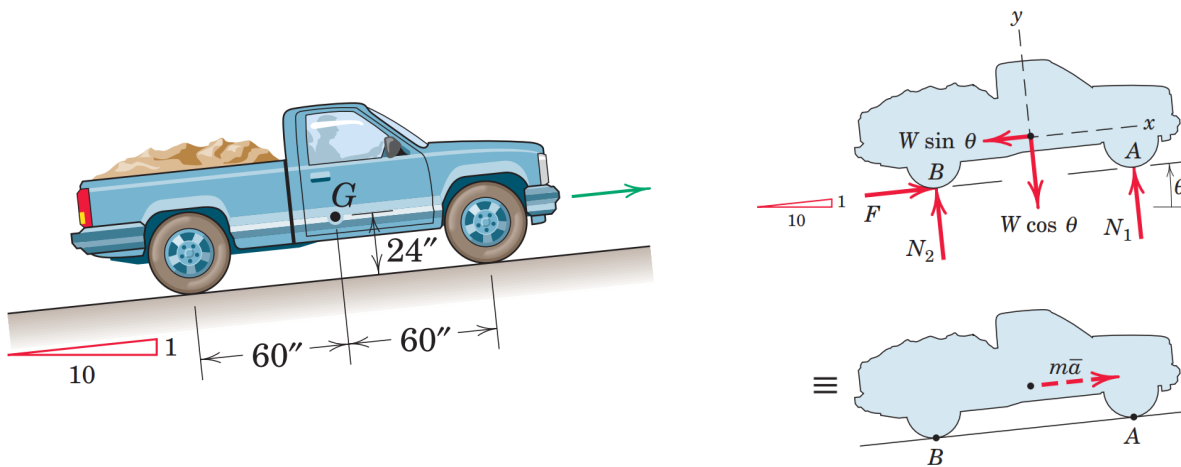


The rear-wheel drive pickup truck weighs 3220 lb and is accelerating at a rate of 4.84 ft/s² up the 10-percent incline. Calculate the resultant normal force N_1 under the front wheels, and the normal force N_2 under the rear driving wheels.



The free-body diagram of the complete truck shows the normal forces N_1 and N_2 , the friction force F in the direction to oppose the slipping of the driving wheels, and the weight W represented by its two components. With $\theta = \tan^{-1} 1/10 = 5.71^\circ$, these components are $W \cos \theta = 3220 \cos 5.71^\circ = 3200$ lb and $W \sin \theta = 3220 \sin 5.71^\circ = 320$ lb. The kinetic diagram shows the resultant, which passes through the mass center and is in the direction of its acceleration. Its magnitude is

$$m\bar{a} = \frac{3220}{32.2}(4.84) = 484 \text{ lb}$$

Applying the three equations of motion, Eqs. 6/1, for the three unknowns gives

$$[\Sigma F_x = m\bar{a}_x] \quad F - 320 = 484 \quad F = 804 \text{ lb} \quad \text{Ans.}$$

$$[\Sigma F_y = m\bar{a}_y = 0] \quad N_1 + N_2 - 3200 = 0 \quad (a)$$

$$[\Sigma M_G = \bar{I}\alpha = 0] \quad 60N_1 + 804(24) - N_2(60) = 0 \quad (b)$$

Solving (a) and (b) simultaneously gives

$$N_1 = 1441 \text{ lb} \quad N_2 = 1763 \text{ lb} \quad \text{Ans.}$$

Alternative Solution. From the kinetic diagram we see that N_1 and N_2 can be obtained independently of one another by writing separate moment equations about A and B .

$$[\Sigma M_A = m\bar{a}d] \quad 120N_2 - 60(3200) - 24(320) = 484(24)$$

$$N_2 = 1763 \text{ lb} \quad \text{Ans.}$$

$$[\Sigma M_B = m\bar{a}d] \quad 3200(60) - 320(24) - 120N_1 = 484(24)$$

$$N_1 = 1441 \text{ lb} \quad \text{Ans.}$$