2.2 THE DERIVATIVE AS A FUNCTION

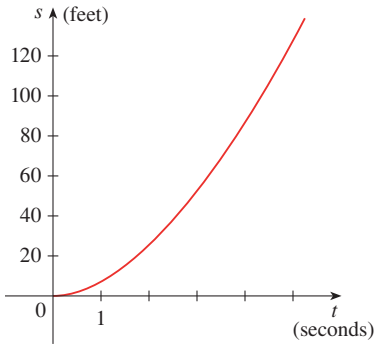

FIGURE 1
Position function of a car

■ The units for acceleration are feet per second per second, written as ft/s^2.

EXAMPLE A A car starts from rest and the graph of its position function is shown in Figure 1, where s is measured in feet and t in seconds. Use it to graph the velocity and acceleration of the car. What is the acceleration at $t = 2$ seconds?

SOLUTION By measuring the slope of the graph of $s = f(t)$ at $t = 0, 1, 2, 3, 4,$ and 5, and using the method of Example 1, we plot the graph of the velocity function $v = f'(t)$ in Figure 2. The acceleration when $t = 2$ s is $a = f''(2)$, the slope of the tangent line to the graph of f' when $t = 2$. We estimate the slope of this tangent line to be

$$a(2) = f''(2) = v'(2) \approx \frac{27}{3} = 9 \text{ ft/s}^2$$

Similar measurements enable us to graph the acceleration function in Figure 3.

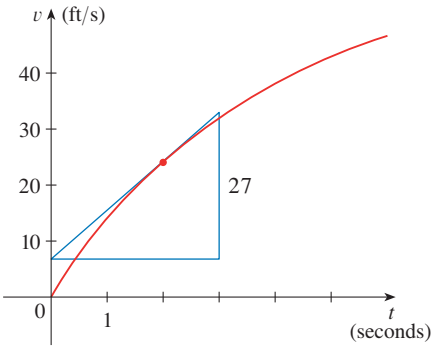

FIGURE 2
Velocity function

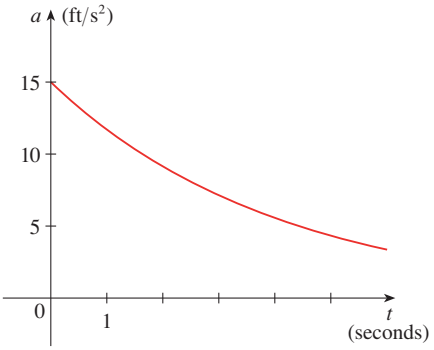

FIGURE 3
Acceleration function ■