UNIVERSITY PHYSICS

Chapter 7 WORK AND KINETIC ENERGY

PowerPoint Image Slideshow

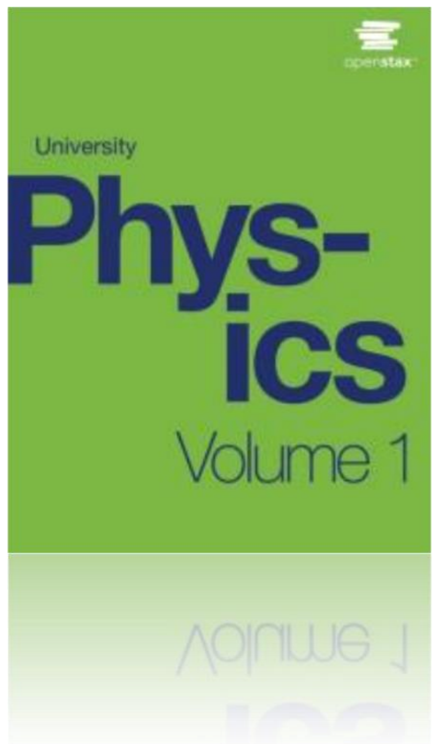

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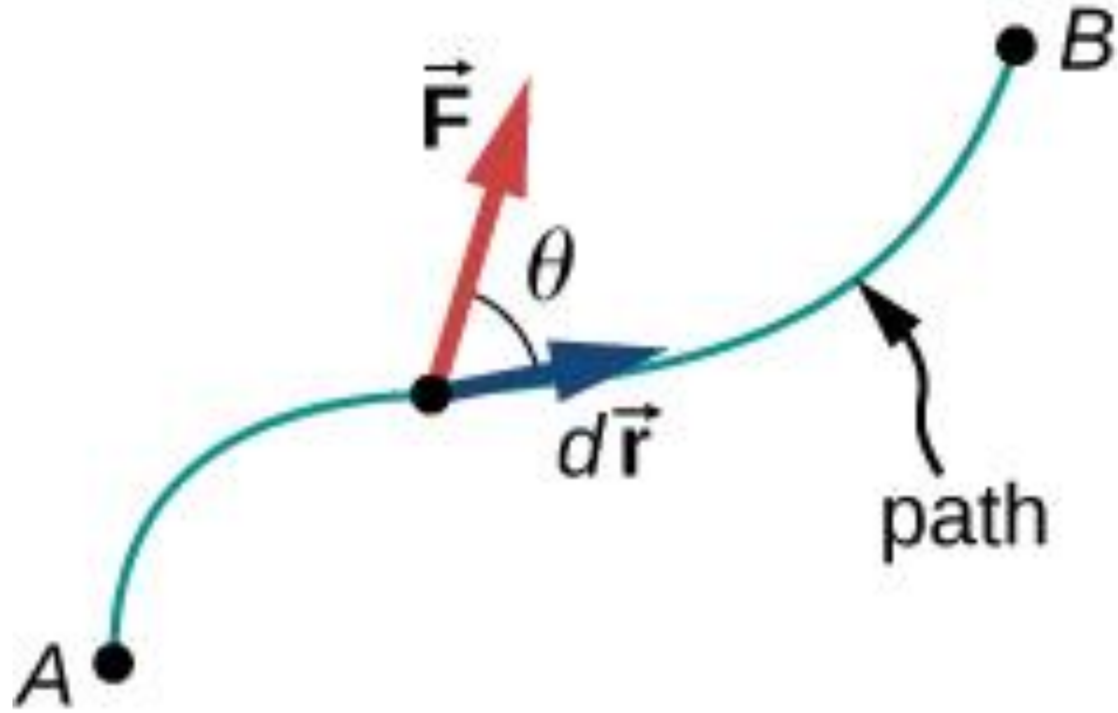
FIGURE 7.1

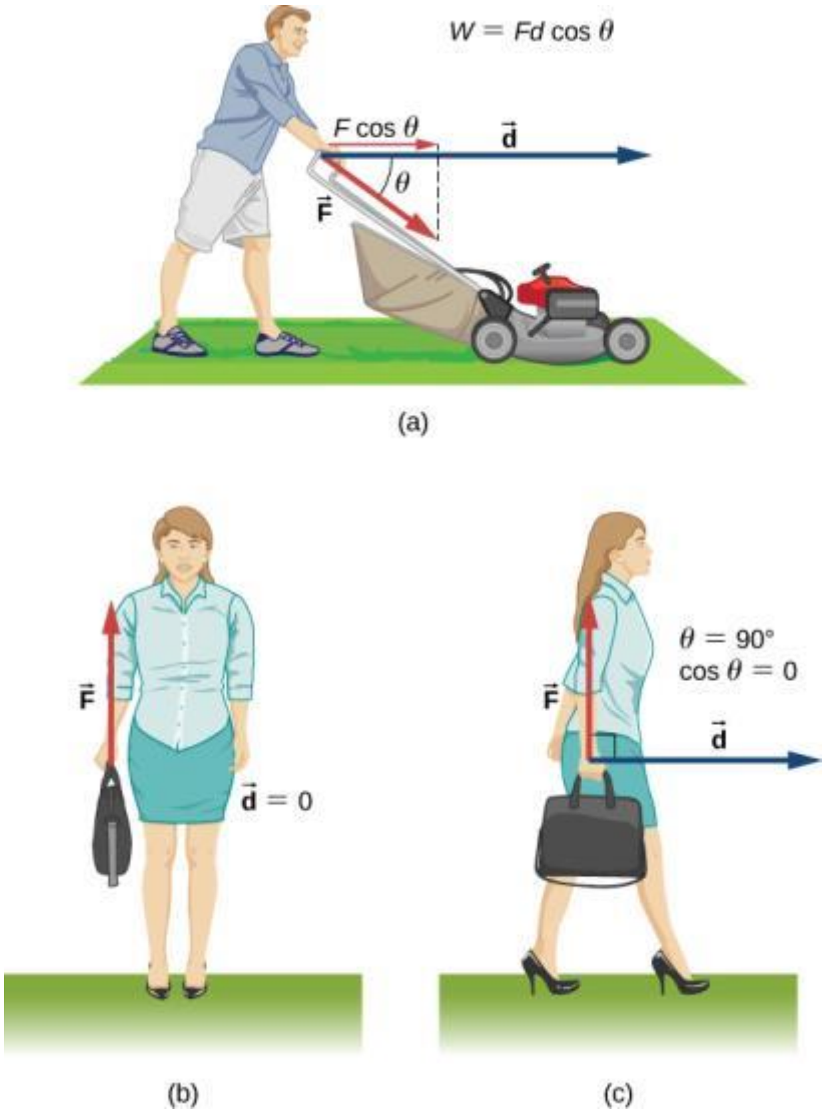
A sprinter exerts her maximum power to do as much work on herself as possible in the short time that her foot is in contact with the ground. This adds to her kinetic energy, preventing her from slowing down during the race. Pushing back hard on the track generates a reaction force that propels the sprinter forward to win at the finish. (credit: modification of work by Marie-Lan Nguyen)

FIGURE 7.2



Vectors used to define work. The force acting on a particle and its infinitesimal displacement are shown at one point along the path between *A* and *B*. The infinitesimal work is the dot product of these two vectors; the total work is the integral of the dot product along the path.

