Newton's Second Law and Circular Motion- HW Problems

1. Find the velocity and acceleration vectors and the speed for $\vec{c}(t) = (\frac{1}{2}t^2)\vec{\imath} + (\frac{1}{3}t^3)\vec{\jmath} + (\frac{2}{3}t^{\frac{3}{2}})\vec{k}$.

2. Determine which of the following curves is regular.

a. $\vec{c}(t) =< \cos(2t), \sin(2t), t >$

b. $\vec{c}(t) =< \cos(t^2), \sin(t^2), t^2 >$

c. $\vec{c}(t) =< e^t,\ t^4,\ 2t + 1 >$

3. The acceleration, initial velocity, and initial position of a particle is given by $\vec{a}(t) =< -4, 12t, 2 >$, $\vec{v}(0) =< -4, 6, -6 >$, $\vec{r}(0) =< 0, 0, 5 >$. Find the particle's path $\vec{r}(t)$ and when it crosses the x-y plane.

4. A body of mass 6 kg moves in a circle of radius 3 m making one revolution every 4 seconds. Find the centripetal force on the body.

5. The velocity of a particle is given by $\vec{v}(t) =< te^{t^2},\ 2t,\ 3t^2 + 1 >$. Find the path of the particle, $\vec{c}(t)$, if $\vec{c}(0) =< 2, 3, 4 >$.

6. A particle is moving in space with a velocity $\vec{v}(t) =< 2t - 5,\ 3t^2 + 2,\ 2t >$. Its position at $t = 0$ is $\vec{r}(0) =< 4, 3, 0 >$.

a. Find the position of the particle, $\vec{r}(t)$, for $t \geq 0$.

b. Find the coordinates of the point(s) where the particle crosses the y-z plane.