Moreover, $U + W \subseteq W$ by 1.39 Axler.

Therefore $U + W = W$.

Next, we show $U \cap W = \{0\}$.

Let $x \in U \cap W$.

Since $x \in W$, $x = b_1 v_1 + \dots + b_m v_m$

Moreover, observe that $x - 0 = x \in U$.

By 3.85, $x + U = 0 + U$

Thus, $0 + U = x + U$

$$= (b_1 v_1 + \dots + b_m v_m) + U$$

$$= (b_1 v_1 + U) + \dots + (b_m v_m + U)$$

since $v_1 + U, \dots, v_m + U$ is linearly indep.,

$b_1 = \dots = b_m = 0 \Rightarrow x = 0$

$$\Rightarrow U + W \subseteq \{0\}$$