Problem Set 8

1. Sketch the curve of the vector equation $\mathbf{r}(t) = \langle t, 2 - t, 2t \rangle$ and indicate with an arrow the direction in which t increases.

2. For the vector equation $\mathbf{r}(t) = \langle t, \sin(t), 2\cos(t) \rangle$, draw the projections of the curve on the three coordinate planes and then use these projections to sketch the curve.

3. Find a vector equation and parametric equations for the line segment that joins P to Q:
P(2, 0, 0)
Q(6, 2, -2)

4. Find a vector function that represents the curve of intersection of a cone, $z = \sqrt{x^2 + y^2}$, and the plane $z = 1 + y$.

5. Sketch the plane curve for the vector equation, $\mathbf{r}(t) = \langle t - 2, t^2 + 1 \rangle$. Find $\mathbf{r}'(t)$. Sketch the position vector $\mathbf{r}(t)$ and the tangent vector $\mathbf{r}'(t)$ for the curve at $t = -1$.

6. Find the derivative of the function $\mathbf{r}(t) = \langle t \cdot \sin(t), t^2, t \cdot \cos(2t) \rangle$

7. For the vector equation $\mathbf{r}(t) = \langle t^3 + 3t, t^2 + 1, 3t + 4 \rangle$, find the unit tangent vector $\mathbf{T}(t)$ at $t = 1$.

8. If $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$, find $\mathbf{r}'(t)$, $\mathbf{T}(1)$, $\mathbf{r}''(t)$, and $\mathbf{r}'(t) \times \mathbf{r}''(t)$.

9. Find parametric equations for the tangent line to the curve of ($x = 1 + 2\sqrt{t}$, $y = t^3 - t$, $z = t^3 + t$) at (3, 0, 2).

10. Evaluate the integral $\int_0^2 (t\boldsymbol{i} - t^3\boldsymbol{j} + 3t^5\boldsymbol{k})dt$.