1. Carefully define the linear algebra term “linear mapping”. Give two examples on \( \mathbb{R}^2 \).

2. Give any inner product on \( \mathbb{R}^2 \), OTHER than the dot product. Use your inner product to calculate \( \langle u, v \rangle \) for \( u = (1, 3)^T \), \( v = (2, -1)^T \).

3. Find two different functions \( f, g \) on \( \mathbb{R} \), with \( f \circ f = g \circ g = 1_{\mathbb{R}} \).

4. Consider all possible linear mappings from \( \mathbb{R}^4 \) to \( \mathbb{R}^2 \). What are the possible nullities and ranks of these? Give an example function for each possible combination, and indicate which functions are one-to-one and which are onto.

5. Consider the mapping \( F : \mathbb{R}_2[t] \to \mathbb{R}^2 \) given by \( F(p(t)) = (p(3), p(-1)) \). Calculate \( F(p(t)) \) for \( p(t) = t^2 - 3t + 1 \). Determine whether \( F \) is linear.

Please hand in ONLY the second page; keep this first page.
Please write all solutions on this page (front and back if necessary).