FIGURE 7.3



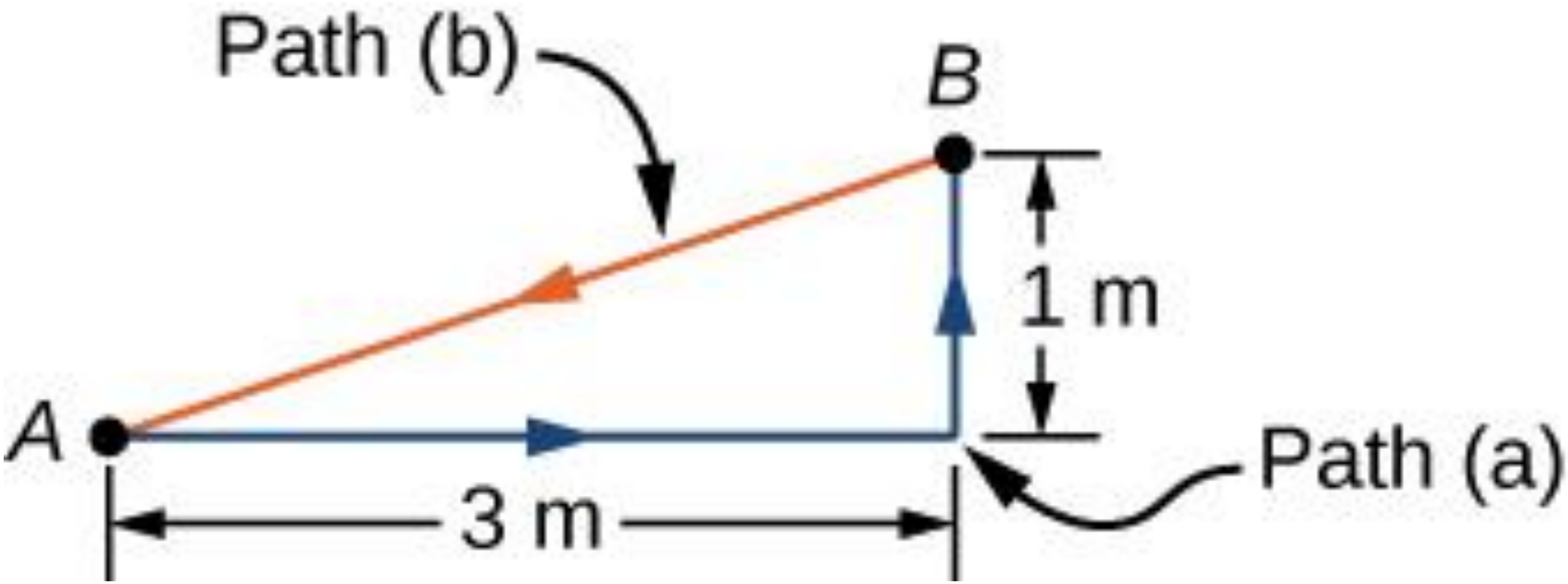
Work done by a constant force.

(a) A person pushes a lawn mower with a constant force. The component of the force parallel to the displacement is the work done, as shown in the equation in the figure.

(b) A person holds a briefcase. No work is done because the displacement is zero.

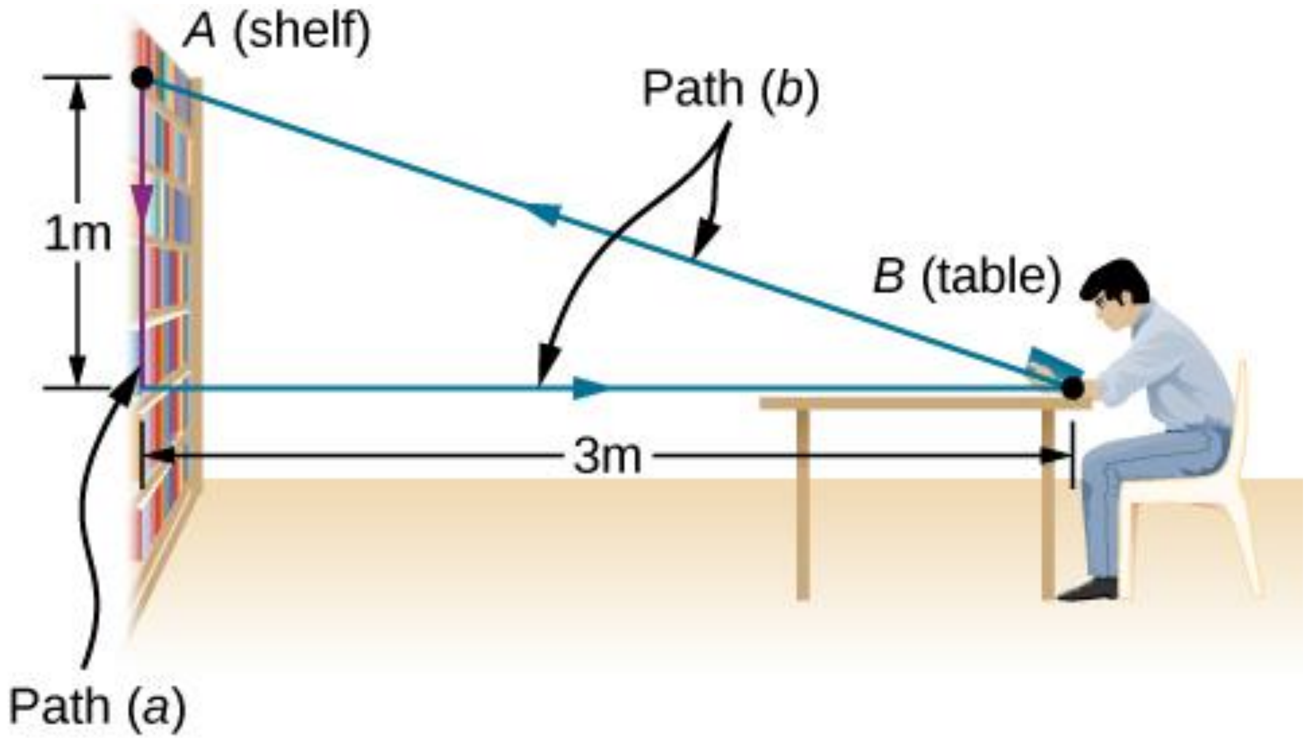
(c) The person in (b) walks horizontally while holding the briefcase. No work is done because $\cos\theta$ is zero.

FIGURE 7.4



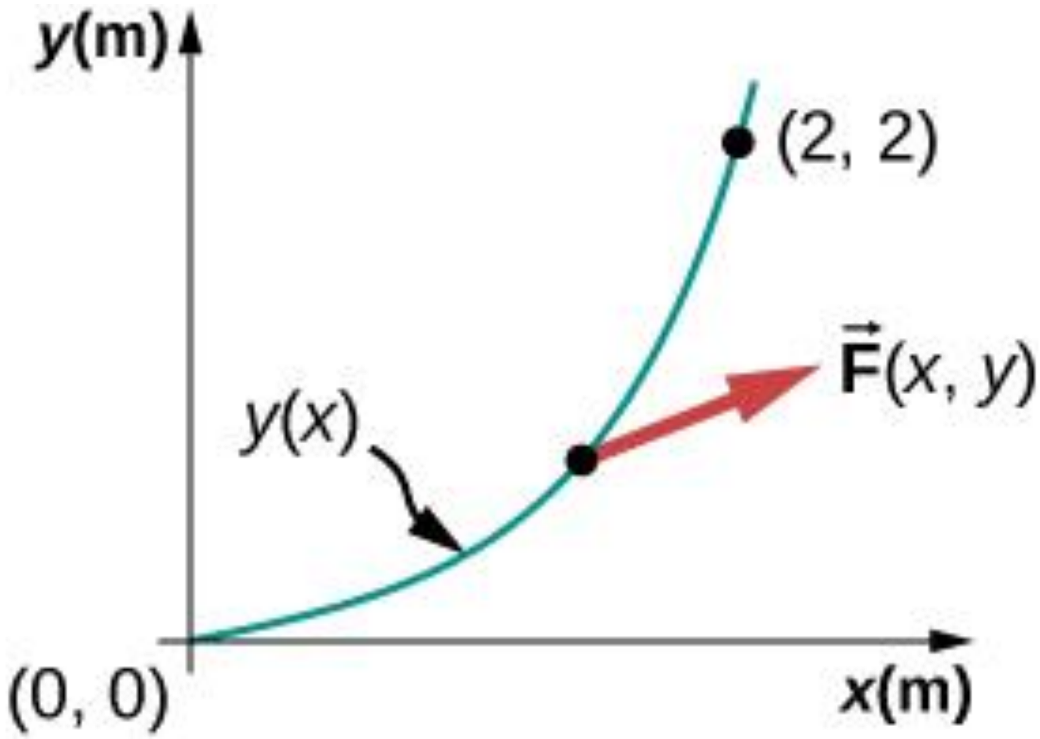
Top view of paths for moving a couch.

FIGURE 7.5



Side view of the paths for moving a book to and from a shelf.

FIGURE 7.6



The parabolic path of a particle acted on by a given force.

FIGURE 7.7

(a) The spring exerts no force at its equilibrium position. The spring exerts a force in the opposite direction to (b) an extension or stretch, and (c) a compression.

