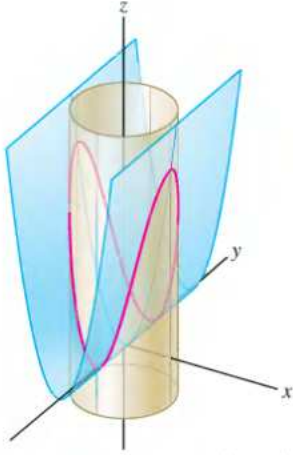


YOUR NAME: _____

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 5 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Use sine and cosine to parametrize the intersection of the surfaces $x^2 + y^2 = 1$ and $z = 4x^2$.



2. Determine whether the moving objects with position vectors $\mathbf{r}_1 = \langle t^2 + 3, t + 1, 6t^{-1} \rangle$ and $\mathbf{r}_2(t) = \langle 4t, 2t - 2, t^2 - 7 \rangle$ collide or intersect.

3. Find a parametric form of the tangent line to the graph of $\mathbf{r}(t) = (\ln t)\mathbf{i} + \frac{1}{t}\mathbf{j} + 9t\mathbf{k}$, when $t = 1$.

4. Find the domain of the vector function $\mathbf{r}(t) = \langle t^3 + t, t^4, t^5 \rangle$ and determine (providing **detailed explanation**) whether the curve is smooth.