Problem F12-12 (Page 25)
A sports car travels along a straight road such that its position is described by the graph. Construct the v-t and the a-t graphs for the time interval $0 \leq t \leq 10$ sec.

\[ 0 \leq t \leq 5 \]
\[ s = 3t^2 \]
\[ v = 6t \]
\[ a = 6 \]

\[ 5 < t \leq 10 \]
\[ s = 30t - 75 \]
\[ v = 30 \]
\[ a = 0 \]
Problem 12-54 (Page 28)

A dragster starts from rest and has an acceleration described by the graph. Determine a) the time \( t' \) for it to stop and, b) the maximum speed. Also, construct the \( v-t \) and the \( s-t \) graphs for the time interval \( 0 \leq t \leq t' \).

\[
\int_0^v dv = \int_0^{t'} 80 \, dt \\
v = (80t) \text{ ft/s}
\]

The maximum speed occurs at the instant \( t = 5 \) s. Thus,

\[v_{\text{max}} = v|_{t=5} = 80(5) = 400 \text{ ft/s}\]

For the time interval \( 5 < t \leq t' \)

\[
\int_{400 \text{ ft/s}}^v dv = \int_{5 \text{s}}^{t'} (-t + 5) \, dt \\
v = \left( -\frac{t^2}{2} + 5t + 387.5 \right) \text{ ft/s}
\]

Thus when \( v = 0 \),

\[0 = -\frac{t^2}{2} + 5t' + 387.5 \]

Choosing the positive root,

\[t' = 33.28 \text{ s} = 33.3 \text{ s}\]
Problem 12-54 (Page 28)
A dragster starts from rest and has an acceleration described by the graph. Determine a) the time \( t' \) for it to stop and, b) the maximum speed. Also, construct the \( v-t \) and the \( s-t \) graphs for the time interval \( 0 \leq t \leq t' \).

\[
\Delta v = \int a \, dt \\
0 = 80(5) + \left\{ \frac{1}{2} \left[ (-t' + 5)(t' - 5) \right] \right\} \\
0 = -\frac{t'^2}{2} + 5t' + 387.5
\]

\( s-t \) Graph: For the time interval \( 0 \leq t < 5 \) s, \( t = 0 \) s.

\[
(\uparrow) \quad ds = v \, dt \\
\int_0^s ds = \int_0^t 80 \, t \, dt \\
s = (40t^2) \text{ ft} \\
\text{When } t = 5 \text{ s}, \quad s_{|t=5} = 40(5^2) = 1000 \text{ ft}
\]

For the time interval \( 5 \) s < \( t \leq t' \) \( t = 5 \) s.

\[
(\uparrow) \quad ds = v \, dt \\
\int_{1000 \text{ ft}}^s ds = \int_{5 \text{ s}}^{t'} \left( -\frac{t'^2}{2} + 5t + 387.5 \right) dt \\
s = \left( -\frac{t'^3}{6} + \frac{5}{2} t^2 + 387.5t - 979.17 \right) \text{ ft}
\]

\text{When } t = t' = 33.28 \text{ s}, \quad s_{|t=33.28} = 8542 \text{ ft}
Problem F12-26 (Page 45)
A projectile is fired with an initial velocity of $v_A = 150 \text{ m/sec}$ off the roof of a building. Determine the range $R$ where it strikes the ground at B.

\[
V_{A_x} = 150 \cos 36.87^\circ, \text{ or } 150 \left( \frac{4}{5} \right) = 120 \text{ m/s} = \text{constant}
\]

\[
R = \int dx = \int_0^t 120 \, dt
\]

\[
R = 120t
\]

\[\text{y-direction}\]

\[
0 = -9.81 \text{ m/s}^2 = \frac{dv_y}{dt} \quad \int_{0}^{t} -9.81 \, dt = \int_{0}^{\frac{V_y}{3/5(150)}} dv_y
\]

\[
v_y = 90 - 9.81t = \frac{dy}{dt}
\]

\[
\int_{0}^{t} dy = \int_{0}^{t} (90 - 9.81t) \, dt
\]

\[
-150 = 90t - 9.81t^2
\]

\[
4.905t^2 - 90t - 150 = 0
\]

\[
t = 19.886 \text{ sec}
\]

\[
R = 120(19.886) = 2386 \text{ m}
\]