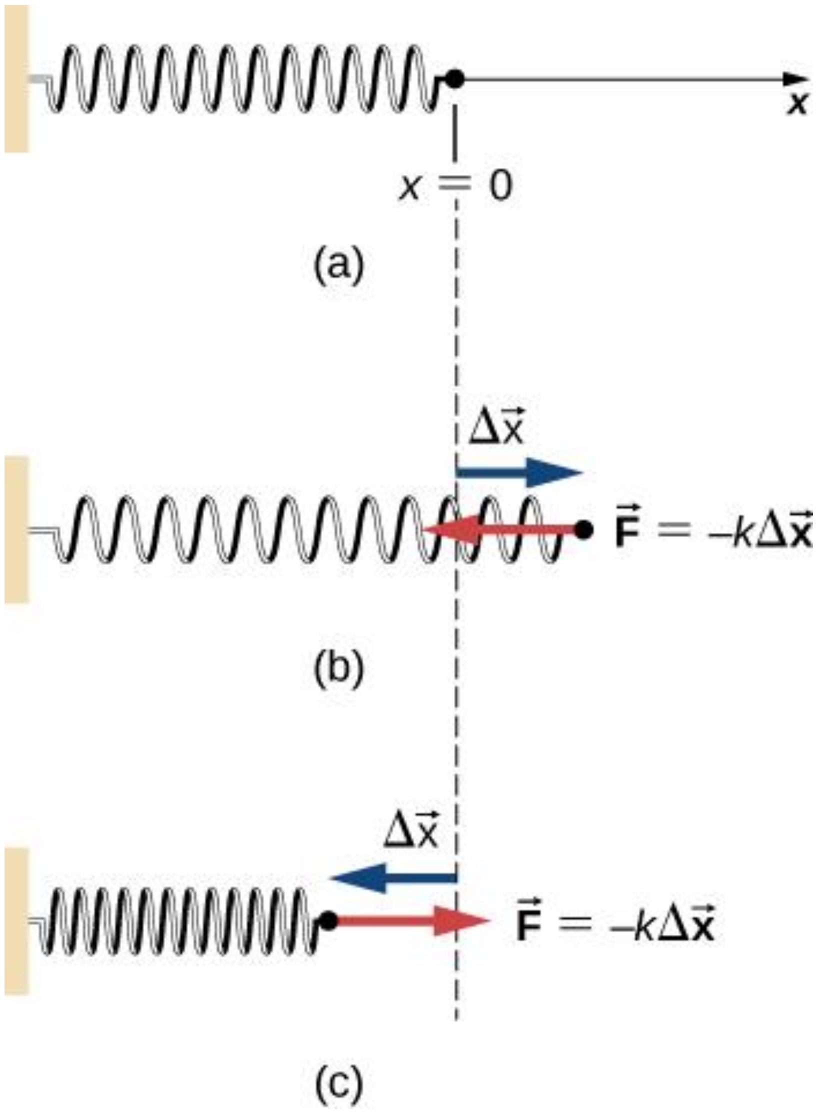
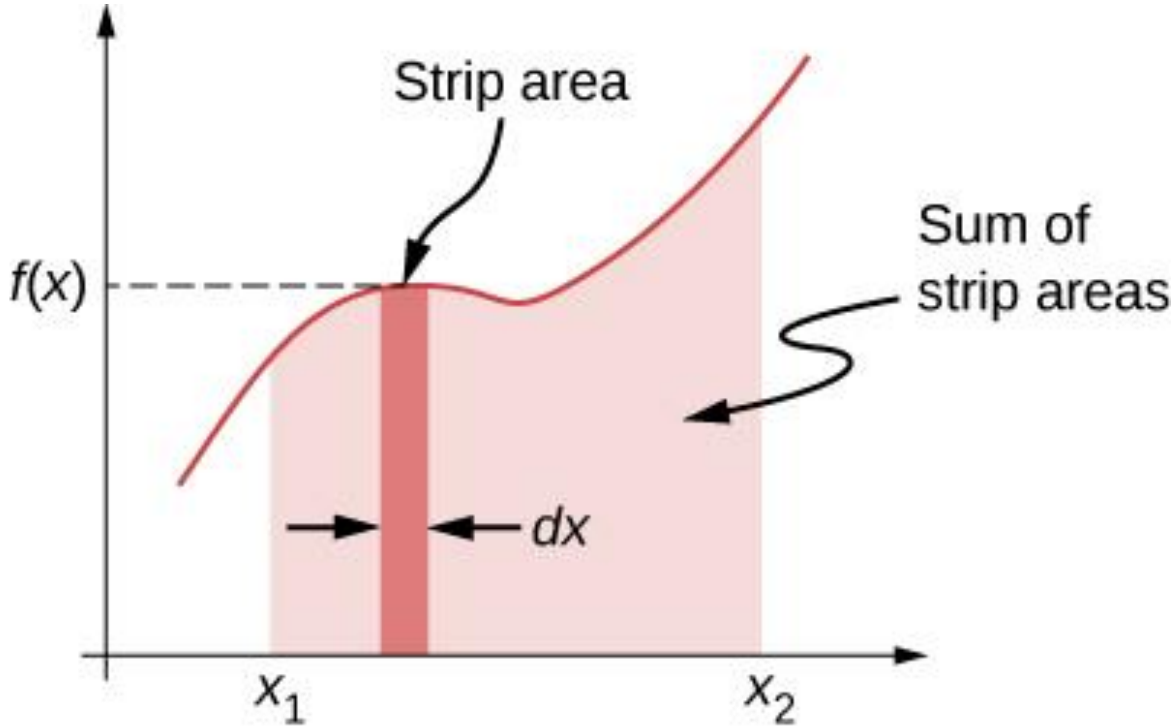
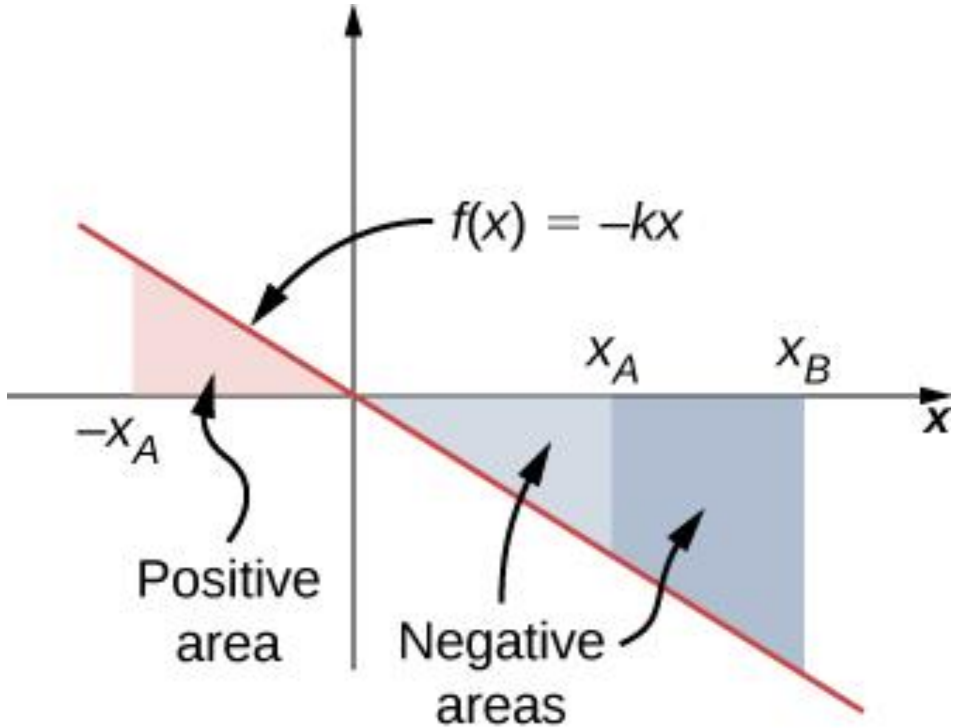


FIGURE 7.8



A curve of $f(x)$ versus x showing the area of an infinitesimal strip, $f(x)dx$, and the sum of such areas, which is the integral of $f(x)$ from x_1 to x_2.

FIGURE 7.9



Curve of the spring force $f(x) = -kx$ versus x, showing areas under the line, between x_A and x_B , for both positive and negative values of x_A . When x_A is negative, the total area under the curve for the integral in **Equation 7.5** is the sum of positive and negative triangular areas. When x_A is positive, the total area under the curve is the difference between two negative triangles.

