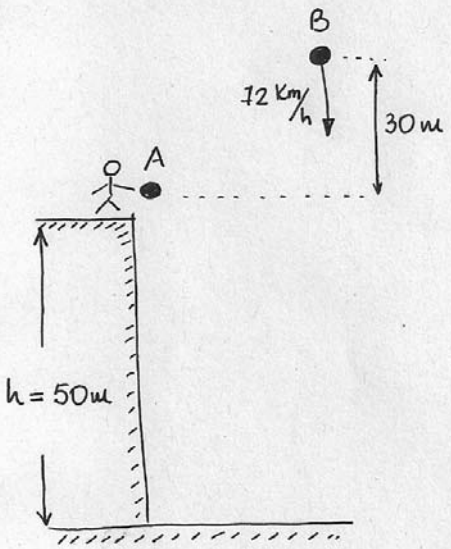

The bodies "A" and "B" start falling at the same time; the initial velocity of "A" is $v_A = 0$ and the speed (initial) of "B" is 72 km/h.

Determine:

a) the equations of the position vectors (suppose that x=0 along the motion)

b) the equations of the velocities

c) the first body that hits the floor

d) the positions of both when t = 2.2 s

e) their velocities when they hit the floor

(a) $\vec{r}_A = (50 - 5t^2)\vec{j}$ (m) ... $y_A = 50 - 5t^2$ (m)

$\vec{r}_B = (80 - 20t - 5t^2)\vec{j}$ (m) ... $y_B = 80 - 20t - 5t^2$ (m)

$v = 72 \frac{km}{h} \frac{1h}{3600\,s} \frac{1000\,m}{1\,km} = 20 \frac{m}{s}$

(b) $\vec{r}_A \xrightarrow{\text{differentiation}} \vec{v}_A = -10t\,\vec{j}$ (m/s)

$\vec{r}_B \xrightarrow{\text{differentiation}} \vec{v}_B = (-20 - 10t)\vec{j}$ (m/s)

(c) "A" body → when it hits the floor → $y_A = 0$

$50 - 5t^2 = 0 \rightarrow t = \sqrt{\frac{50}{5}} = 3.16$ s

"B" body → when it hits the floor → $y_B = 0$

$80 - 20t - 5t^2 = 0 \rightarrow t^2 + 4t - 16 = 0$

$t = \frac{-4 \pm \sqrt{16+64}}{2} = \frac{-4 \pm 8.94}{2}$ → negative value; → $t = 2.47$ s

"B" body is the first to hit the floor.

(d) $t = 2.2$ s

→ $y_A = 50 - 5 \times (2.2)^2 = 25.8$ m

→ $y_B = 80 - 20 \times 2.2 - 5 \times (2.2)^2 = 11.8$ m

(e) "A" body

→ $t = 3.16$ s → $\vec{v}_A = -10 \times 3.16\,\vec{j}$ (m/s) $= -31.6\,\vec{j}$ (m/s)

"B" body

→ $t = 2.47$ s → $\vec{v}_B = (-20 - 10 \times 2.47)\vec{j}$ (m/s) $= -44.7\,\vec{j}$ (m/s)