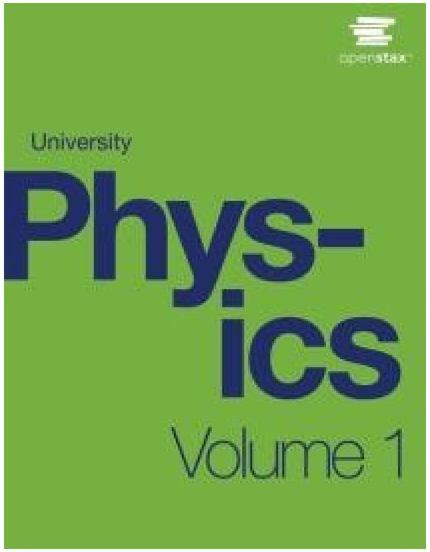
# UNIVERSITY PHYSICS

## Chapter 7 WORK AND KINETIC ENERGY

PowerPoint Image Slideshow

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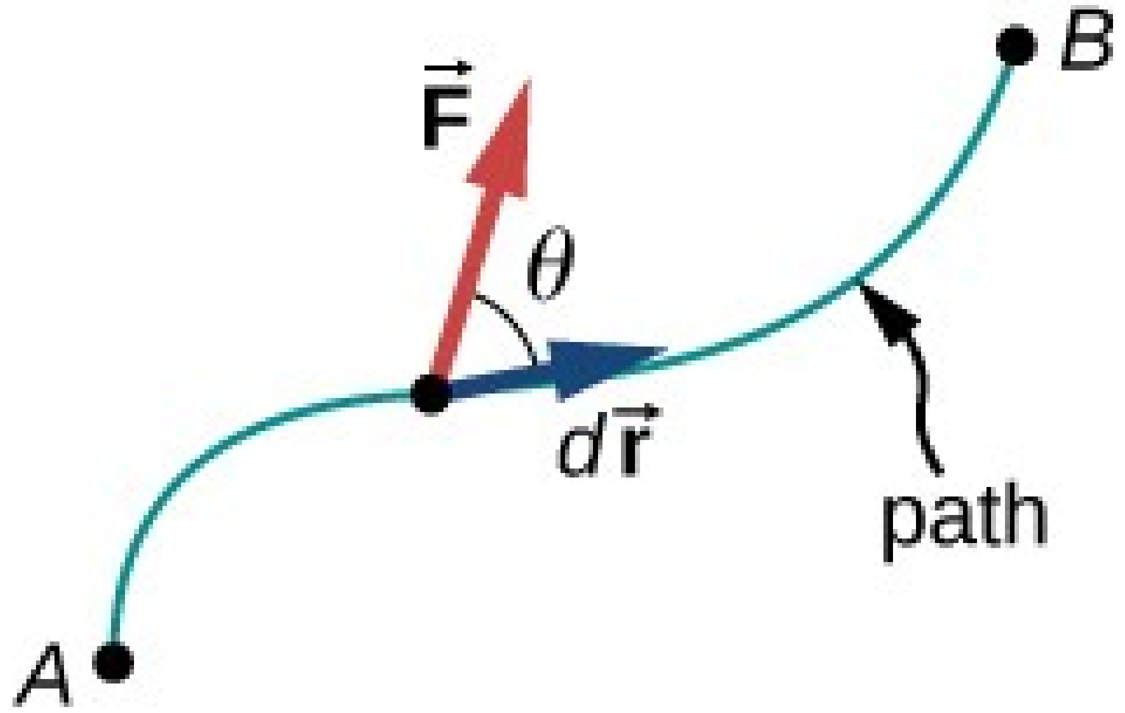
# Work

