$A\,x = B$

A is 5×3 may not have solution

Ax is 5×1 B is 5×1

$$\begin{bmatrix} Ax_1 \\ Ax_2 \\ Ax_3 \\ Ax_4 \\ Ax_5 \end{bmatrix}$$

$$[Ax]^T[Ax] = 1\times1 = Ax_1^2 + Ax_2^2 + \cdots$$

$A_{34}\,B_{42}$

$(B_{24}^T A_{43}^T)^T$

$$e = (Ax-B)^T(Ax-B) = (Ax)^T Ax - (Ax)^T B - (B^T Ax) + B^T B$$

$$= (x^T A^T)^T Ax - (x^T A^T)^T B - ((Ax)^T B)^T + B^T B$$

$$= (x^T A^T)^T Ax - 2(Ax)^T B + B^T B$$

$$\frac{de}{dx} = (A)^T(Ax-B) + (Ax-B)^T(A)$$

$$(A^T Ax - A^T B) + (A^T(Ax-B))^T$$

3×5 5×1 3×5 5×1 3×1 1×3

$(5\times1)^T(5\times1) = 1\times1$

$3\times5,\ 5\times1 = 3\times1$

$$((x^T A^T) - B^T)(Ax-B)$$

$$x^T A^T Ax - x^T A^T B - B^T Ax + B^T B$$

$$\frac{de}{dx} =$$