Hint for Problem 5.5.8(a)
(from Artin's "Algebra")
Math 455

Here are some facts from Linear Algebra (which you should know). The first one is Proposition 3.3.15 from Artin (pg. 92):

Theorem (Base Completion)**.** *Let V be a vector space of dimension n. If the set $\{v_1, \ldots, v_m\}$ is linearly independent (and so $m \leq n$), then there are $v_{m+1}, \ldots, v_n \in V$ such that $\{v_1, \ldots, v_m, v_{m+1}, \ldots, v_n\}$ is a basis of V.*

This second one is a consequence of Corollary 3.4.23 from Artin (pg. 99):

Theorem (Change of Basis)**.** *If V is a vector space and $\{v_1, \ldots, v_n\}$ and $\{w_1, \ldots, w_n\}$ are two bases of V, then there is a (necessarily invertible) linear transformation T such that $T(v_i) = w_i$.*

In particular, if $V = \mathbb{R}^n$, then there is a matrix $M \in \mathrm{GL}_n(\mathbb{R})$ such that $M(v_i) = w_i$.