$$W = \vec{F} \cdot \Delta \vec{X}$$

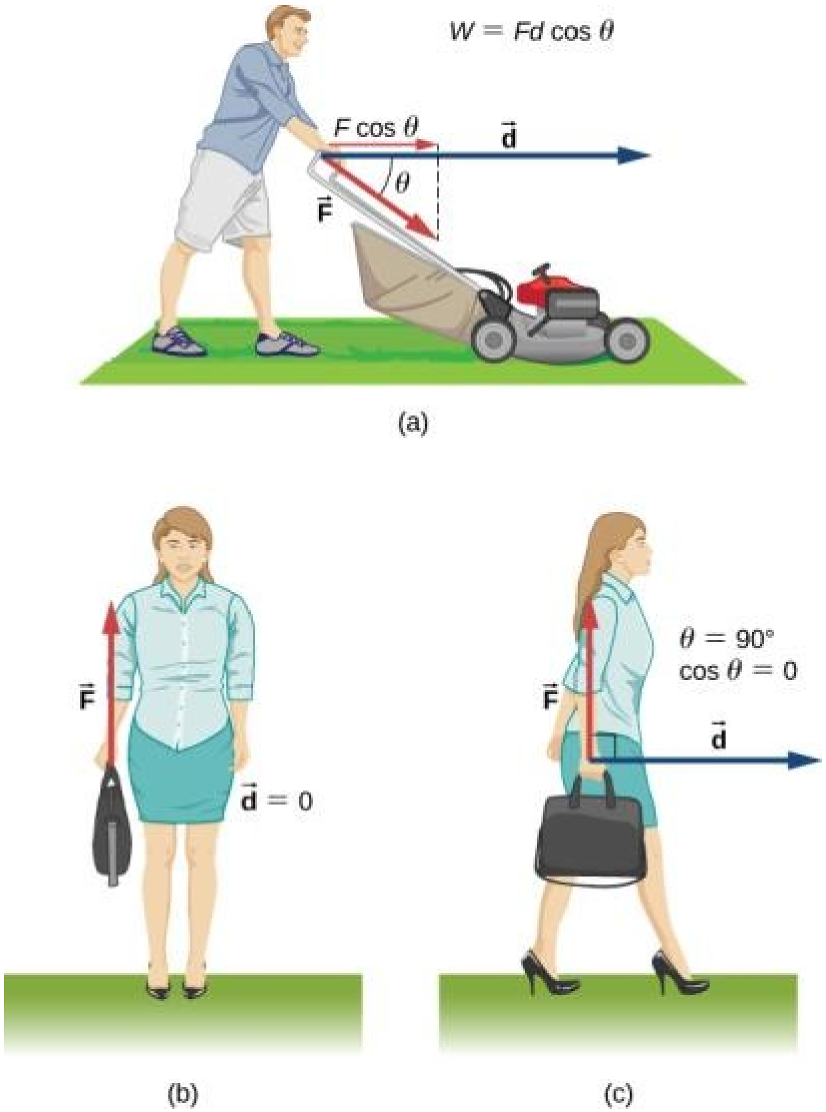
$$W = \int \vec{F} \cdot d\vec{X}$$

# 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



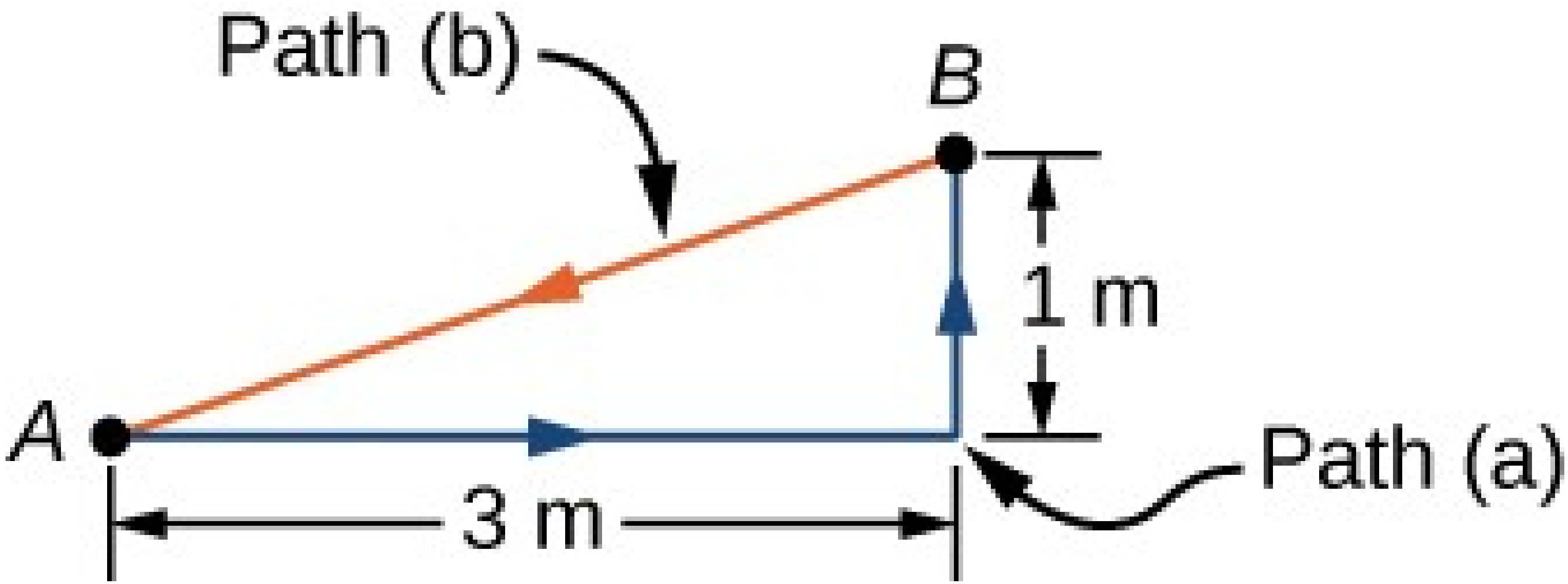

Work done by a constant force.

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.

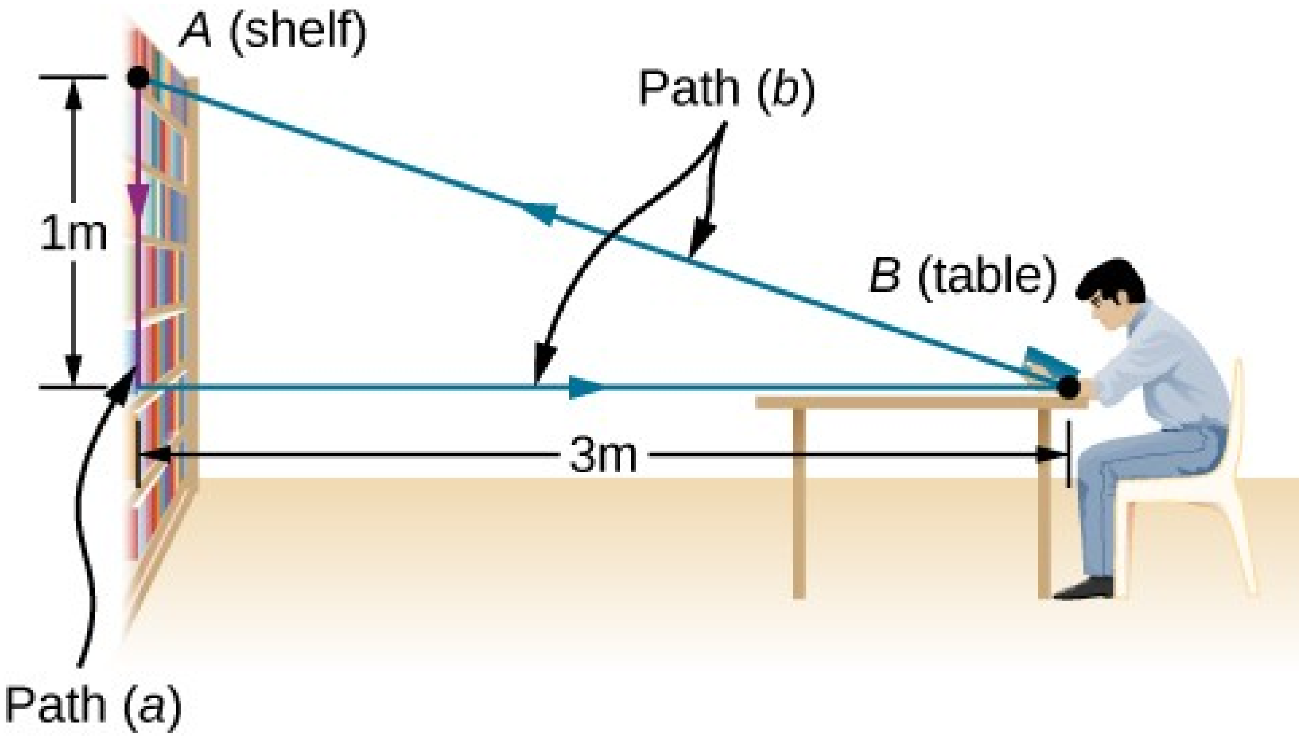
c) The person in (b) walks horizontally while holding the briefcase. No work is done because cos  is zero.

