Solution to Problem 3) By definition, the inverse $(AB)^{-1}$ of the product matrix AB must have the following properties: (i) $(AB)^{-1}(AB) = I$, and (ii) $(AB)(AB)^{-1} = I$. Below, we verify that the product matrix $B^{-1}A^{-1}$ does, in fact, satisfy both requirements.

i) $(B^{-1}A^{-1})(AB) = B^{-1}(A^{-1}A)B = B^{-1}IB = B^{-1}B = I.$

ii) $(AB)(B^{-1}A^{-1}) = A(BB^{-1})A^{-1} = AIA^{-1} = AA^{-1} = I.$

Consequently, $B^{-1}A^{-1}$ it is the desired inverse $(AB)^{-1}$ of the matrix AB.
