Intuition for Matrix/Vector from Scalar

MATRIX (X)	**SCALAR (X)**
$X = Q\Lambda Q^T$ [1]	$x = \sqrt{x}\sqrt{x}$
$X \succ 0$ (positive definite)	$x > 0$
$X \succcurlyeq 0$ (positive semi-definite)	$x \geq 0$
Jaccobian Matrix [2]	first derivative
Hessian Matrix [3]	second derivative

1. Every real symmetric matrix can be decomposed into an expression using only real-valued eigenvectors and eigenvalues. Analogy in the scalar world: Every real number can be decomposed into the square root of itself multiply the square root of itself.↩

2. Given $f : \mathbb{R}^m \to \mathbb{R}^n$, Jaccobian Matrix $\mathcal{J}$ is definited as $f_{i,j} = \frac{\partial}{\partial x_j} f(x)_i$ ↩

3. Given $f : \mathbb{R}^n \to \mathbb{R}$, Hessian Matrix $\mathcal{H}$ is definited as $f_{i,j} = \frac{\partial}{\partial x_i \partial x_j} f(x)$↩