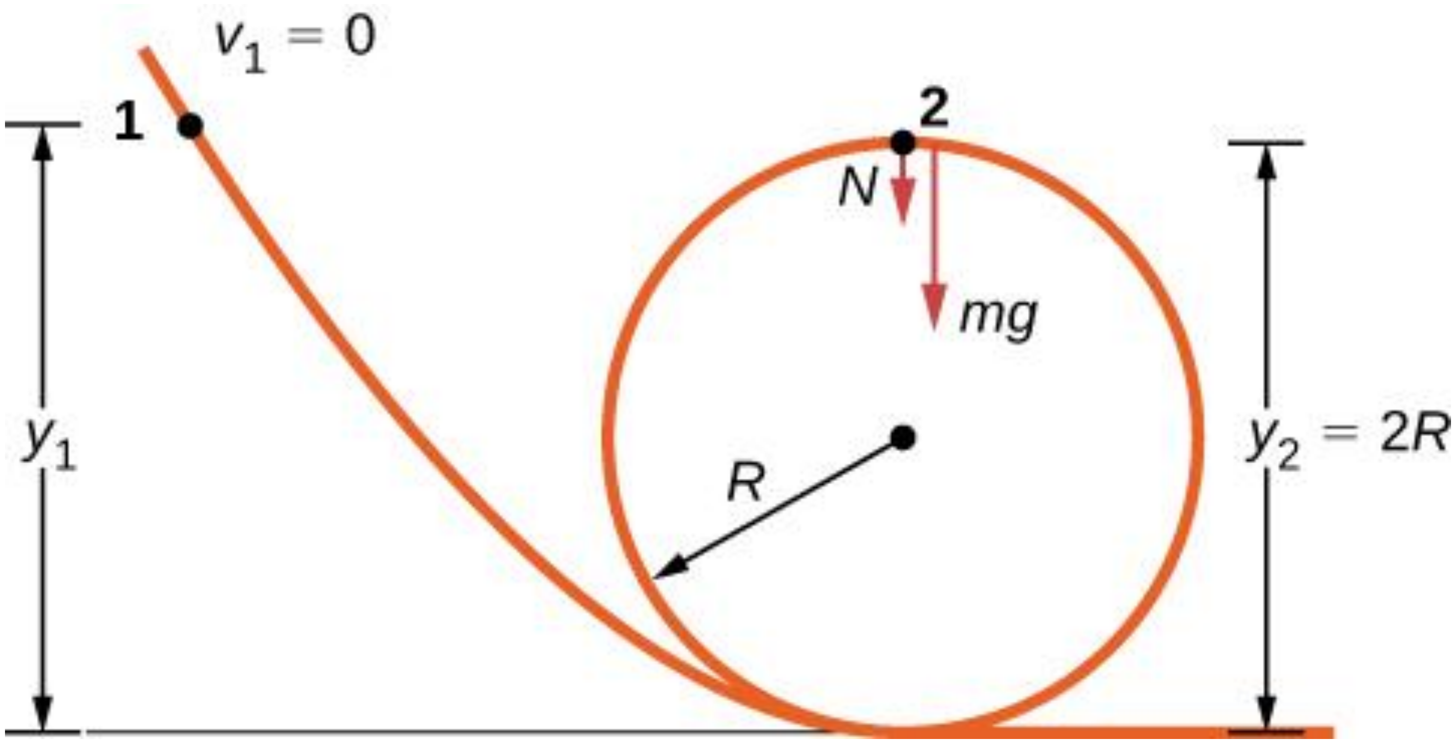
FIGURE 7.10

The possible motions of a person walking in a train are (a) toward the front of the car and (b) toward the back of the car.

FIGURE 7.11

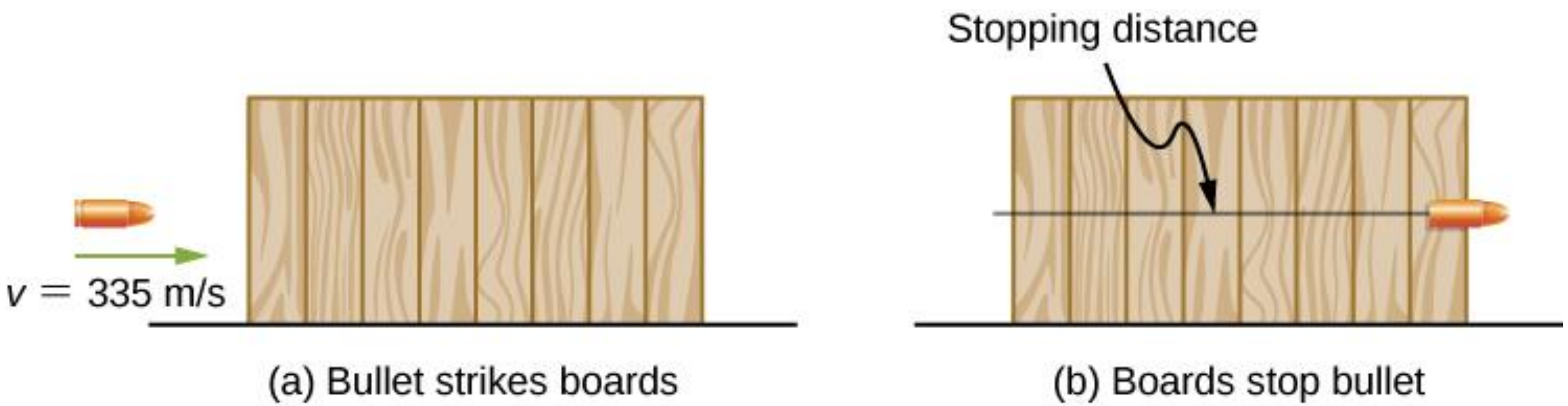
Horse pulls are common events at state fairs. The work done by the horses pulling on the load results in a change in kinetic energy of the load, ultimately going faster. (credit: “Jassen”/ Flickr)

FIGURE 7.12



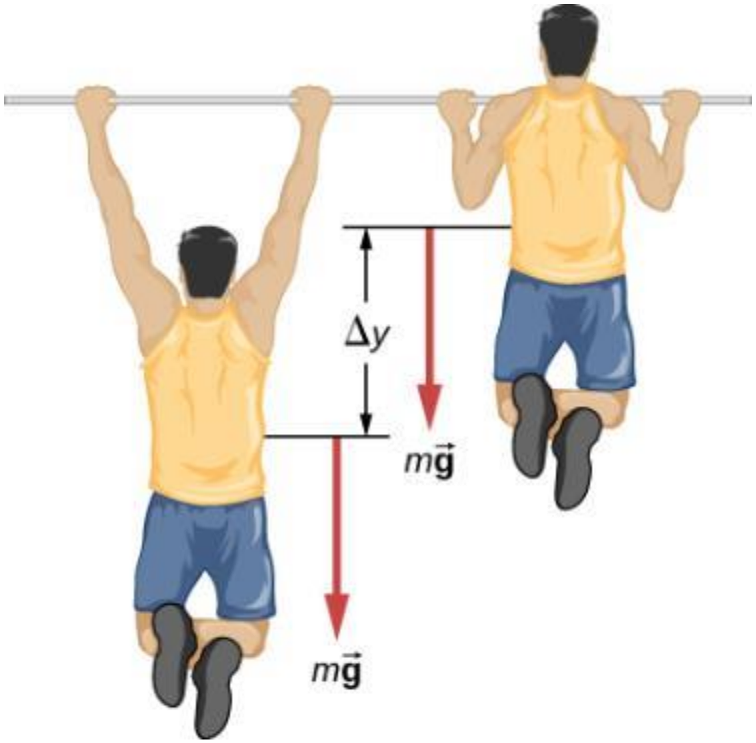
A frictionless track for a toy car has a loop-the-loop in it. How high must the car start so that it can go around the loop without falling off?

