

2)  $B = (v_1, v_2, v_3)$  basis of  $\mathbb{R}^3$

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$$v_1 = (1, 0, 1); \quad v_2 = (5, 1, 0); \quad v_3 = (0, 5, 1)$$

Determine coord. of  $v = (1, 3, 1) \in \mathbb{R}^3$  in basis  $B$

$B$  basis of  $\mathbb{R}^3 \Rightarrow \forall v \in \mathbb{R}^3, \exists! k_1, k_2, k_3 \in \mathbb{R}$   
s.t.  $\sum_{i=1}^3 k_i v_i = v$

$\Rightarrow$  We can write  $v$  as a lin. comb. of  $B$ .

$\Rightarrow$  We have to solve the system:

$$k_1 \cdot v_1 + k_2 \cdot v_2 + k_3 \cdot v_3 = v$$

$$k_1 \cdot (1, 0, 1) + k_2 \cdot (5, 1, 0) + k_3 \cdot (0, 5, 1) = (1, 3, 1)$$

$$\Rightarrow \begin{cases} k_1 + 5k_2 = 1 & (1) \\ k_2 + 5k_3 = 3 & (2) \\ k_1 + k_3 = 1 & (3) \end{cases}$$

$$(1) - (3) \Rightarrow 5k_2 - k_3 = 0 \quad | \cdot 5 \Rightarrow 25k_2 - 5k_3 = 0$$

$$(2) \Rightarrow k_2 + 5k_3 = 3 \Rightarrow \frac{k_2 + 5k_3 = 3}{26k_2 = 3} \quad (4)$$

the second component:  $k_2 = \frac{3}{26} \approx 0.12$