Exercise 1
Which of the following sets of vectors are bases for the corresponding space $\mathbb{R}^n$? (The dimension $n$ should be clear from the length of vectors.)
(i) $(1, -1)$;
(ii) $(1, 0), (1, 2)$;
(iii) $(1, 1), (-2, -2)$;
(iv) $(1, 1), (15, 222), (-1, -1)$;
(v) $(1, -1, 2, 0), (1, 1, 5, -3), (1, -1, 2, 1)$;
(vi) $(1, 0, 1), (1, 1, 0), (2, 1, 0)$.

Exercise 2
Find the coordinates of the vector $v$ with respect to the basis $v_1, \ldots, v_n$ (i.e. the coefficients $k_1, \ldots, k_n$ in the representation $v = k_1v_1 + \cdots + k_nv_n$):
(i) $v = (2, 1), v_1 = (1, -1), v_2 = (1, -2)$;
(ii) $v = (1, -3, 2), v_1 = (1, 1, 0), v_2 = (1, 0, 1), v_3 = (0, 1, 1)$;
(iii) $v = (1, 1, 1, 0), v_1 = (1, 0, 1, 0), v_2 = (1, 1, 0, 0), v_3 = (0, 0, 2, 0), v_4 = (1, 0, 0, -1)$.

Exercise 3
Write the general solution of the system as a sum of its partial solution and a linear combination of basis vectors of the associated homogenous system:
(i) \[
\begin{align*}
x + y + t &= 1 \\
-z + 2t &= 3
\end{align*}
\]
(ii) \[
\begin{align*}
x_4 - x_3 &= -1 \\
x_3 - x_2 &= 1 \\
x_2 - x_1 &= 1
\end{align*}
\]
(iii) \[x_1 - x_2 + x_3 - x_4 = -2.\]