FIGURE 7.13



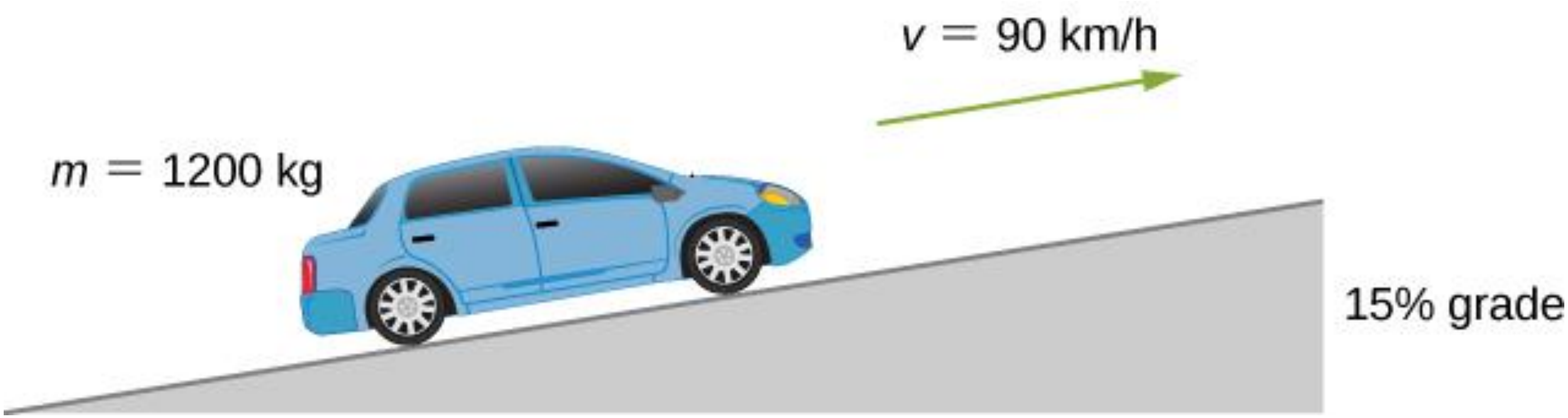
The boards exert a force to stop the bullet. As a result, the boards do work and the bullet loses kinetic energy.

FIGURE 7.14



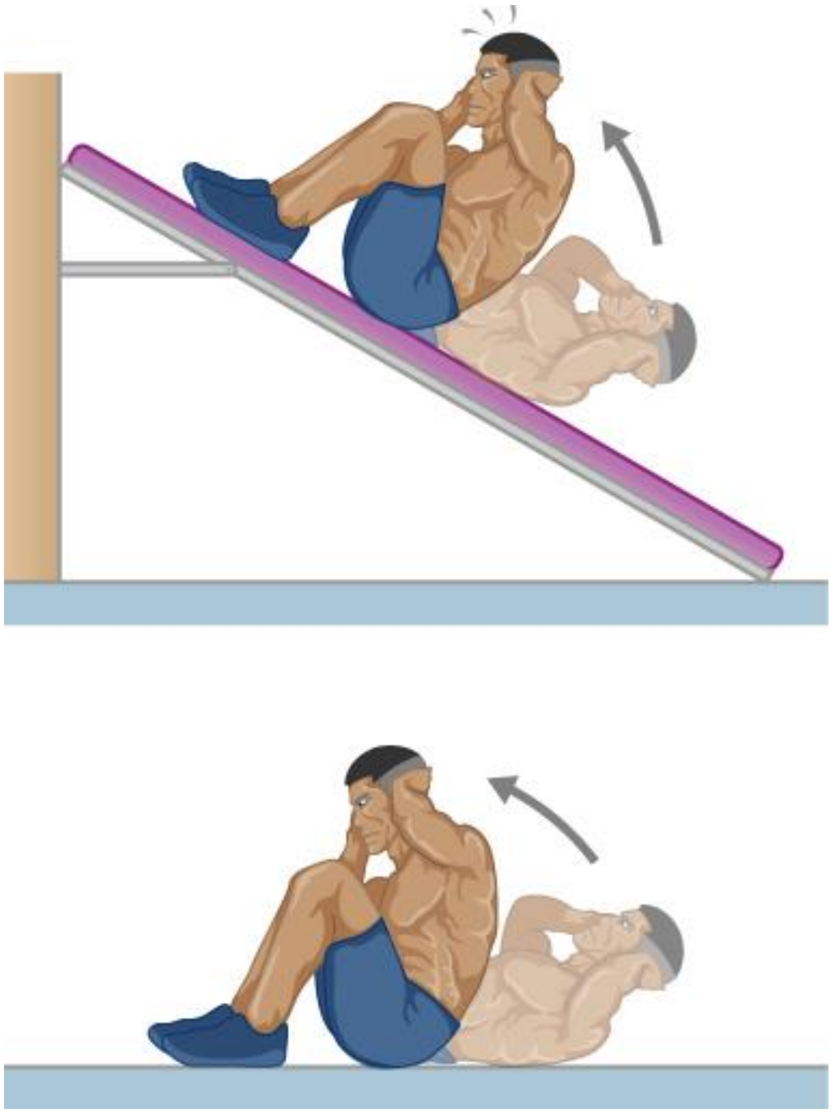
What is the power expended in doing ten pull-ups in ten seconds?

FIGURE 7.15

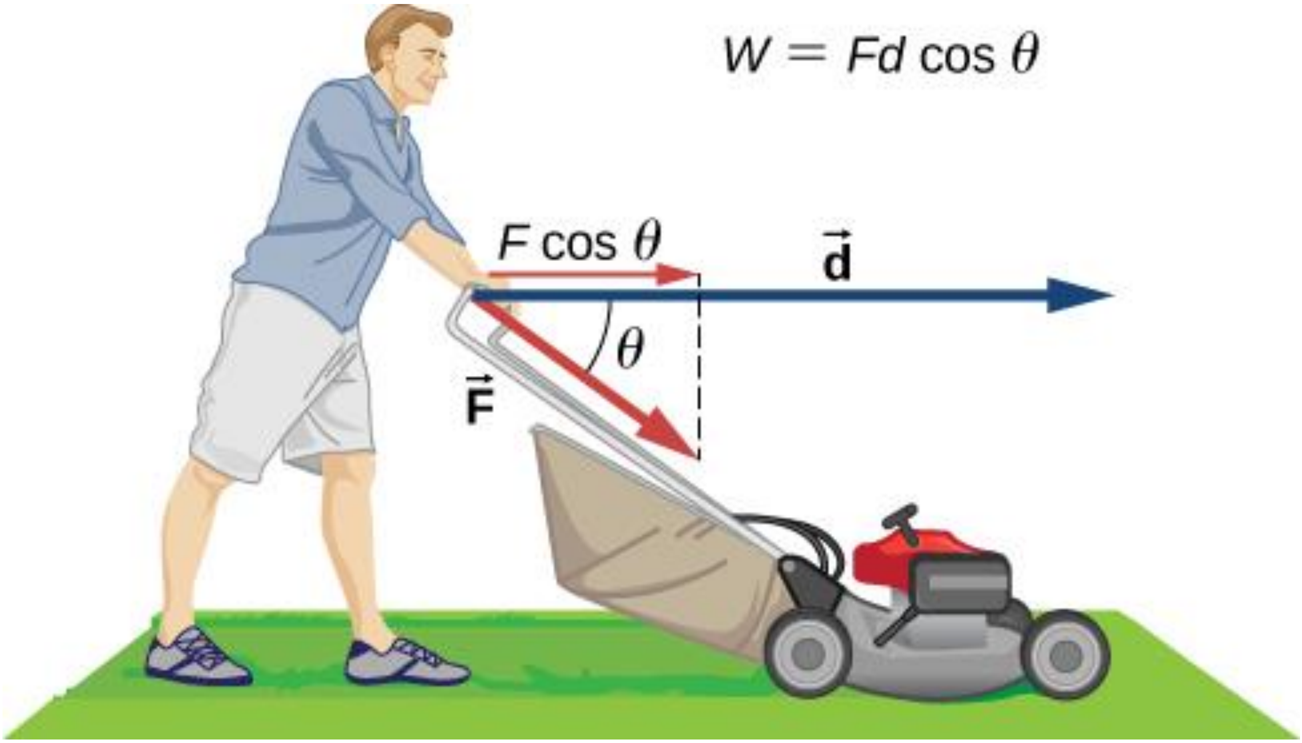


We want to calculate the power needed to move a car up a hill at constant speed.

