Review Practice: Chapter 13

Formulas:

$$W = \mathbf{F} \cdot \mathbf{D} \qquad \tau = |\mathbf{r} \times \mathbf{F}|$$

$$\mathbf{T}(t) = \frac{\mathbf{r}'(t)}{|\mathbf{r}'(t)|} \qquad \mathbf{N}(t) = \frac{\mathbf{T}'(t)}{|\mathbf{T}'(t)|} \qquad L = \int_a^b |\mathbf{r}'(t)|\, dt$$

1. Let $\mathbf{r}(t) = \left\langle \dfrac{\sin t}{t}, e^{\cos t}, \sqrt{4 - t^2} \right\rangle$

   (a) Find the domain of $\mathbf{r}$

   (b) Find $\lim\limits_{t \to 0} \mathbf{r}(t)$

   (c) Find $\mathbf{r}'(t)$

2. Find a vector function that represents the curve on intersection of

$$x^2 + y^2 + z = 4 \quad \text{and} \quad x^2 + y^2 = 9$$

3. Reparametrize $\mathbf{r}(t) = \langle e^t, \cos e^t, \sin e^t \rangle$ with respect to arc length measured from $t = 0$ in the direction of increasing t.

4. Find the curvature of the ellipse $x = 3\cos t$, $y = 4\sin t$ at the points $(3, 0)$ and $(0, 4)$.

5. A particle starts at the origin with initial velocity $\mathbf{i}-\mathbf{j}+3\mathbf{k}$ and its acceleration is $\mathbf{a}(t) = \langle 6t, 12t^2, -6t \rangle$. Find its position function and its speed funtion.