1. Since $v(t) = 3 - 2t \longrightarrow s(t) = 3t - t^2 + C$.

   We know $s(0) = 4 \longrightarrow C = 4$.

   $\therefore s(t) = 3t - t^2 + 4$.

2. Since $v(t) = 3t^{1/2} \longrightarrow s(t) = 2t^{3/2} + C$.

   We know $s(1) = 5 \longrightarrow C = 3$.

   $\therefore s(t) = 2t^{3/2} + 3$.

3. Since $a(t) = \cos t + \sin t \longrightarrow v(t) = \sin t - \cos t + C$.

   We know $v(0) = 5 \longrightarrow C = 6$.

   $\therefore v(t) = 6 + \sin t - \cos t$.

   Since $v(t) = 6 + \sin t - \cos t \longrightarrow s(t) = 6t - \cos t - \sin t + D$.

   We know $s(0) = 0 \longrightarrow D = 1$.

   $\therefore s(t) = 6t + 1 - \cos t - \sin t$.

4. Velocity Function
   $a(t) = -9.8 \longrightarrow v(t) = -9.8t + C$
   Since $v(0) = 0 \longrightarrow C = 0$.
   $\therefore v(t) = -9.8t$.

   Position Function
   Since $v(t) = -9.8t \longrightarrow s(t) = -4.9t^2 + D$.
   We know $s(0) = 450 \longrightarrow D = 450$.
   $\therefore s(t) = -4.9t^2 + 450$.

   Time to Impact
   At impact $s(t) = 0 \longrightarrow 0 = -4.9t^2 + 450 \longrightarrow t \approx -9.583$ or $t \approx 9.583$.
   We choose $t \approx 9.583 \therefore$ it takes approximately 9.583 seconds to hit the ground.

   Velocity at Impact
   $v(9.583) \approx -93.915 \therefore$ the velocity at impact is approximately -93.915 meters per second.

5. Velocity Function
   $a(t) = -32 \longrightarrow v(t) = -32t + C$
   Since $v(0) = -64 \longrightarrow C = -64$.
   $\therefore v(t) = -32t - 64$.

   Position Function
   Since $v(t) = -32t - 64 \longrightarrow s(t) = -16t^2 - 64t + D$.
   We know $s(0) = 80 \longrightarrow D = 80$.
   $\therefore s(t) = -16t^2 - 64t + 80$.

   Time to Impact
   At impact $s(t) = 0 \longrightarrow 0 = -16t^2 - 64t + 80 \longrightarrow t = -5$ or $t = 1$.
   We choose $t = 1 \therefore$ it takes one second to hit the ground.

   Velocity at Impact
   $v(1) = -96 \therefore$ the velocity at impact is approximately -96 feet per second.

6. Velocity Function
   $a(t) = -32 \longrightarrow v(t) = -32t + C$
   Since $v(0) = 40 \longrightarrow C = 40$.
   $\therefore v(t) = -32t + 40$.

   Position Function
   Since $v(t) = -32t + 40 \longrightarrow s(t) = -16t^2 + 40t + D$.
   We know $s(0) = 60 \longrightarrow D = 60$.
   $\therefore s(t) = -16t^2 + 40t + 60$.

   Time to Maximum Height
   At maximum height $v(t) = 0 \longrightarrow 0 = -32t + 40 \longrightarrow t = 1.250$.
   $\therefore$ it takes 1.250 seconds to reach the maximum height.

   Maximum Height
   $s(1.250) = 85 \therefore$ the maximum height is 85 feet.

   Time to Impact
   At impact $s(t) = 0 \longrightarrow 0 = -16t^2 + 40t + 60 \longrightarrow t \approx -1.055$ or $t \approx 3.555$.
   We choose 3.555 $\longrightarrow$ it takes approximately 3.555 seconds to hit the ground.

   Velocity at Impact
   $v(3.555) \approx --73.756 \therefore$ the velocity at impact is approximately -73.756 feet per second.

7. Velocity Function Ball #1
   Since $a(t) = -32 \longrightarrow v(t) = -32t + C$.
   We know $v(0) = 48 \longrightarrow C = 48 \longrightarrow v(t) = -32t + 48$.

   Position Function Ball #1
   Since $v(t) = -32t + 48 \longrightarrow s(t) = -16t^2 + 48t + D$.
   We know $s(0) = 423 \longrightarrow D = 423 \longrightarrow s(t) = -16t^2 + 48t + 423$.

   Velocity Function Ball #2
   Since $a(t) = -32 \longrightarrow v(t) = -32t + C$.
   We know $v(1) = 24 \longrightarrow C = 56 \longrightarrow v(t) = -32t + 56$.

   Position Function Ball #1
   Since $v(t) = -32t + 56 \longrightarrow s(t) = -16t^2 + 56t + D$.
   We know $s(1) = 423 \longrightarrow D = 383 \longrightarrow s(t) = -16t^2 + 56t + 383$

   Time to Pass
   Because we want the positions to be the same we set the position functions equal to each other.
   $-16t^2 + 48t + 423 = -16t^2 + 56t + 383 \longrightarrow t = 5$.
   $\therefore$ the balls pass each other 5 seconds after the first ball is thrown. At this time they are 263 feet off the ground.