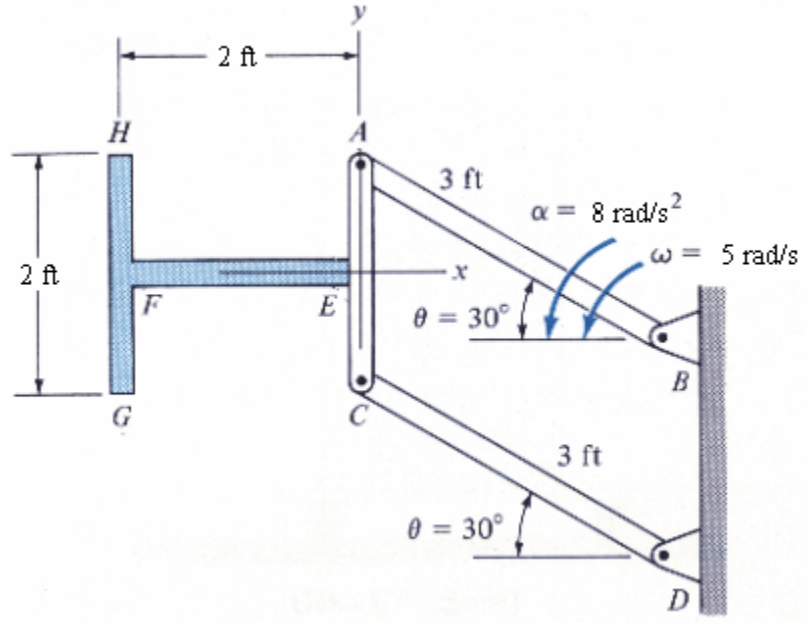
1.
The sports car has been designed so that the 270-kg engine E and the 185-kg transmission T have been placed over the front and rear wheels, respectively. Their mass centers are located at G_E and G_T. The remaining 470-kg mass of the body and frame is located at G_b. If power is supplied to the rear wheels only, determine the shortest time it takes the car to reach a speed of 80 km/h, starting from rest. The front wheels are free rolling, and the coefficient of friction between the wheels and the road is μ=0.4 . Neglect the mass of the wheels and the driver.



t = _____s

2.

The two 3-lb rods *EF* and *GH* are fixed (welded) to the link *AC* at *E*. Determine the internal axial force E_x shear force E_y and moment M_E which the bar *AC* exerts on *FE* at *E* is at the instant θ=30º link *AB* has an angular velocity ω=5 rad/s and an angular acceleration α = 8 rad /s^2 as shown.



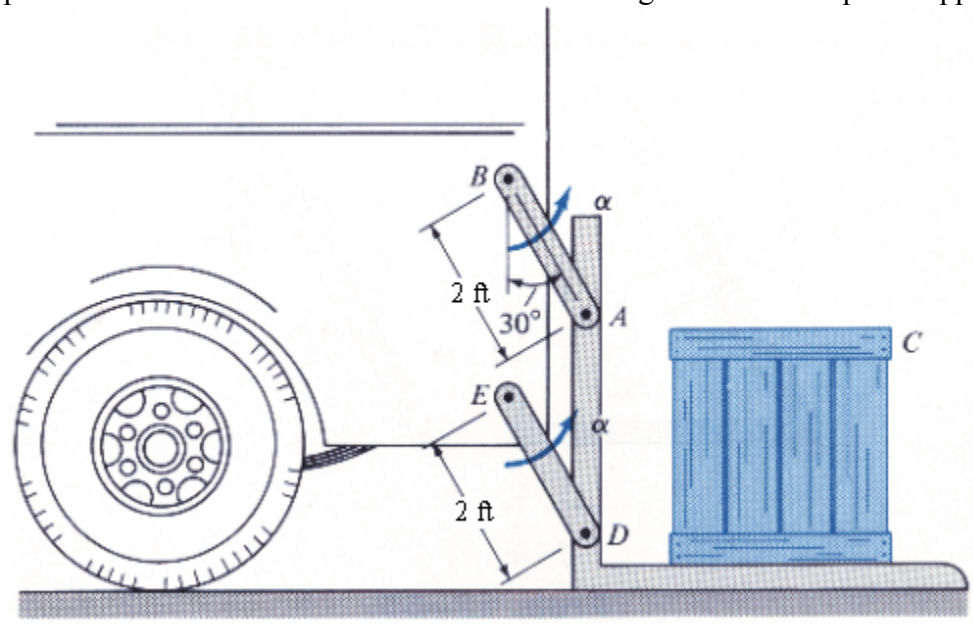
$|E_x|$ = _____ lb

$|E_y|$ = _____ lb

$|M_E|$ = _____ ft lb

3.