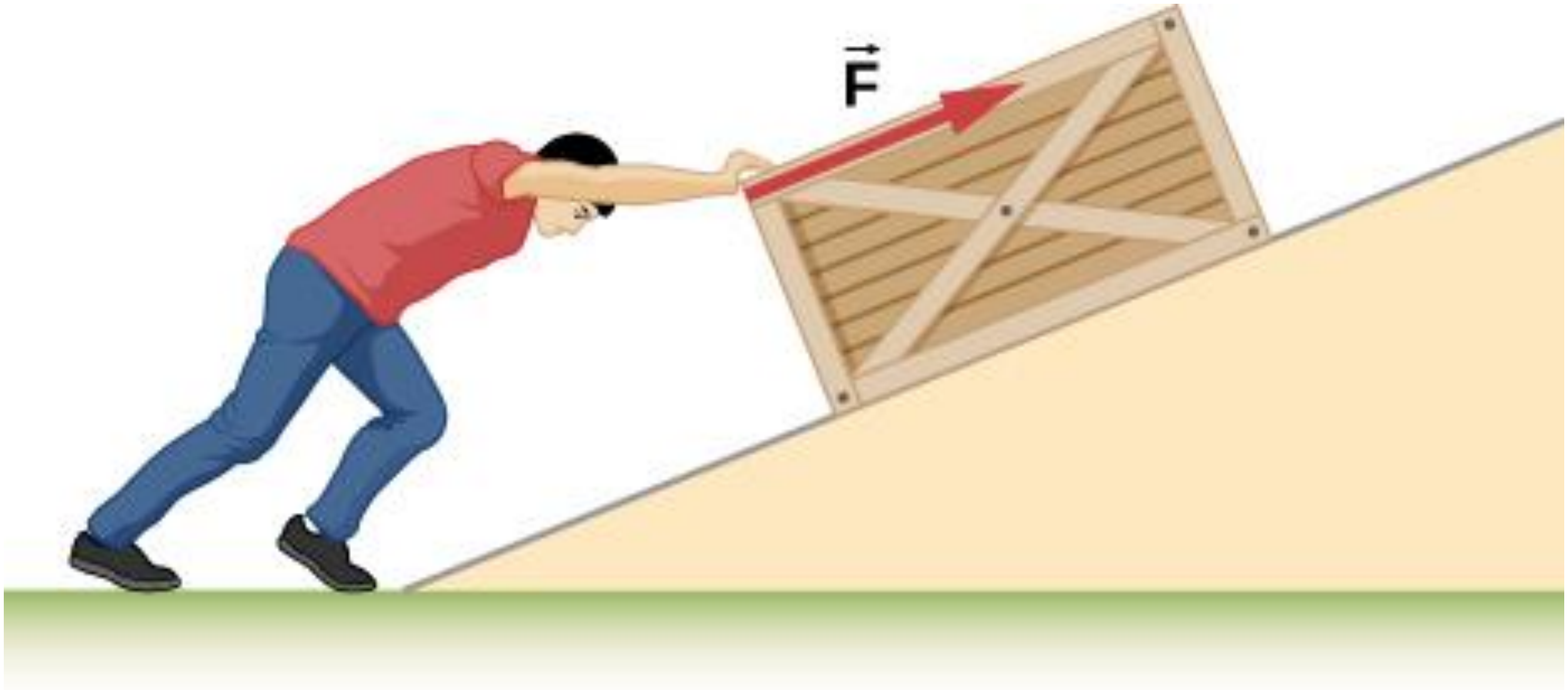
EXERCISE 6



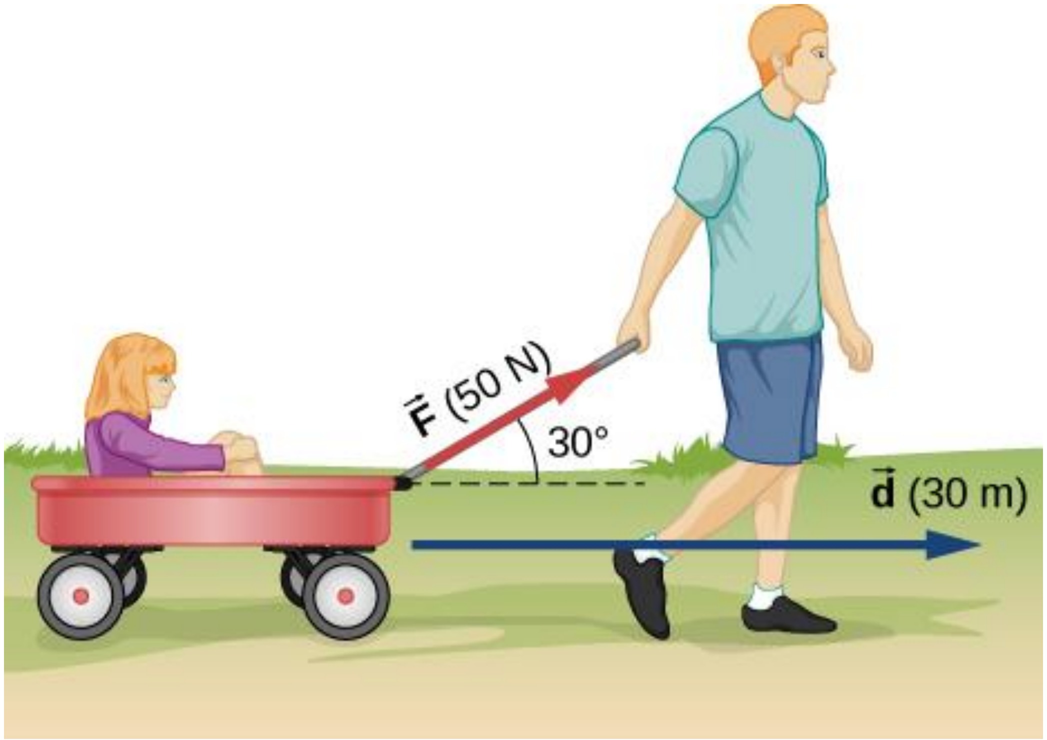
EXERCISE 11



EXERCISE 27



EXERCISE 28



EXERCISE 30

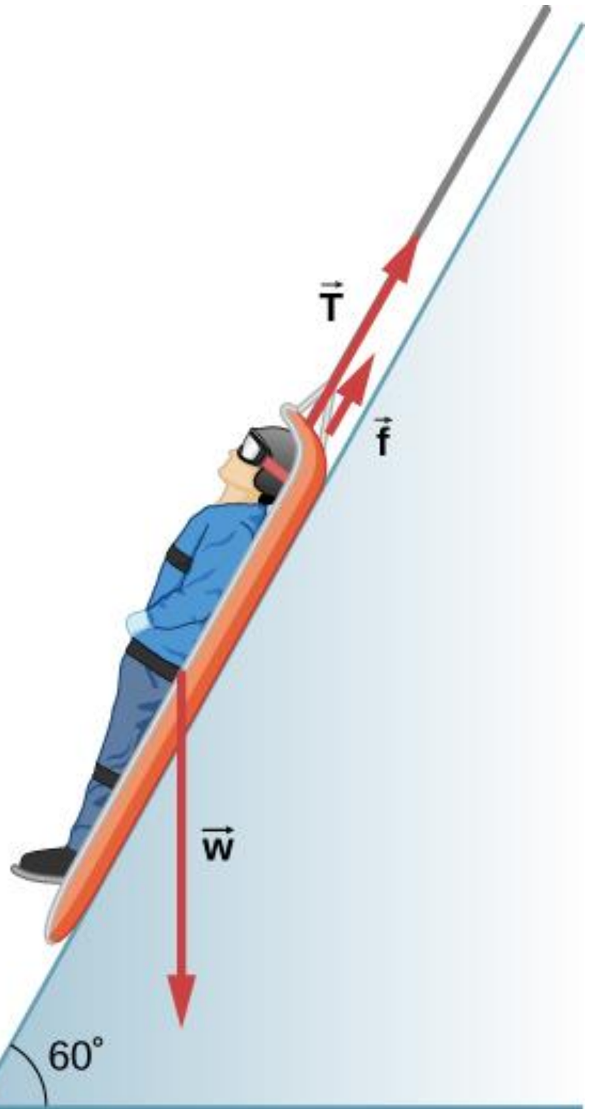
