Math 143 Set 15

11. Find the length of the curve described by $\mathbf{r}(t) = \langle \sin t, 5t, \cos t \rangle$ for $t \in [-10, 10]$.

12. The DNA molecule has the shape of a double helix. The radius of each helix is nearly 10 angstroms (1 angstrom is 10^{-8}cm). Each helix rises about 34 angstroms during a complete turn, and there are 2.9×10^8 complete turns. Estimate the length of each helix.

13. Parameterize $\mathbf{r}(t) = \langle 3t, 4t - 1, t + 3 \rangle$ by arclength.

14. Find the unit tangent vector $\mathbf{T}$, the unit normal vector $\mathbf{N}$, and the binomial vector $\mathbf{B}$ at the point $(1, 2/3, 1)$ for $\mathbf{r}(t) = \langle t^2, 2t^3/3, t \rangle$.

15. Find $\mathbf{T}$, $\mathbf{N}$, and $\mathbf{B}$ for

a. $\mathbf{r}(t) = \langle \sin(kt), t, \cos(kt) \rangle$ for some number k,

b. $\mathbf{r}(t) = \left\langle \sqrt{2}t, e^t, e^t \right\rangle$.