Name: Date: 09/13/2018

M20550 Calculus III Tutorial
Worksheet 3

1. Find an equation of the tangent line to the space curve $\mathbf{r}(t) = \langle e^t, 3t, \sin t \rangle$ at the point $(e^\pi, 3\pi, 0)$.

2. Find the distance from the point $(1, 0, 0)$ to the space curve given by $\mathbf{r}(t) = \langle e^t, \sin t, \cos t \rangle$.

3. Find $\mathbf{r}(t)$ if $\mathbf{r}''(t) = 2\sec^2 t \tan t\mathbf{i}$, $\mathbf{r}(0) = 2\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$, and $\mathbf{r}'(0) = \mathbf{i} + \mathbf{j} + \mathbf{k}$.

4. Find the unit tangent vector, the principal unit normal vector, and the unit binormal vectors to the curve $\mathbf{r}(t) = \langle \cos 3t, \sin 2t, t^3 \rangle$ at $t = \pi$.

5. Find the equation for the normal and osculating planes to the curve $\mathbf{r}(t) = \arctan t\mathbf{i} + \sin t\mathbf{j} + \cos t\mathbf{k}$ at the point $(0, 0, 1)$. **Challenge:** Without graphin' software, sketch the curve. Can you describe the limit as $t \to \pm\infty$?

6. Find the length of the curve $\mathbf{r}(t) = \langle \sin t, \cos t, 2t \rangle$ from $(0, 1, 0)$ to $(0, 1, 4\pi)$.

7. A particle moves with position function $\mathbf{r}(t) = \langle \sin t, \cos t, \sin^2 t \rangle$. Find the tangential and normal components of acceleration when $t = \pi/4$.