MATRIX RULES

Some general transpose and addition (and subtraction) operations for all matrices **A**, **B**, and **C** (of conformable dimensions), and scalar λ.

$(\mathbf{A}')' = \mathbf{A}$
$(\lambda\mathbf{A})' = \lambda\mathbf{A}'$
$(\mathbf{A}+\mathbf{B})' = \mathbf{A}'+\mathbf{B}'$
$\mathbf{A}+\mathbf{B} = \mathbf{B}+\mathbf{A}$
$(\mathbf{A}+\mathbf{B})+\mathbf{C} = \mathbf{A}+(\mathbf{B}+\mathbf{C})$
$\lambda(\mathbf{A}+\mathbf{B}) = \lambda\mathbf{A}+\lambda\mathbf{B}$

Some general multiplication operations for all matrices **A**, **B**, and **C** (of conformable dimensions), and scalar λ.

$\lambda(\mathbf{AB}) = (\lambda\mathbf{A})\mathbf{B}$
$\mathbf{A}(\mathbf{BC}) = (\mathbf{AB})\mathbf{C}$
$\mathbf{A}(\mathbf{B}+\mathbf{C}) = \mathbf{AB} + \mathbf{AC}$
$(\mathbf{B}+\mathbf{C})\mathbf{A} = \mathbf{BA} + \mathbf{CA}$
$(\mathbf{AB})' = \mathbf{B}' \mathbf{A}'$
$(\mathbf{ABC})' = \mathbf{C}'\mathbf{B}' \mathbf{A}'$
$\mathbf{AB} \neq \mathbf{BA}$ (in most cases)

Some general properties of the trace for all matrices **A**, and **B** (of conformable dimensions), and scalar λ.

$\text{tr}(\lambda\mathbf{A}) = \lambda \, \text{tr}(\mathbf{A})$
$\text{tr}(\mathbf{A} \pm \mathbf{B}) = \text{tr}(\mathbf{A}) \pm \text{tr}(\mathbf{B})$
$\text{tr}(\mathbf{A} \, \mathbf{B}) = \text{tr}(\mathbf{B} \, \mathbf{A})$

Some general properties of the inverse:

$\mathbf{A}\mathbf{A}^{-1} = \mathbf{A}^{-1}\mathbf{A} = \mathbf{I}$ a matrix multiplied by its inverse is the identity matrix

$(\mathbf{A}^{-1})^{-1} = \mathbf{A}$ the inverse of the inverse is the original matrix

$(\mathbf{A}')^{-1} = (\mathbf{A}^{-1})\,'$ the inverse of a transpose is the transpose of the inverse

$(\mathbf{AB})^{-1} = \mathbf{B}^{-1} \mathbf{A}^{-1}$ the product of two inverses is the inverse of the product