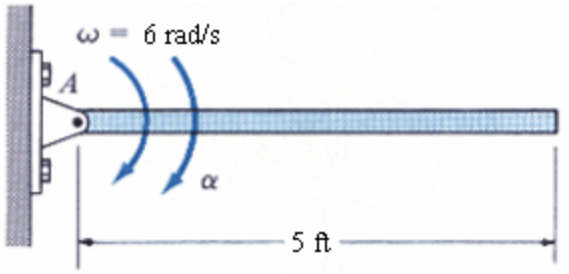
The crate *C* has a weight of 156 lb and rests on the floor of a truck elevator for which μ=0.35 . Determine the largest initial angular acceleration α, starting from rest, which the parallel links *AB* and *DE* can have without causing the crate to slip. No tipping occurs.



$|\alpha|$ = _____ rad/s^2

4.

The 8-lb rod is pin-connected to its support and has an angular velocity $\omega = 6$ rad/s when it is in the horizontal position shown. Determine its angular acceleration and the magnitude of the horizontal and vertical components of reaction which the pin exerts on the rod at this instant.

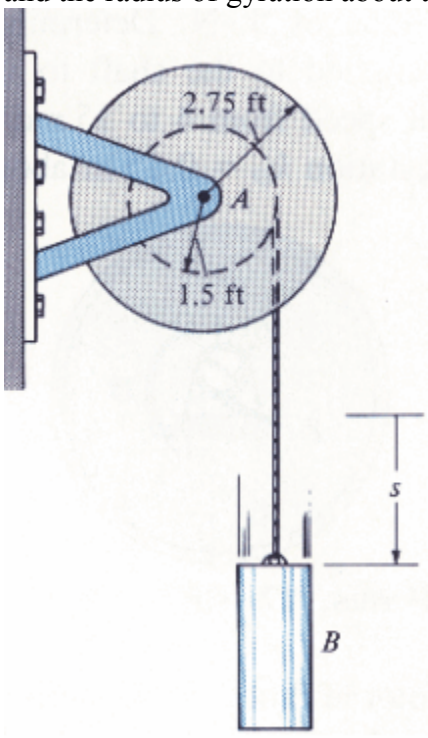


$|\alpha|$ = _____ rad/s^2

$|A_x|$ = _____ lb

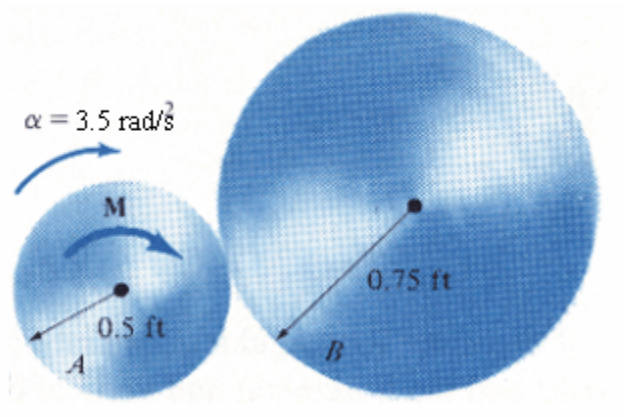
$|A_y|$ = _____ lb

5.
The cord is wrapped around the inner core of the spool. If a 4-lb weight B is suspended from the cord and released from rest, determine the spool's angular velocity when the weight has descended 8 ft. Neglect the mass of the cord. The spool has a weight of 180 lb and the radius of gyration about the axle A is k_A = 1.45 ft.



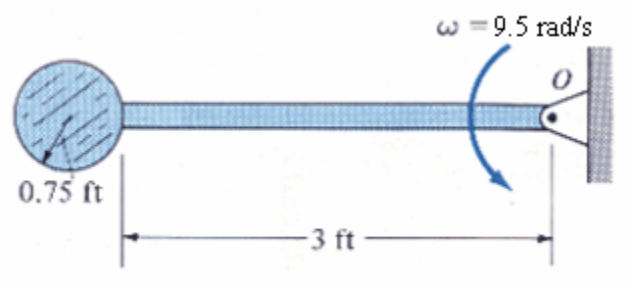
$|\omega|$ = _____ rad/s

6.
Disk *A* has a weight of 4.5 lb and disk *B* has a weight of 18 lb. If no slipping occurs between them, determine the couple **M** which must be applied to disk *A* to give it an angular acceleration of 3.5 rad/s^2.



|**M**| = _____ft lb

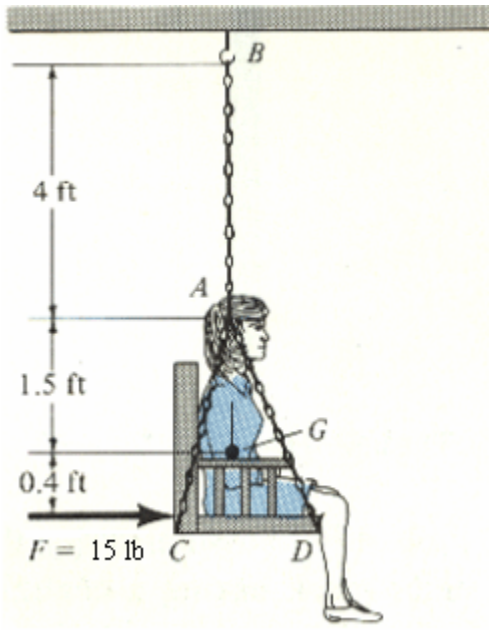
7.
The pendulum consists of a 13.5-lb disk and a 11-lb slender rod. Compute the horizontal and vertical components of reaction that the pin O exerts on the rod just as it passes the horizontal position, at which time its angular velocity is ω=9.5 rad/s.