# FIGURE 7.4




Top view of paths for moving a couch.

# FIGURE 7.5

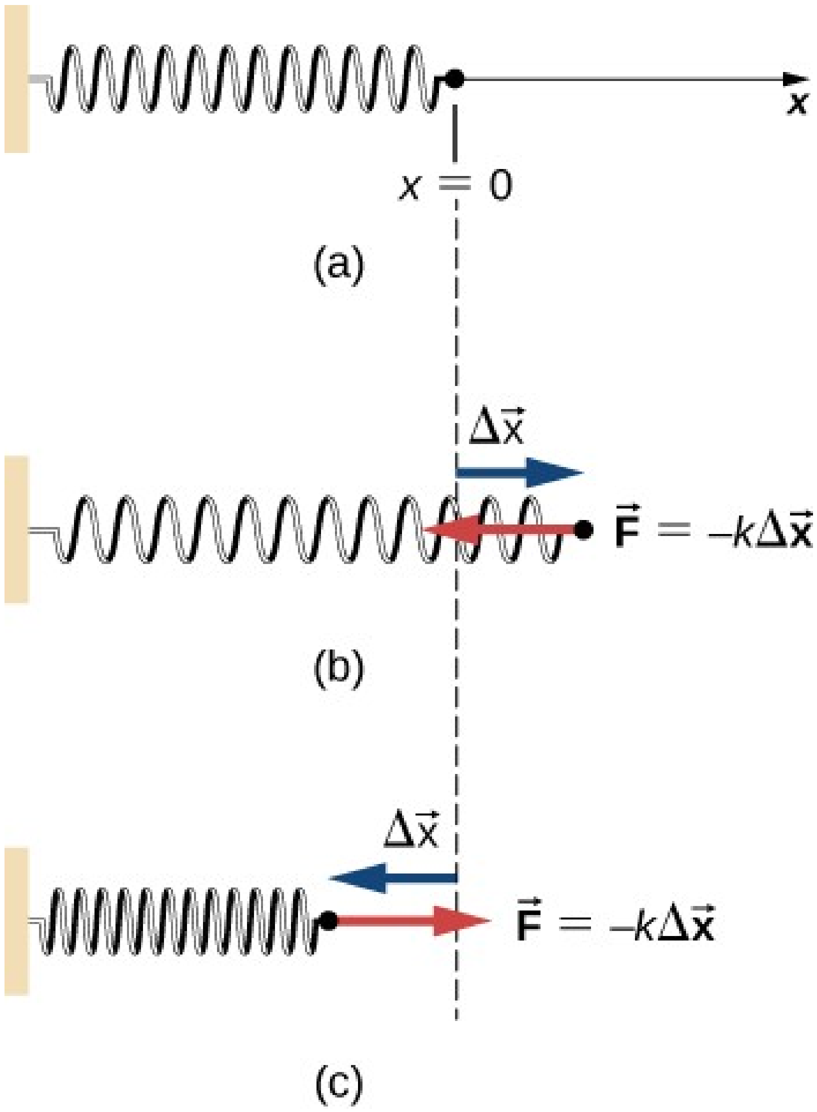



Side view of the paths for moving a book to and from a shelf.

