4) This is not a vector space because it doesn't satisfy the distributivity 
\((c_1+c_2)\alpha = c_1\alpha + c_2\alpha\) for \(c_1, c_2 \in \mathbb{R}\), \(\alpha \in V\).

Indeed, for \(\alpha = (x, y)\) we have:

\[(c_1+c_2)(x, y) = ((c_1+c_2)x, y),\]

\[c_1(x, y) + c_2(x, y) = (c_1x, y) + (c_2x, y),\]

\[= (c_1x+c_2x, 2y)\]

and \(y \neq 2y\) for \(y \neq 0\).

6) The set of all functions \(f: \mathbb{R} \to \mathbb{C}\)

is a vector space over \(\mathbb{C}\), and then by restriction of scalars, over \(\mathbb{R}\).

We'll check that \(V\) is a subspace of the real space of functions \(f: \mathbb{R} \to \mathbb{C}\).
We need to check closure:

1) \( f + g \in V \) for \( f, g \in V \)

2) \( cf \in V \) for \( c \in \mathbb{R} \), \( f \in V \).

Indeed,

\[
(f + g)(-t) = f(-t) + g(-t) = \overline{f(t)} + \overline{g(t)}
\]

\[
= \overline{f(t) + g(t)} = (f + g)(t) \quad \Rightarrow \quad 1).
\]

\[
(cf)(t) = cf(t) = c \overline{f(t)} = \overline{cf(t)}
\]

\[
= \overline{(cf)(t)} \quad \Rightarrow \quad 2)
\]

using that \( c = \overline{c} \).

An example of a function \( f \in V \) is

\( f(t) = it \). Then \( f(-t) = -it = \overline{it} = \overline{f(t)} \).
7. This is not a vector space because it fails the axiom $1x = x$ for $x \in V$.

Indeed, $1(x, y) = (lx, 0) = (x, 0) \neq (x, y)$ for $y \neq 0$. 