O_x = _____ lb

O_y = _____ lb

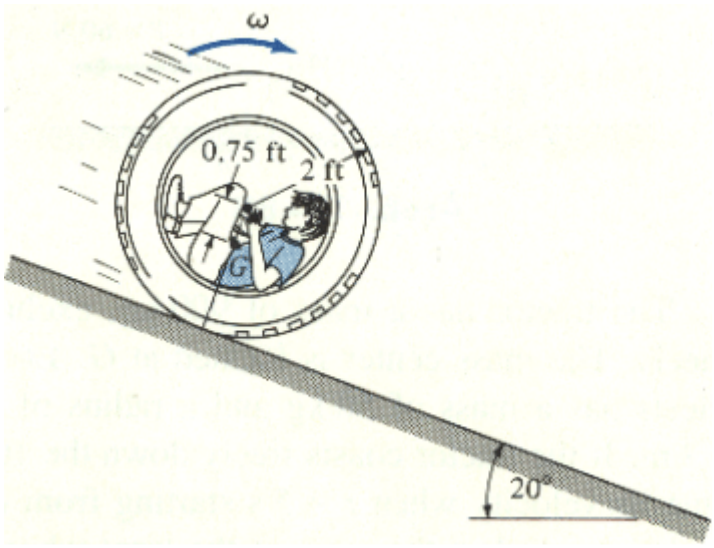
8.
A woman sits in a rigid position in the middle of the swing. The combined weight of the woman and swing is 160 lb and the radius of gyration about the center of mass G is k_G = 4 ft. If a man pushes on the swing with a horizontal force F = 15 lb as shown, determine the initial angular acceleration and the tension in each of the two supporting chains AB. During the motion, assume that the chain segment CAD remains rigid. The swing is originally at rest.



$|\alpha|$ = _____ rad/s^2

T = _____ lb

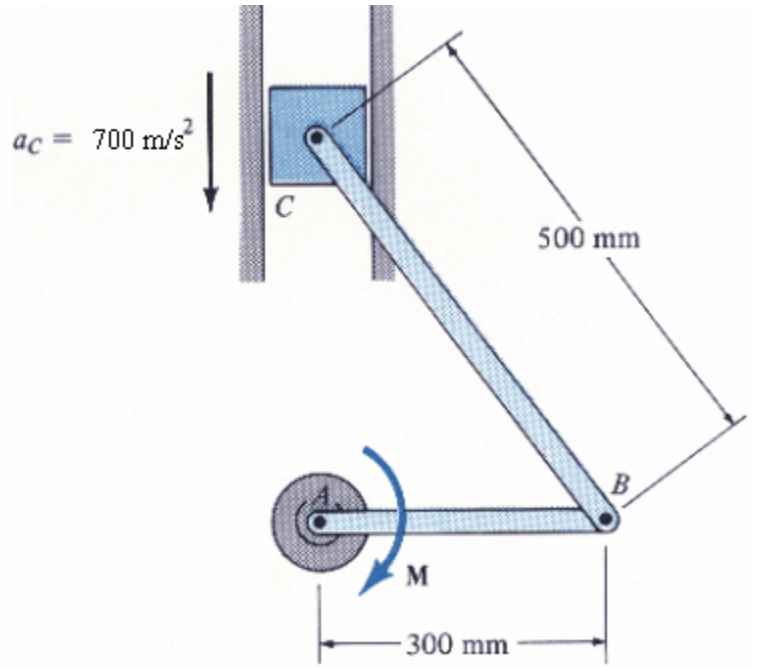
9.
A boy sits snugly inside a large tire such that both the boy and tire have a total weight of 190 lb, a center of mass at G, and a radius of gyration $k_G = 1.65$ ft about G. If the tire rolls freely down the incline, determine the normal and frictional forces it exerts on the ground when it is in the position shown and has an angular velocity of 6.5 rad/s. Assume that the tire does not slip as it rolls.



F_N =_____ lb

F_f =_____ lb

10.
Each of the two links (slender rods) has a mass density of 2.1 kg/m. If the piston has a mass of 2 kg, determine the torque M that must be applied to link AB so that the piston has an acceleration of 700m/s^2 at the instant shown. Originally the system is at rest. Motion occurs in the horizontal plane.



M = _____N m