3/1 During a brake test, the rear-engine car is stopped from an initial speed of 100 km/h in a distance of 50 m. If it is known that all four wheels contribute equally to the braking force, determine the braking force $F$ at each wheel. Assume a constant deceleration for the 1500-kg car.

\[ F = 2890 \text{ N} \]

**Problem 3/1**

3/3 At a certain instant, the 80-lb crate has a velocity of 30 ft/sec up the 20° incline. Calculate the time $t$ required for the crate to come to rest and the corresponding distance $d$ traveled. Also, determine the distance $d'$ traveled when the crate speed has been reduced to 15 ft/sec.

\[ t = 1.615 \text{ sec}, \quad d = 24.2 \text{ ft}, \quad d' = 18.17 \text{ ft} \]

**Problem 3/3**

3/5 The 10-Mg truck hauls the 20-Mg trailer. If the unit starts from rest on a level road with a tractive force of 20 kN between the driving wheels of the truck and the road, compute the tension $T$ in the horizontal drawbar and the acceleration $a$ of the rig.

\[ T = 13.33 \text{ kN}, \quad a = 0.667 \text{ m/s}^2 \]

**Problem 3/5**

3/9 A man pulls himself up the 15° incline by the method shown. If the combined weight of the man and cart is 250 lb, determine the acceleration of the cart if the man exerts a pull of 60 lb on the rope. Neglect all friction and the mass of the rope, pulleys, and wheels.

\[ a = 14.85 \text{ ft/sec}^2 \]

**Problem 3/9**

3/19 A train consists of a 400,000-lb locomotive and one hundred 200,000-lb hopper cars. If the locomotive exerts a friction force of 40,000 lb on the rails in starting the train from rest, compute the forces in couplers 1 and 100. Assume no slack in the couplers and neglect friction.

\[ T_1 = 39,200 \text{ lb}, \quad T_{100} = 392 \text{ lb} \]

**Problem 3/19**

3/26 The system is released from rest with the cable taut. For the friction coefficients $\mu_s = 0.25$ and $\mu_k = 0.20$, calculate the acceleration of each body and the tension $T$ in the cable. Neglect the small mass and friction of the pulleys.

**Problem 3/26**
3/54 The standard test to determine the maximum lateral acceleration of a car is to drive it around a 200-ft-diameter circle painted on a level asphalt surface. The driver slowly increases the vehicle speed until he is no longer able to keep both wheel pairs straddling the line. If this maximum speed is 35 mi/hr for a 3000-lb car, determine its lateral acceleration capability $a_y$ in $g$'s and compute the magnitude $F$ of the total friction force exerted by the pavement on the car tires.

![Diagram of a car driving in a circle](image)

Problem 3/54

$\text{Ans. } a_y = -22.0 \text{ ft/sec}^2$

3/55 The car of Prob. 3/54 is traveling at 25 mi/hr when the driver applies the brakes, and the car continues to move along the circular path. What is the maximum deceleration possible if the tires are limited to a total horizontal friction force of 2400 lb?

![Diagram of a car with braking system](image)

Problem 3/55

3/113 The 2-kg collar is released from rest at $A$ and slides down the inclined fixed rod in the vertical plane. The coefficient of kinetic friction is 0.4. Calculate (a) the velocity $v$ of the collar as it strikes the spring and (b) the maximum deflection $x$ of the spring.

$\text{Ans. (a)} \quad v = 2.56 \text{ m/s}, \quad (b) \quad x = 98.9 \text{ mm}$

![Diagram of a collar sliding down a rod](image)

Problem 3/113

3/107 The 0.5-kg collar $C$ starts from rest at $A$ and slides with negligible friction on the fixed rod in the vertical plane. Determine the velocity $v$ with which the collar strikes end $B$ when acted upon by the 5-N force, which is constant in direction. Neglect the small dimensions of the collar.

$\text{Ans. } v = 2.32 \text{ m/s}$

![Diagram of a collar sliding down a rod with a force applied](image)

Problem 3/107

3/121 The 15-lb cylindrical collar is released from rest in the position shown and drops onto the spring. Calculate the velocity $v$ of the cylinder when the spring has been compressed 2 in.

$\text{Ans. } v = 7.08 \text{ ft/sec}$

![Diagram of a collar dropping onto a spring](image)

Problem 3/121