Problem F12-2 (Page 15)
A ball is thrown vertically upward with a speed of 15 m/sec. Determine the time of flight when it returns to its original position.

\[ q = -q = \frac{dv}{dt} \]

\[ \int_{0}^{t} -q \, dt = \int_{15}^{V} dv \]

\[-q \, t = V - 15\]

\[ V = 15 - q \, t = \frac{dz}{dt} \]

\[ \int_{0}^{t} (15 - q \, t) \, dt = \int_{0}^{z} dz \]

\[ 15t - \frac{1}{2} q \, t^2 = 0 \]

\[ t = \frac{30}{9.81} = 3.058 \text{ sec} \]
Problem F12-6 (Page 15)
A particle travels along a straight line with an acceleration of \( a = 10 - 0.2s \) (m/sec\(^2\)), where \( s \) is measured in meters. Determine the velocity of the particle when \( s = 10 \) m if \( v = 5 \) m/sec at \( s = 0 \).

\[
0 = 10 - 0.2s = \frac{dV}{dt} = V \frac{dv}{ds}
\]

\[
\int_0^s (10 - 0.2s) \, ds = \int_s^V v \, dv
\]

\[
10s - 0.2 \frac{s^2}{2} = \frac{1}{2} (V^2 - 5^2)
\]

For \( s = 10 \) m

\[
10(10) - 0.2 \left( \frac{(10)^2}{2} \right) = \frac{1}{2} (V^2 - 25)
\]

\[
v = 14.32 \text{ m/sec}
\]
Problem 12-11 (Page 16)
A particle has an initial velocity of $v_0 = 12$ ft/sec to the right at $s_0 = 0$. The acceleration $a = 2$ ft/sec$^2$ is to the left. Determine its position when $t = 10$ seconds.

$$a = \frac{dv}{dt} \quad \int_0^t a \, dt = \int_{12}^v dv$$

$$a \, t = v - 12$$

$$v = a \, t + 12 = \frac{ds}{dt}$$

$$\int_0^s ds = \int_0^{10} (a \, t + 12) \, dt$$

$$s = \frac{a \, t^2}{2} + 12 \, t \bigg|_0^{10} = -2 \frac{(10)^2}{2} + 12(10)$$

$$s = -100 + 120 = 20 \text{ ft}$$
Problem 12-22 (Page 17)
The position of a particle on a straight line is given by \( s = t^3 - 9t^2 + 15t \) (ft), where \( t \) is in seconds. Determine the position of the particle when \( t = 6 \) sec, and the total distance it travels during the 6-sec interval.

\[
s = t^3 - 9t^2 + 15t
\]

\[
v = \frac{ds}{dt} = 3t^2 - 18t + 15
\]

\( v = 0 \) when \( t = 1 \) s and \( t = 5 \) s

\( t = 0, \ s = 0 \)

\( t = 1 \) s, \( s = 7 \) ft

\( t = 5 \) s, \( s = -25 \) ft

\( t = 6 \) s, \( s = -18 \) ft

\( s_T = 7 + 7 + 25 + (25 - 18) = 46 \) ft