6. Show it.

Since $n \in \mathbb{Z}^+$, and $\{\vec{v_1}, \vec{v_2}, \cdots, \vec{v_k}\}$ is a set of linearly dependent vectors in $\mathbb{R}^n$, so by the definition of linear dependence, we have that:
there exists an index i and scalars α_j's such that

$$\vec{v_i} = \sum_{j \neq i} \alpha_j \vec{v_j} \qquad (1)$$

Take any $n \times n$ matrix A, multiply both sides of Eq. (1) by A, so

$$A\vec{v_i} = A\left(\sum_{j \neq i} \alpha_j \vec{v_j}\right).$$

and by distributivity of matrix-vector multiplication, so we have:

$$A\vec{v_i} = \sum_{j \neq i}\left(A\alpha_j \vec{v_j}\right) = \sum_{j \neq i} \alpha_j (A\vec{v_j}).$$

which means that there exists an index i and scalars α_j's for the set $\{A\vec{v_1}, A\vec{v_2}, \cdots, A\vec{v_k}\}$ such that $A\vec{v_i} = \sum_{j \neq i} \alpha_j (A\vec{v_j})$

Thus, by definition of linear dependence, the set

$\{A\vec{v_1}, A\vec{v_2}, \cdots, A\vec{v_k}\}$ is a set of linear dependent vectors.

Q.E.D.