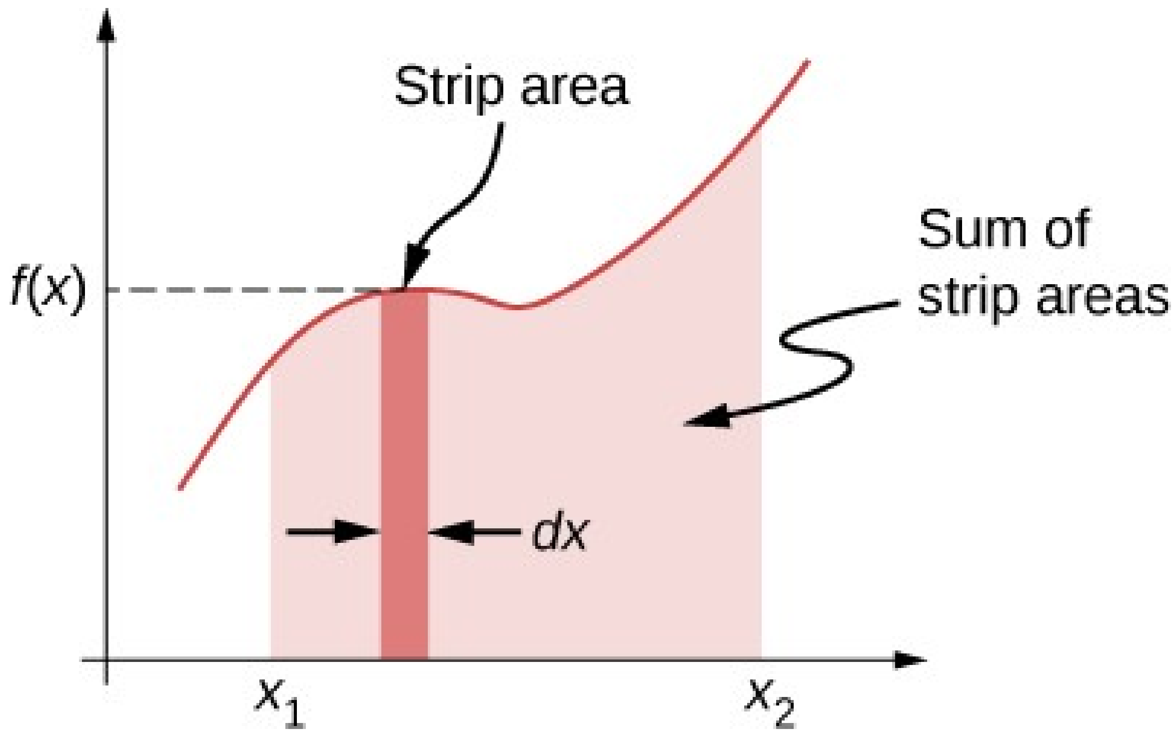
# Springs

## 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.

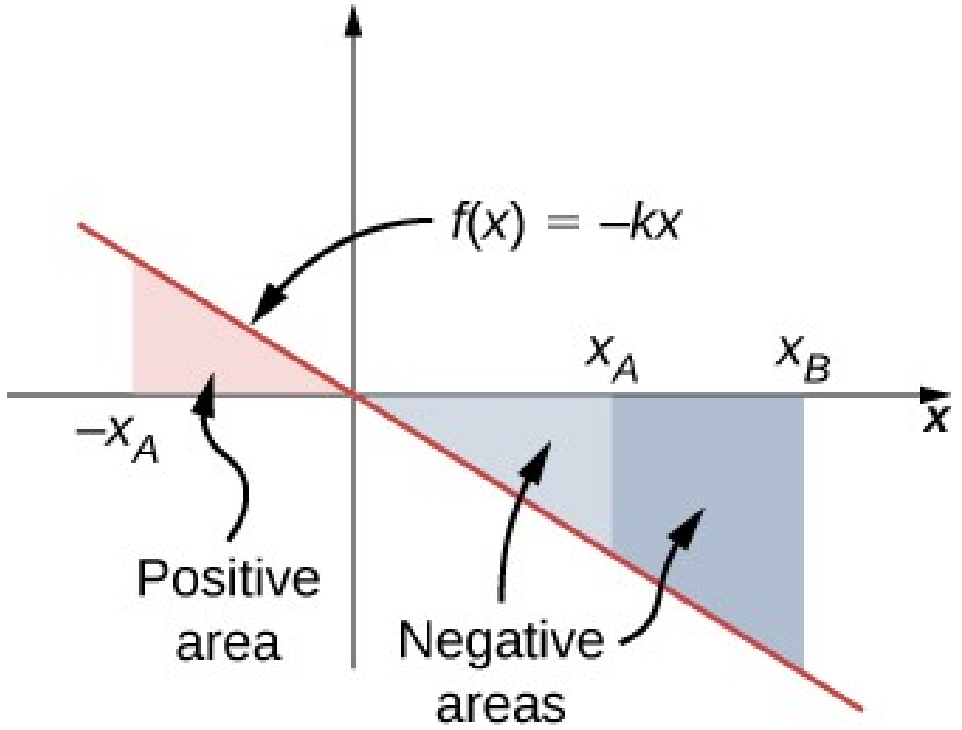


# FIGURE 7.8




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 $x_2$.

