Definition of matrix calculus

Suppose and is matrix, with arbitrary dimensions. As and . Define the matrix calculus as follows

*So, the following criterions for matrix calculus hold*

1. *When the column of matrix is seen as* ***first dimension****, matrix calculus follows Jacobian or numerator formulation*
2. *When the row of matrix is seen as first dimension, matrix calculus follows Hessian or denominator formulation*

*The two tips are illustrated in the table below*



Figure 1 Illustration of matrix calculus.