Calculus II

Assignment 2

20180619

Name : _____

Student ID : _____

1. Find the domain of the vector function.
   $\mathbf{r}(t) = \left\langle \sqrt{4 - t^2}, e^{-3t}, \ln(t + 1) \right\rangle$

2. Find the unit tangent vector $\mathbf{T}(t)$ at the point with the given value of the parameter t.

   (a) $\mathbf{r}(t) = \langle t^3 + 3t, t^2 + 1, 3t + 4 \rangle, \quad t = 1$

   (b) $\mathbf{r}(t) = \cos t\mathbf{i} + 3t\mathbf{j} + 2\sin 2t\mathbf{k}, \quad t = 0$

3. Find parametric equations for the tangent line to the curve with the given parametric equations at the specific point.
   $x = \sqrt{t^2 + 3}, y = \ln(t^2 + 3), z = t; \quad (2, \ln 4, 1)$

4. What force is required so that a particle of mass m has the position function $\mathbf{r}(t) = t^3\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$?

5. Prove that if $|\mathbf{r}(t)| = c$ (a constant), then $\mathbf{r}'(t)$ is orthogonal to $\mathbf{r}(t)$ for all t.
   Hint : (1)$\frac{d}{dt}[\mathbf{r}(t) \cdot \mathbf{r}(t)]$ (2)$\mathbf{a}$ is orthogonal to $\mathbf{b}$ when $\mathbf{a} \cdot \mathbf{b} = 0$

Reading materials : Textbook Section 14.1~14.4.