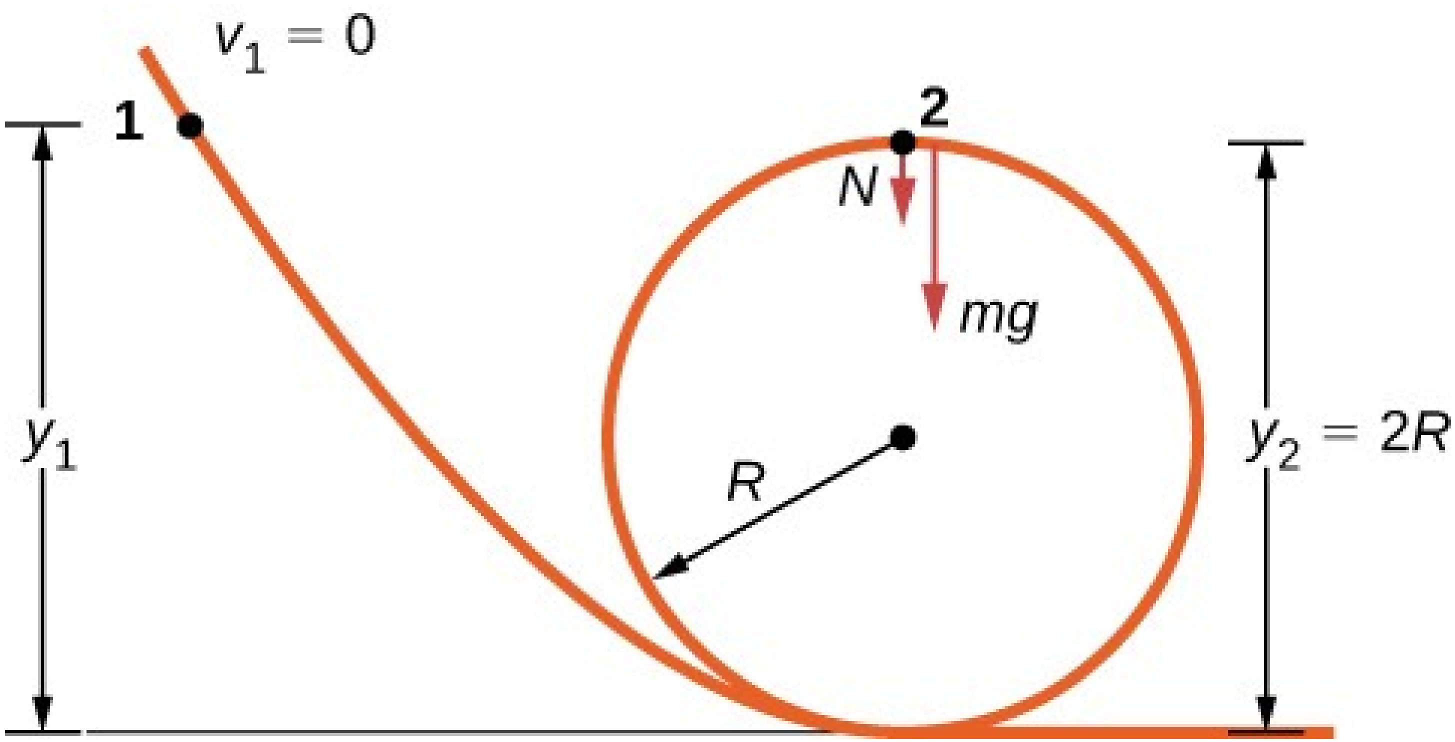
# FIGURE 7.9




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.

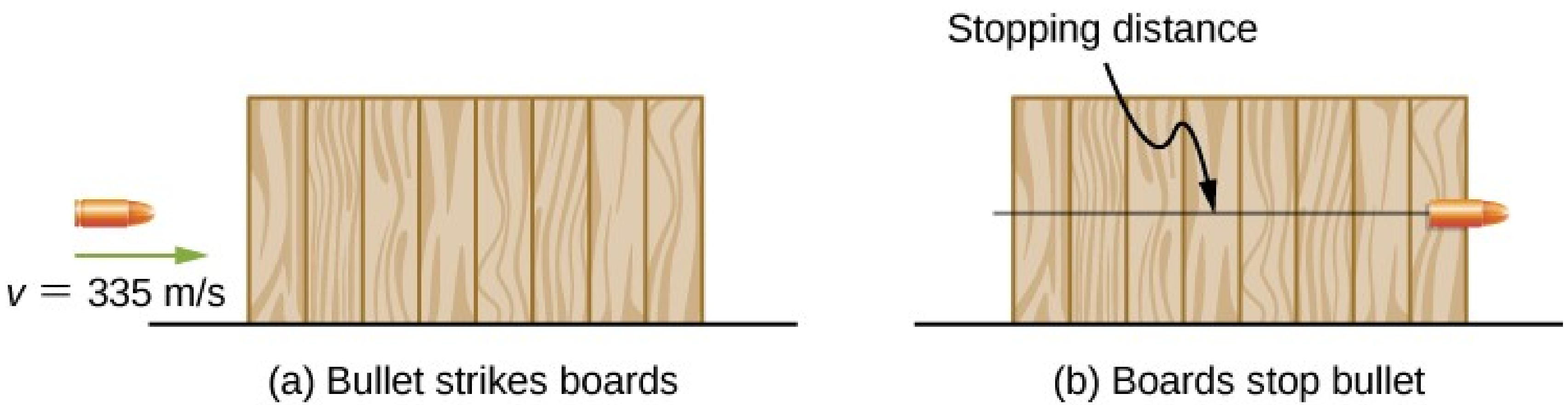
# Conservation of energy

# 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

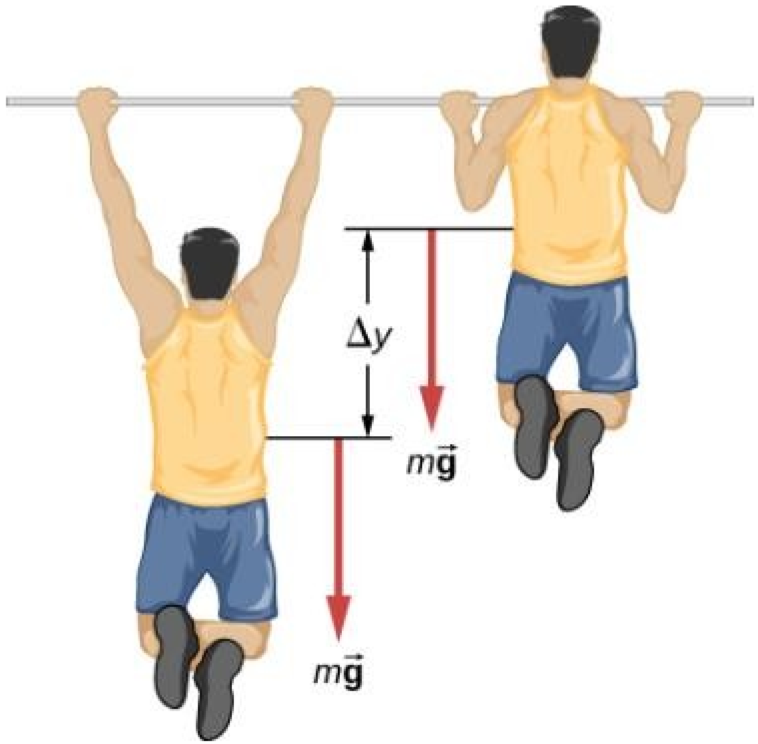



The boards exert a force to stop the bullet. As a result, the boards do work and the bullet loses kinetic energy.

