Homework #5

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1. a.

① $T: V \to W$ $\qquad V = \mathbb{R}^2$

$u, v \in V$

$T(u+v) = T(u,v) = T(u,v) \quad$ and $\quad T(u) + T(v)$

$\therefore \exists\, u, v \in V \mid u+v \neq T(u,v)$

and $T(u) + T(v)$

$\Rightarrow$ False

② $T: V \to W$ such that $T(c_1 u) = T(c_1 u, c_1 u)$

Assume that $c_1 u, c_1 u \in \mathbb{R}$ such that

$c_1 u = c_1 u \Rightarrow c_1 u = 0$

Then

$T(c_1 u, c_1 u) \neq 0 \qquad$ —— $W = \mathbb{R}^2$

But $\forall\, u \in V \mid T(u) = T(u, u)$

So the range is $T \neq W$

③ $T(c_1 u) = c_1 u \qquad W = \mathbb{R}$

Assume that $c_1 u = (a, b)$ where $a, b \neq 0$

Then

$T(c_1 u) = 0 \qquad$ and $\quad W \neq T(u)$

So the kernel is $T \neq \{0\}$