

Shepley L. Ross *Introduction to Ordinary Differential Equations*

Chapter 3. Applications of First-Order Equations

3.2. Problems in Mechanics

- 3.2.1.** A stone weighing 4 lb falls from rest toward the Earth from a great height. As it falls it is acted upon by air resistance that is numerically equal to $\frac{1}{2}v$ (in pounds), where v is the velocity (in feet per second).
- (a) Find the velocity and distance fallen at the time t sec.
 - (b) Find the velocity and distance fallen at the end of 5 sec.
- 3.2.3.** A ball weighing $3/4$ lb is thrown vertically upward from a point 6 ft above the surface of the Earth with an initial velocity of 20 ft/sec. As it rises it is acted upon by air resistance that is numerically equal to $v/64$ lb, where v is the velocity (in feet per second). How high will the ball rise?
- 3.2.7.** Two people are riding in a motorboat and the combined weight of individuals, motor, boat and equipment is 640 lb. The motor exerts a constant force of 20 lb on the boat in the direction of motion, while the resistance (in pounds) is numerically equal to one and one-half times the velocity (in feet per second). If the boat started from rest, find the velocity of the boat after (a) 20 sec, (b) 1 minute.
- 3.2.9.** A bullet weighing 1 oz is fired vertically downward from a stationary helicopter with a muzzle velocity of 1200 ft/sec. The air resistance (in pounds) is numerically equal to $16^{-5}v^2$, where v is the velocity (in feet per second). Find the velocity of the bullet as a function of the time. HINT: 16 oz = 1 lb.
- 3.2.15(a).** A case of canned milk weighing 24 lb is released from rest at the top of a plane metal slide which is 30 ft long and inclined 45° to the horizontal. Air resistance (in pounds) is numerically equal to one-third the velocity (in feet per second) and the coefficient of friction is 0.4. What is the velocity of the moving case 1 sec after it is released.