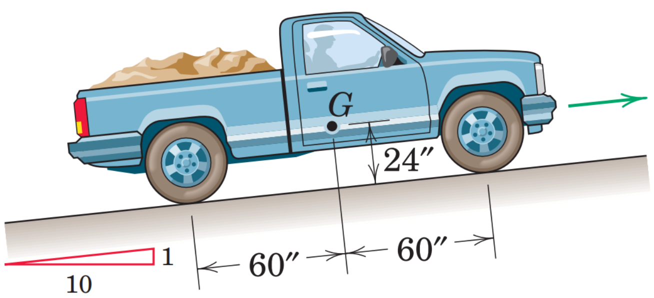
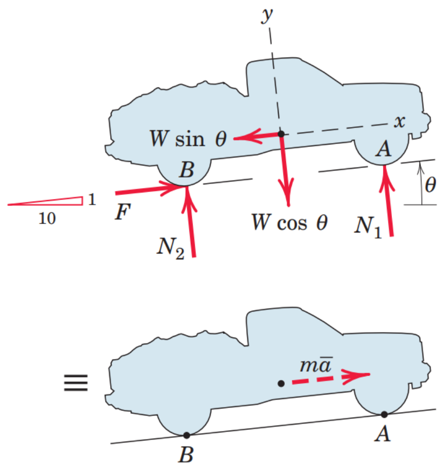
The rear-wheel drive pickup truck weighs 3220 lb and is accelerating at a rate of 4.84 ft/s2 up the 10-percent incline. Calculate the resultant normal force N_1 under the front wheels, and the normal force N_2 under the rear driving wheels. The effective coefficient of friction between the tires and the road is known to be at least 0.80.





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 $\theta = \tan^{-1} 1/10 = 5.71°$, these components are $W \cos\theta = 3220 \cos 5.71° = 3200$ lb and $W \sin\theta = 3220 \sin 5.71° = 320$ 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

$[\Sigma F_x = m\bar{a}_x]$	$F - 320 = 484 \qquad F = 804$ lb	*Ans.*
$[\Sigma F_y = m\bar{a}_y = 0]$	$N_1 + N_2 - 3200 = 0$	(a)
$[\Sigma M_G = \bar{I}\alpha = 0]$	$60N_1 + 804(24) - N_2(60) = 0$	(b)

Solving (a) and (b) simultaneously gives

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

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.

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

$N_2 = 1763$ lb *Ans.*

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

$N_1 = 1441$ lb *Ans.*