$\Rightarrow$ $v_1, v_2, v_3, v_4$ spans $V$

Show that $v_1 - v_2,\ v_2 - v_3,\ v_3 - v_4,\ v_4$ also spans $V$

$$L = (v_1, v_2, v_3, v_4)$$

Span of $L = \{ a_1 v_1 + a_2 v_2 + a_3 v_3 + a_4 v_4 : a_1 a_2 a_3 a_4 \in \mathbb{R} \}$

$$L' = (v_1 - v_2,\ v_2 - v_3,\ v_3 - v_4,\ v_4)$$

Span of $L' = \{ b_1(v_1 - v_2) + b_2(v_2 - v_3) + b_3(v_3 - v_4) + b_4 v_4 : b_1 b_2 b_3 b_4 \in \mathbb{R} \}$

$$= b_1 v_1 - b_1 v_2 + b_2 v_2 - b_2 v_3 + b_3 v_3 - b_3 v_4 + b_4 v_4$$

$$= b_1 v_1 + (b_2 - b_1) v_2 + (b_3 - b_2) v_3 + (b_4 - b_3) v_4$$

Since $b_1, b_2, b_3, b_4 \in \mathbb{R}$

$b_2 - b_1,\ b_3 - b_2,\ b_4 - b_3 \in \mathbb{R}$

$\therefore$ $L'$ also spans $V$

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Alternatively,

if $v \in V$

$v = a_1 v_1 + a_2 v_2 + a_3 v_3 + a_4 v_4$ for some $a_1 a_2 a_3 a_4 \in \mathbb{R}$

Let $b_1, b_2, b_3, b_4 \in \mathbb{R}$

s.t.

$b_1 = a_1 \quad b_2 - b_1 = a_2 \quad b_3 - b_2 = a_3$

$b_4 - \cancel{b_3} = a_4$ such values of $b$ always exist in $\mathbb{R}$ for any $a$'s.

QED.