# Power

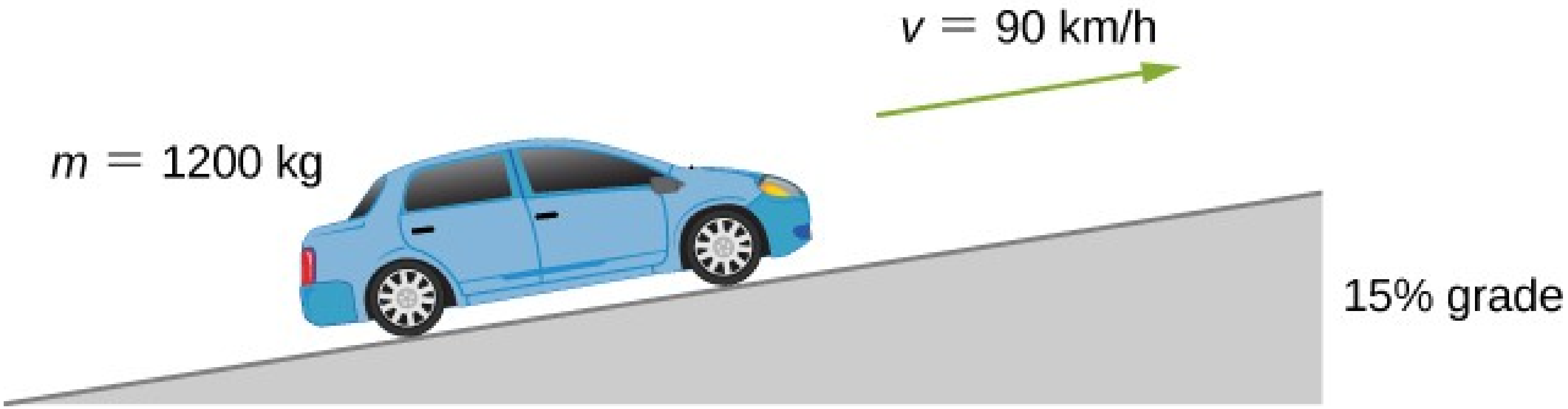
$$P = \frac{dE}{dt} \approx \frac{\Delta E}{\Delta t}$$

