1. Find a set of parametric equations for the curve of intersection of the cylinders $x = y^2$ and $y^2 + z^2 = 1$.

Theorem. *For any vector* $\mathbf{v}$, $\mathbf{v} \cdot \mathbf{v} = |\mathbf{v}|^2$.

Theorem. *If* $\mathbf{u}(t)$ *and* $\mathbf{v}(t)$ *are differentiable vector functions, then* $\dfrac{d}{dt}[\mathbf{u}(t) \cdot \mathbf{v}(t)] = \mathbf{u}'(t) \cdot \mathbf{v}(t) + \mathbf{u}(t) \cdot \mathbf{v}'(t)$.

2. If $\mathbf{r}(t)$ is a space curve in a sphere of radius c centered at the origin, then $|\mathbf{r}(t)| = c$ for every t. Show that for such a curve $\mathbf{r}(t)$ and $\mathbf{r}'(t)$ are always orthogonal.

3. This problem deals with the space curves determined by the following sets of parametric equations:

$$\begin{array}{ccc} x = \cos t & y = \sin t & z = \cos 2t \\ x = 1 + s & y = s^2 & z = 1 + s \end{array}$$

a) Verify that the curves intersect at the point $(1, 0, 1)$.

b) Find equations for the tangent line to each curve at $(1, 0, 1)$.

c) Find an equation for the plane containing the two tangent lines you found in part b.