Section 2.3

Assigned problems: 1-6, 8, 10, 12. The answers are rounded to five significant digits.

1. $t = 6.1224 \times 10^6$

2. $t = 6.3004$

3. 18.545

4. maximum altitude 2.0167×10^6m $= 2,016.7$km, total time 1313.8s or 21 minutes and 53.8 seconds.

5. It took 3.4142 seconds to complete the distance of 57.119

6. (a) $\dfrac{{v_0}^2}{2\,g}$ (b) It takes $\dfrac{v_0}{g}$ seconds to reach the maximum height. It takes $\dfrac{v_0}{g}$ seconds, the same time, for the ball to return to the ground. The reason is that the height of the ball is expressed as a quadratic function. The graph of this function is a parabola. The t-intercepts of this parabola are symmetric with respect to its vertex. (c) The speed of the ball on its return to the ground is v_0.

8. To reach one half of the terminal velocity it will take $\dfrac{m \ln 2}{r}$, where m is the mass of the ball and r is the constant of proportionality in the expression for the resistance. During this time the ball will travel $\dfrac{g\,m^2\,(\ln(4) - 1)}{2\,r^2}$.

10. (a) The velocity at the end of of 2 seconds is $-20\left(1 - e^{-g/10}\right) \approx -12.494$ m/s, while the distance traveled is $-40\left(\dfrac{10}{g}\left(1 - e^{-g/10}\right) - 1\right) \approx 14.502$ m. (b) $\dfrac{20}{g}\ln(5) \approx 3.2846$ seconds.

12. -17.34 m/s