6) $\vec{r}(t) = \langle te^t, \ln t, t \ln t \rangle$ $\int u\,dv = uv - \int v\,du$

$\int te^t dt = te^t - \int e^t dt = te^t - e^t + C_1 = (t-1)e^t + C_1$

$\int \ln t\,dt = t\ln t - \int t \cdot \frac{1}{t} dt = t\ln t - \int 1\,dt = t\ln t - t + C_2$

$\int t \ln t\,dt = \frac{1}{2}t^2 \ln t - \frac{1}{4}t^2 + C_3$

$\int \vec{r}(t)\,dt = \langle (t-1)e^t + C_1, t\ln t - t + C_2, \frac{1}{2}t^2\ln t - \frac{1}{4}t^2 + C_3 \rangle$

7) $100 \frac{m}{s}$ $45°$ $200m$ wall height $= 3m$ $9.8 m/s^2$

$v_0 = 100\cos 45 = 70.71 m/s$ $t = \frac{200}{70.71} = 2.83 s$

$y = v_0 t - \frac{1}{2}gt^2 = (70.71)(2.83) - \frac{1}{2}(9.8)(2.83)^2$

$y = 160.8 m$

No

8) $k = \frac{|\vec{v} \times \vec{a}|}{|\vec{v}|^3}$ $s = r\theta$ $s' = r\theta'$

$k = \frac{|\vec{v} \times \vec{a}|}{|\vec{v}|^3} = \frac{r^2|\vec{v} \times \vec{a}|}{r^3|\vec{v}|^3} = \frac{|\vec{v} \times \vec{a}|}{r|\vec{v}|^3}$

$F_c = \frac{k}{n}$

9) $\vec{r}(t) = \langle \frac{t^2}{2}, \sqrt{2}t^2, \frac{t^3}{3} \rangle$ $\vec{r}(t) = \langle \frac{1}{4}(t^2), \frac{1}{3}(\sqrt{2}t^3), \frac{1}{3}(t^3) \rangle$

$= \langle \frac{1}{4}t^2, \frac{\sqrt{2}}{3}t^3, \frac{1}{3}t^3 \rangle$

$\sqrt{t^2 + 2t^4 + t^6} = \int t\sqrt{1 + 2t^2 + t^4}\,dt$ $(L = 3120.15)$

10) $\vec{r}(t) = \langle \sin t, \cos t, t \rangle$ $\vec{r}' = \langle \cos t, -\sin t, 1 \rangle$ $\vec{r}'' = \langle -\sin t, -\cos t, 0 \rangle$

$-\cos^2 t \sin t + \sin t \cos^2 t = 0$ $(\vec{r}' \cdot \vec{r}'' = 0)$

$\begin{vmatrix} \cos t & \sin t & 0 \\ -\sin t & \cos t & 0 \end{vmatrix} = 0\vec{i} + 0\vec{j} + \cos^2 t\,\vec{k}$ $\vec{r}' \times \vec{r}'' = \langle 0, 0, 1 \rangle$

2) $\langle x(t), y(t) \rangle = \vec{r}(t)$, $s(v) = \int_0^v |\vec{r}\,'(t)|\,dt$

a) $s(v) = r(v)$ $\quad |r'(t)| = 1$ $\quad 1 = \int_0^v |\vec{s}(u)|\,du = \int_0^v 1\,du = a$

b) [illegible]

3) $\vec{r}(t) = \langle \cos(t), 2\sin(t), 0 \rangle$ $\quad v(t) = \frac{d}{dt} r(t)$ $\quad v(t) = \langle -\sin t, 2\cos t, 0 \rangle$

$a(t) = \frac{d}{dt} v(t)$ $\quad a(t) = \langle -\cos t, -2\sin t, 0 \rangle$ $\quad a_T = \frac{v(t) \cdot a(t)}{|v(t)|}$

$v(t) \cdot a(t) = -\sin t \cdot -\cos t + 2\cos t \cdot -2\sin t = \sin t \cos t - 4\cos t \sin t$

$v(t) \cdot a(t) = -3\sin t \cos t$ $\quad v(t) = \sqrt{-\sin t^2 + 2\cos t^2}$

$v(t) = \sqrt{1 + 3\cos^2 t}$ $\quad a(t) = \frac{-3\sin t \cos t}{\sqrt{1 + 3\cos^2 t}}$

4) $p(t) = \int v(t)\,dt$ $\quad p_x(t) = \int \sin t\,dt = -\cos t + C_1$

$p_y(t) = \int t\cos(t^2)\,dt$ $\quad \frac{1}{2}\int \cos u\,du = \frac{1}{2}\sin u = \frac{1}{2}\sin t^2 + C_2$

$p_z(t) = \int \ln t\,dt = t\ln t - t + C_3$

$p(t) = \langle -\cos t + C_1, \frac{1}{2}\sin t^2 + C_2, t\ln t - t + C_3 \rangle$

$p(t) = \langle -\cos t + \cos 1, \frac{1}{2}\sin t^2 - \frac{1}{2}\sin 1, t\ln t - t + 1 \rangle$

5) $\vec{v}(t) = \langle \sin t, t\cos t^2, \ln t \rangle$ $\quad a(t) = \frac{d}{dt} v(t)$

$a_x(t) = \frac{d}{dt}\sin t = \cos t$ $\quad a_y(t) = \frac{d}{dt} t\cos(t^2)$

$\frac{d}{dt}(t\cos t^2) = \cos t^2 + t \cdot (-\sin(t^2)) \cdot 2t = \cos t^2 - 2t^2 \sin t^2$

$a_z(t) = \frac{d}{dt}(\ln t) = \frac{1}{t}$

$a(t) = \langle \cos t, \cos t^2 - 2t^2 \sin t^2, \frac{1}{t} \rangle$