Problem 1.

a. State the dot product definition for the length of a vector in $\mathbb{R}^n$.

b. Clearly state the Cauchy-Schwarz Inequality.

c. Let $\mathbf{a}$ and $\mathbf{b}$ be vectors in $\mathbb{R}^n$. Use the Cauchy-Schwarz Inequality to prove the Triangle Inequality:

$$||\mathbf{a} + \mathbf{b}|| \leq ||\mathbf{a}|| + ||\mathbf{b}||.$$
Problem 2. Find the distance from the point $(1, -2, 4)$ to the plane $3x + 2y + 6z = 5$. 
Problem 3. Let $F(t) := (t, t^3)$.

a. $F$ is a mapping from $\mathbb{R}^n$ to $\mathbb{R}^m$ for what $n$ and $m$?

b. Sketch the domain and range of $F$.

c. Sketch the graph of $F$. 

Problem 4. Find the Euclidean equation and a parametrization of the plane containing the points $(-2, 4, 8)$, $(-1, 1, 2)$ and $(3, 1, 4)$.
Problem 5. Consider the equation $x^2 = 2y^2 + 3z^2$.

a. Sketch the traces for $x = 1$, $y = 0$ and $z = -1$.

b. Classify the surface and sketch it.
Problem 6. Find the volume of the parallelepiped formed by \( \mathbf{a} = (1, 2, -1) \), \( \mathbf{b} = (1, -1, 2) \) and \( \mathbf{c} = (-1, 2, 1) \).
Problem 7. Find the point in which the line with parametric equations $x := 2 - t$, $y := 1 + 3t$, $z := 4t$ intersects the plane $2x - y + z = 2$. 