

$$\left(Ax - A\vec{\mu}\right)^T \left(A\Sigma A^T\right)^{-1} \left(Ax - A\vec{\mu}\right) = \left(x - \vec{\mu}\right)^T \Sigma^{-1} \left(x - \vec{\mu}\right)$$

$$\left(A\left(x - \vec{\mu}\right)\right)^T \left(A\Sigma A^T\right)^{-1} A\left(x - \vec{\mu}\right) = \left(x - \vec{\mu}\right)^T A^T \left(A\left(\Sigma A^T\right)\right)^{-1} A\left(x - \vec{\mu}\right) =$$

$$\left(x - \vec{\mu}\right)^T A^T \left(\Sigma A^T\right)^{-1} A^{-1} A\left(x - \vec{\mu}\right) = \left(x - \vec{\mu}\right)^T A^T \left(A^T\right)^{-1} \Sigma^{-1} A^{-1} A\left(x - \vec{\mu}\right) =$$

$$\left(x - \vec{\mu}\right)^T \Sigma^{-1} \left(x - \vec{\mu}\right)$$