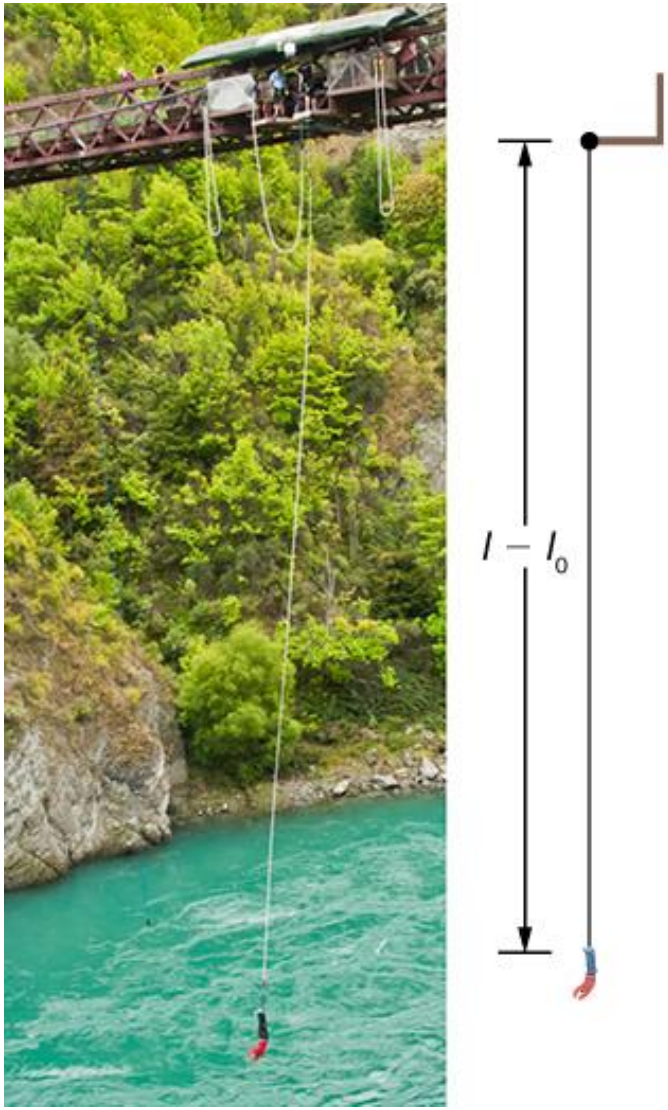
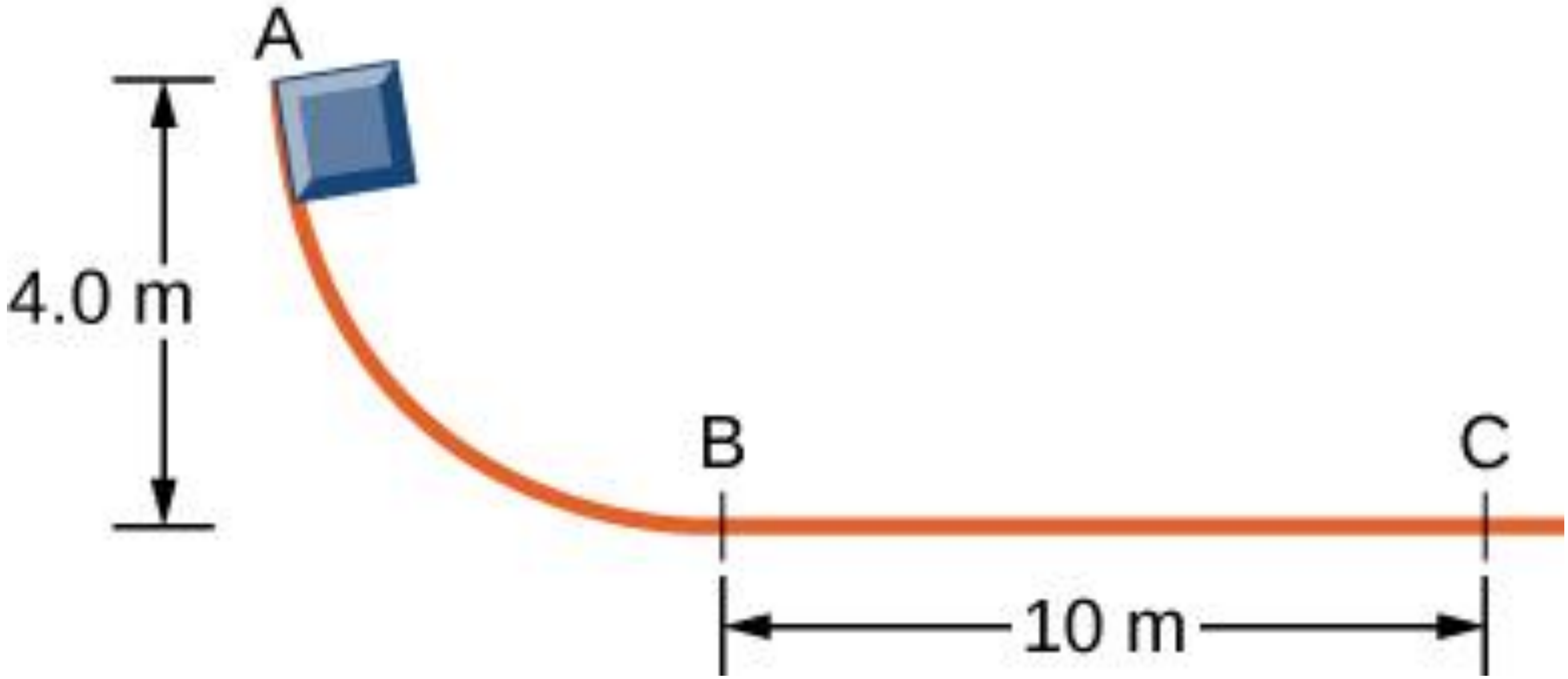


FIGURE 7.16

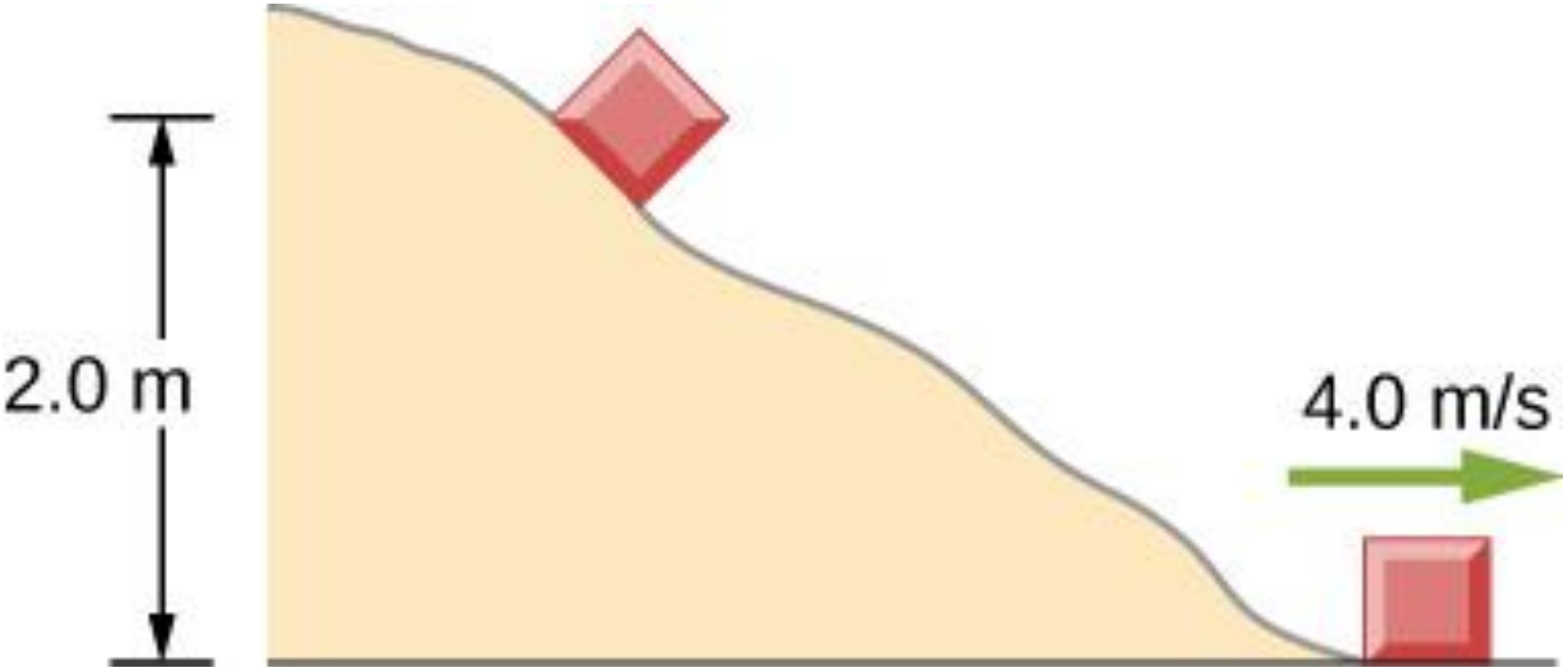


(credit: Graeme Churchard)