# FIGURE 7.14




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

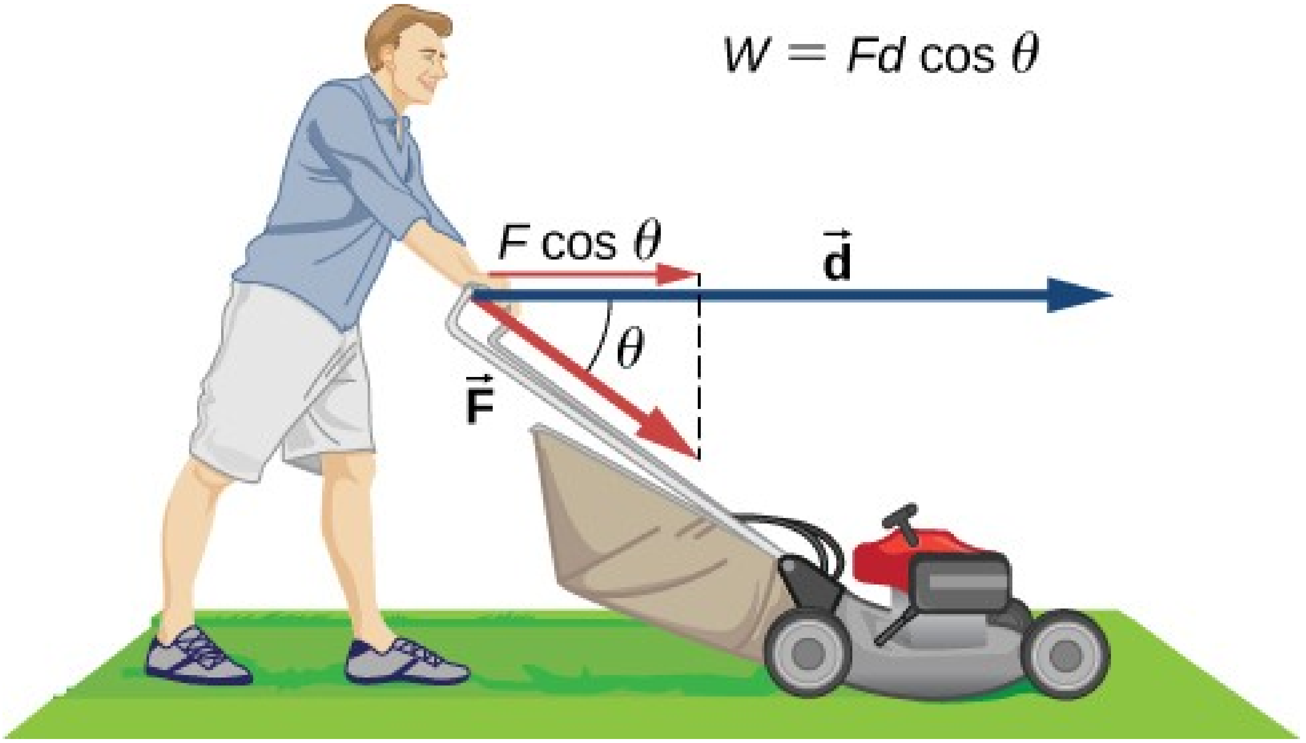
# FIGURE 7.15



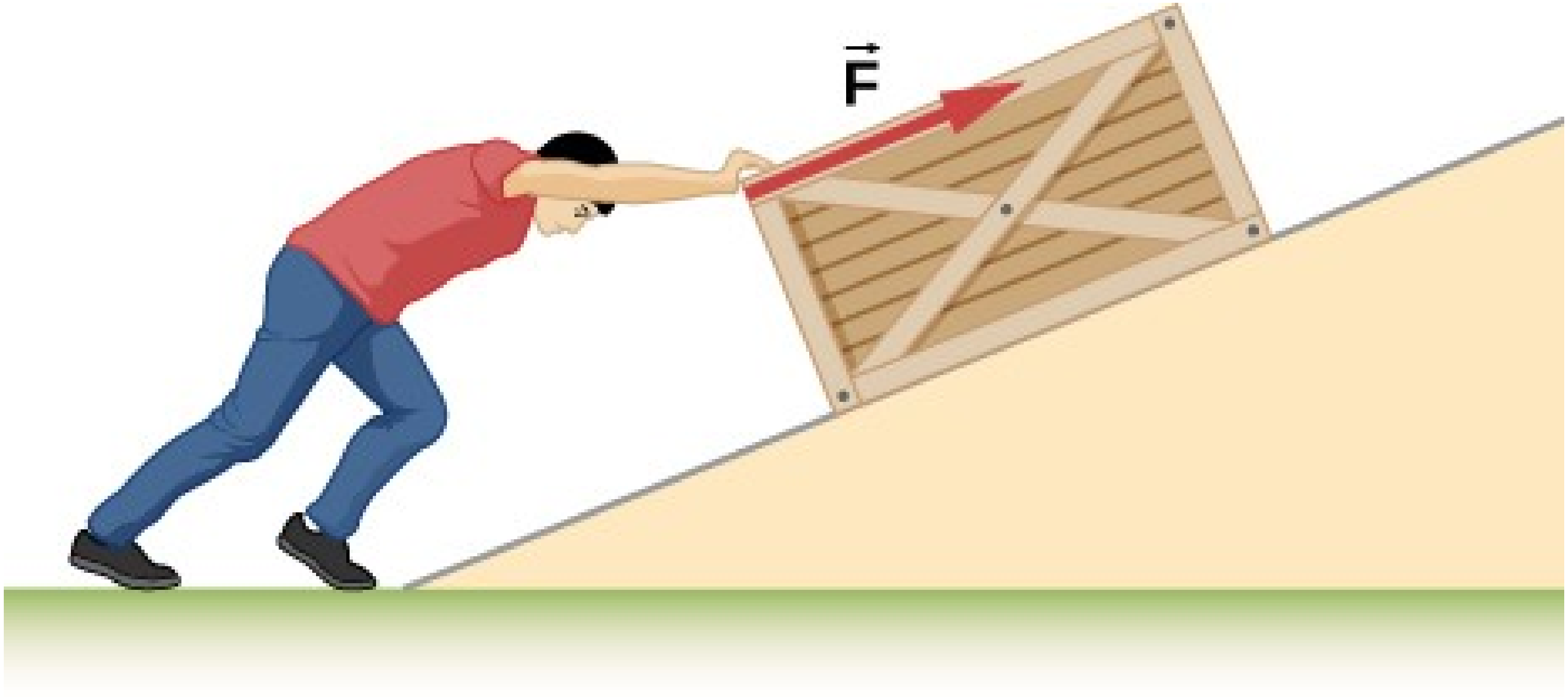

We want to calculate the power needed to move a car up a hill at constant speed.

