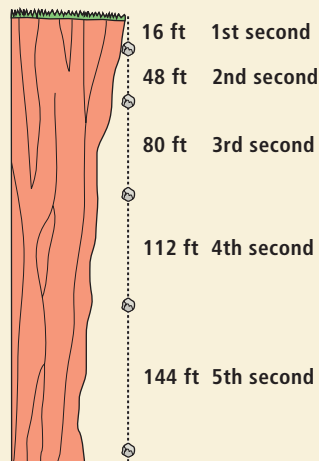


Quadratic Equations and Functions

- ▶ **9-1** The Function with Equation $y = ax^2$
- 9-2** Solving $ax^2 = b$
- 9-3** Graphing $y = ax^2 + bx + c$
- 9-4** Quadratics and Projectiles
- 9-5** The Quadratic Formula
- 9-6** Analyzing Solutions to Quadratic Equations
- 9-7** More Applications of Quadratics: Why Quadratics Are Important

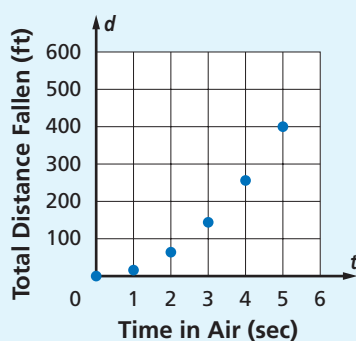
When an object is dropped from a high place, such as the roof of a building or an airplane, it does not fall at a constant speed. The longer it is in the air, the faster it falls. Furthermore, the distance d that a heavier-than-air object falls in a time t does not depend on its weight. In the early 1600s, the Italian scientist Galileo described the relationship between d and t mathematically. In our customary units of today, if d is measured in feet and t is in seconds, then $d = 16t^2$.



A table of values and a graph of this equation are shown on the next page.



t (sec)	d (ft)
0	0
1	16
2	64
3	144
4	256
5	400



The expression $16t^2$ is a *quadratic expression*, the equation $d = 16t^2$ is an example of a *quadratic equation*, and the function whose independent variable is t and dependent variable is d is a *quadratic function*. The word “quadratic” comes from the Latin word *quadratum* for square. Think of the area x^2 of a square with side x .

From the time of the Ancient Greek mathematicians until about 1600, the only known physical applications of quadratic expressions were to the area of squares and other geometric figures. But, in the next hundred years, discoveries by Galileo, Kepler, Newton, Leibniz, and others found uses for quadratic expressions involving objects that were in motion. These discoveries explain everything from the path of a basketball shot to the orbits of planets around our sun. They enable us to talk to each other via cell phones and collect information about stars in distant space. They are important both for mathematics and for science. In this chapter you will learn about a wide variety of quadratic equations and functions, and their applications.