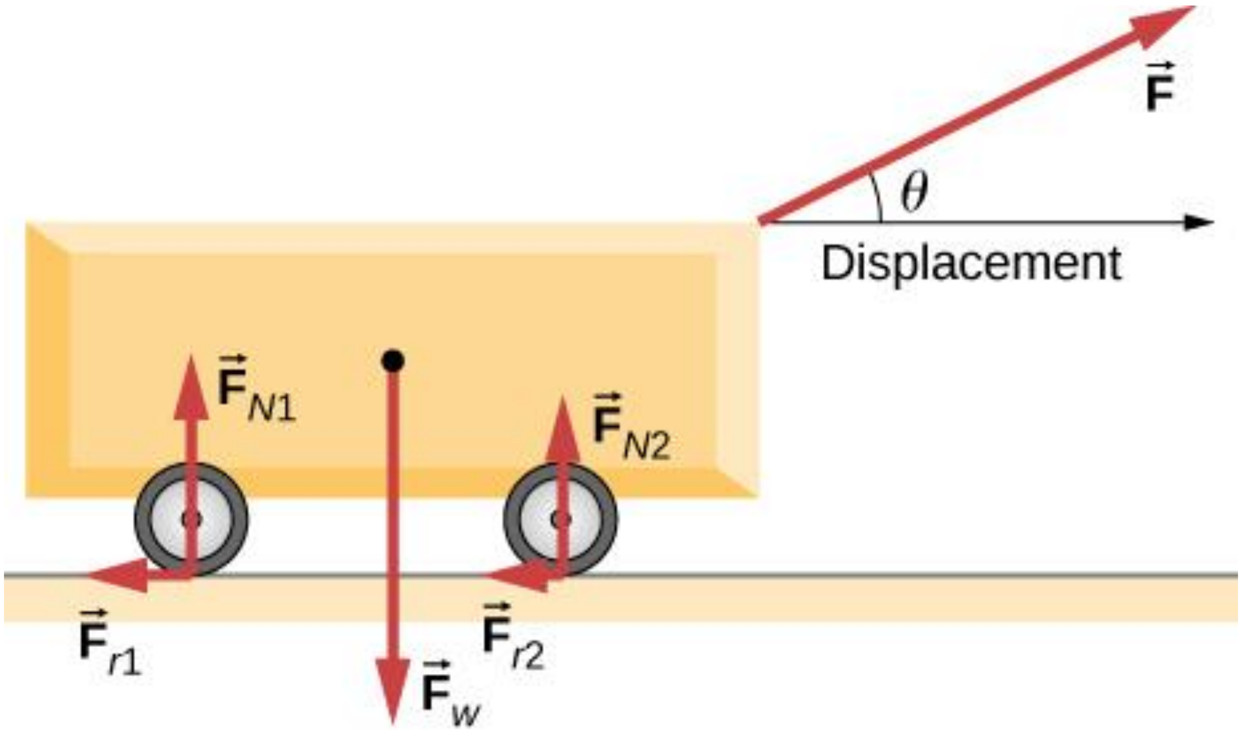
EXERCISE 62



EXERCISE 64

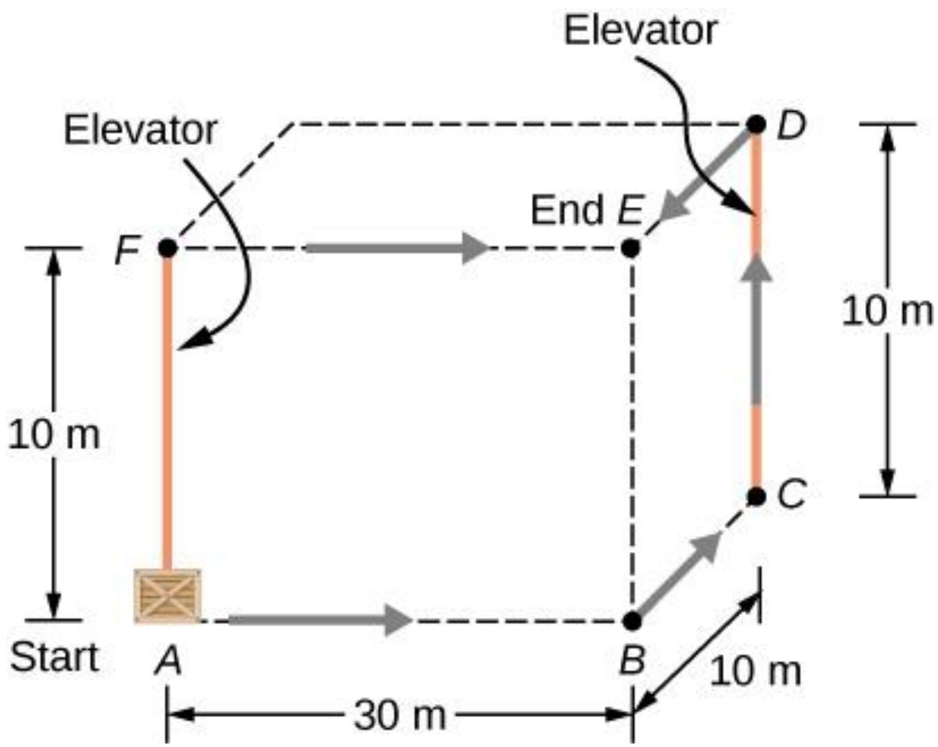


EXERCISE 84

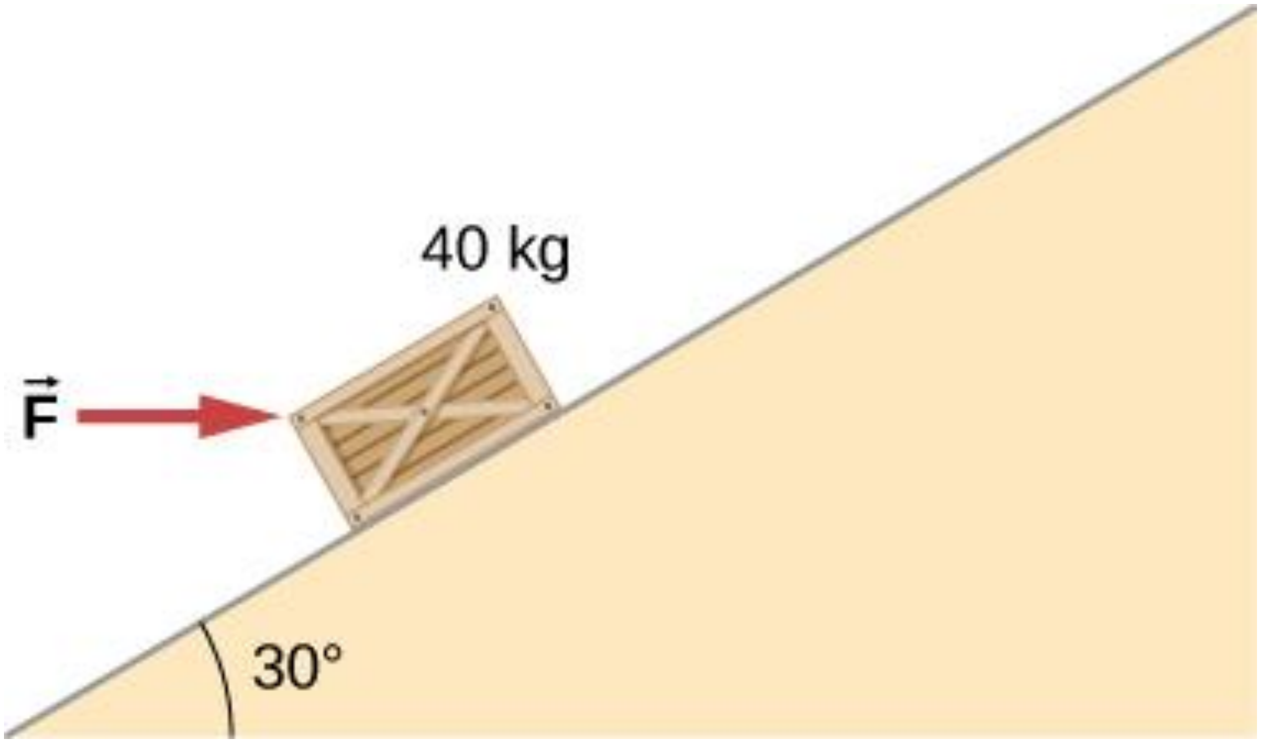


$\vec{F}$
θ
Displacement
$\vec{F}_{N1}$
$\vec{F}_{N2}$
$\vec{F}_{r1}$
$\vec{F}_{r2}$
$\vec{F}_w$

EXERCISE 90



EXERCISE 99



EXERCISE 101