# Examples

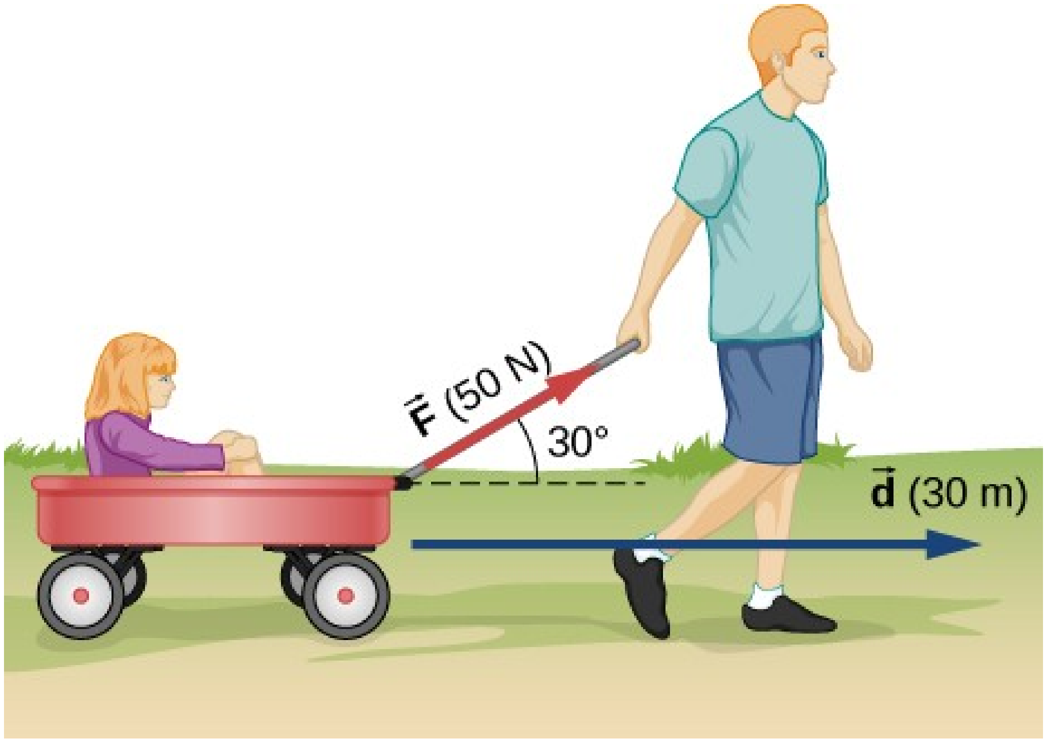
# EXERCISE 11



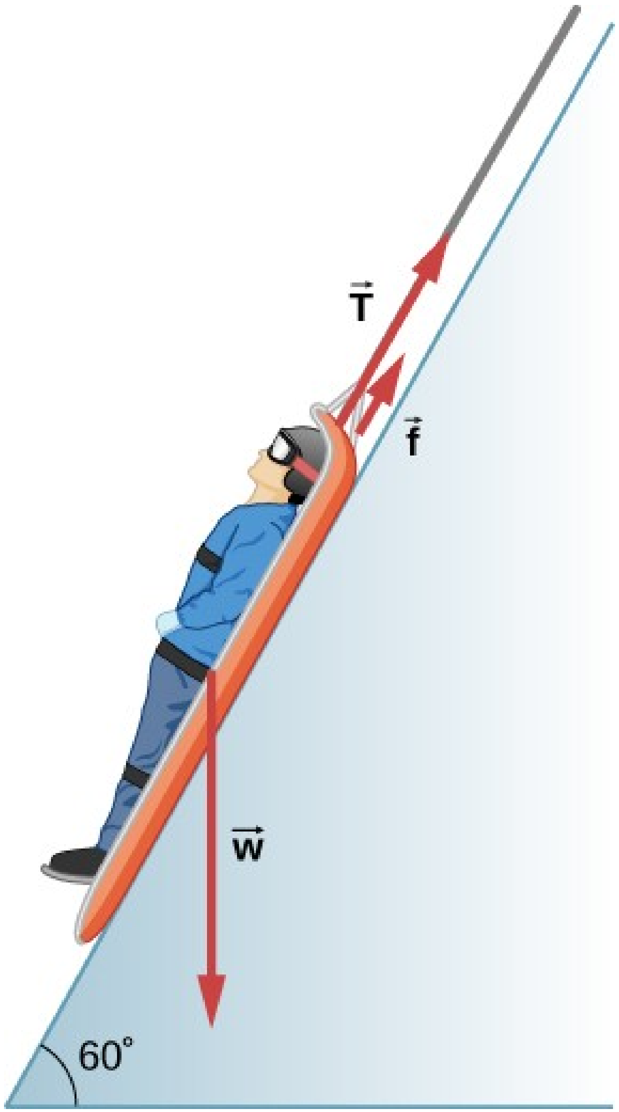
# EXERCISE 27



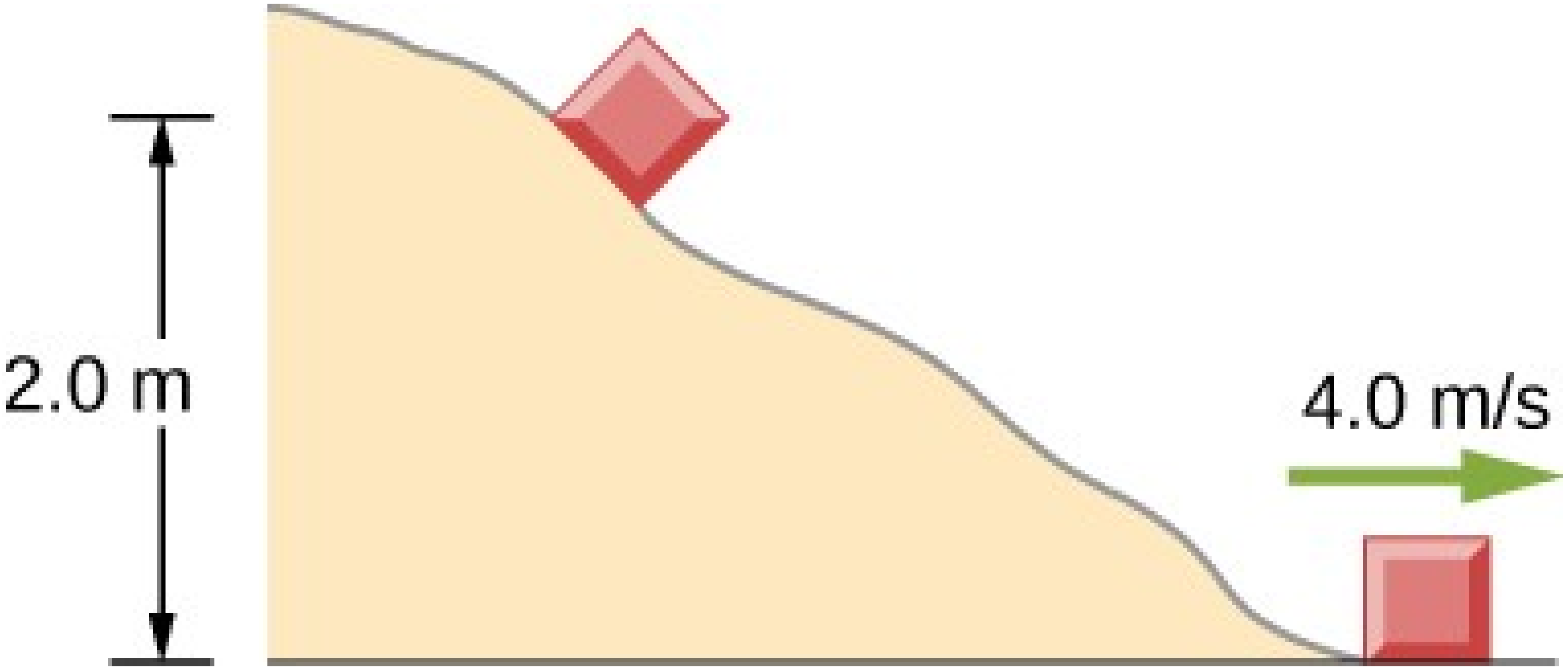
# EXERCISE 28



# EXERCISE 30



# EXERCISE 64



# EXERCISE 101