Given the following five vectors in $\mathbb{R}^4$:

$\alpha_1 = (1, 1, 2, 1)$  
$\alpha_2 = (1, -1, 0, 1)$  
$\alpha_3 = (0, 0, -1, 1)$  
$\alpha_4 = (1, 2, 2, 0)$  
$\alpha_5 = (1, 1, 1, 1)$

Show:
1) that $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ is a basis of $\mathbb{R}^4$
2) Find the coordinates of $\alpha_5$ in the basis $\{\alpha_1, \alpha_2, \alpha_3, \alpha_4\}$