Worksheet #9; date: 02/15/2018
MATH 53 Multivariable Calculus

1. *(Stewart 13.3.25)* Find the curvature of $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$ at the point $(1, 1, 1)$.

2. *(Stewart 13.3.31)* At what point does the curve have maximum curvature? What happens to the curvature as $x \to \infty$?

$$y = e^x.$$

3. *(Stewart 13.3.49; modified)* Find the vectors $\mathbf{T}$, $\mathbf{N}$, and $\mathbf{B}$ at the given point; then the equation of the normal plane and osculating plane of the curve at the given point.

$$x = \sin 2t, \quad y = -\cos 2t, \quad z = 4t; \quad (0, 1, 2\pi).$$

4. *(Stewart 13.4.15)* Find the velocity and position vectors of a particle that has the given acceleration and the given initial velocity and position.

$$\mathbf{a}(t) = 2\mathbf{i} + 2t\mathbf{k}, \quad \mathbf{v}(0) = 2\mathbf{i} - \mathbf{j}, \quad r(0) = \mathbf{j} + \mathbf{k}.$$

5. *(Stewart 13.4.37)* Find the tangential and normal components of the acceleration vector.

$$\mathbf{r}(t) = (t^2 + 1)\mathbf{i} + t^3\mathbf{j}, \quad t \geq 0.$$

6. *(Stewart 13.4.41)* Find the tangential and normal components of the acceleration vector at the given point.

$$\mathbf{r}(t) = \ln t\,\mathbf{i} + (t^2 + 3t)\mathbf{j} + 4\sqrt{t}\mathbf{k}, \quad (0, 4, 4).$$

7. For an ellipse given by

$$\mathbf{r}(t) = \langle a \cos t, b \sin t, 0 \rangle,$$

find the tangential and normal components of the acceleration vector.