Penrose Equations

Let $A$ be an $n \times m$ matrix, $A^*$ denote the conjugate transpose of $A$. Then there exists a unique $m \times n$ matrix $X$ satisfying the following 4 Penrose equations:

1.) $AXA = A$
2.) $XAX = X$
3.) $(AX)^* = AX$
4.) $(XA)^* =XA$

$X$ is called the Moore–Penrose inverse of $A$ and is denoted by $A^\dagger$.

Exercise (1.) If $A$ is an $n \times n$ non-singular matrix then $A^\dagger = A^{-1}$.

Exercise (2.) $A^\dagger$ is unique.