1. Use cross sections of the form $z = k$, $x = 0$, and $y = 0$ to show that $x^2 + y^2 = z^2$ is a cone.

2. Show through substitution that the curve with parametric equations $x = t\cos t, y = t\sin t, z = t$ lies on the above cone. Try to sketch the curve.

3. Find the limit

$$\lim_{t \to 0} \left(e^{-t}i + \frac{\sin t}{t}j + (-1 + 3t^2)k \right).$$

4. At what points (there are two) does the curve $\mathbf{r}(t) = ti + (6t - t^2)k$ intersect the paraboloid $z = x^2 + y^2$?