Homework 1.3.4.1 For $x \in \mathbb{R}^n$

$x - x = 0$ (Always / Sometimes / Never)

Proof: Let x be arbitrary

$$
\begin{aligned}
& x - x \\
= & \\
& x + (-1)\, x && \langle \text{def } - \rangle \\
= & \begin{pmatrix} \chi_0 \\ \chi_1 \\ \vdots \\ \chi_{n-1} \end{pmatrix} + (-1) \begin{pmatrix} \chi_0 \\ \chi_1 \\ \vdots \\ \chi_{n-1} \end{pmatrix} && \langle \text{scalar multiplication} \rangle \\
= & \begin{pmatrix} \chi_0 \\ \chi_1 \\ \vdots \\ \chi_{n-1} \end{pmatrix} + \begin{pmatrix} -\chi_0 \\ -\chi_1 \\ \vdots \\ -\chi_{n-1} \end{pmatrix} && \langle \text{vector addition} \rangle \\
= & \begin{pmatrix} \chi_0 + (-\chi_0) \\ \chi_1 + (-\chi_1) \\ \vdots \\ \chi_{n-1} + (-\chi_{n-1}) \end{pmatrix} && \langle \text{real \# addition} \rangle \\
= & \begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix} \\
= & \; 0
\end{aligned}
$$