1. True or False?

The map $f : \mathbb{R}^2 \to \mathbb{R}^3$ given by

$$\begin{pmatrix} a \\ b \end{pmatrix} \mapsto \begin{pmatrix} a \\ a+b \\ 2a-b \end{pmatrix}$$

is an isomorphism.

2. True or False?

The map $f : \mathcal{M}_{2\times 2} \to \mathbb{R}$ given by

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \mapsto ad - bc$$

is an isomorphism.

3. True or False?

The map $f : \mathbb{R} \to \mathbb{R}$ given by $f(x) = x^3$ is an isomorphism.

4. True or False?

$\mathbb{R}^2$ is isomorphic to

$$U = \left\{ \begin{pmatrix} x \\ y \\ 0 \end{pmatrix} : x, y \in \mathbb{R} \right\}$$

5. True or False?

The map $f : \mathcal{P}_2 \to \mathcal{P}_2$ given by

$$f(ax^2 + bx + c) = bx^2 - (a + c)x + a$$

is an isomorphism.