

Table 2

$$\begin{aligned}
 A \otimes B &= [a_{ij}B] \\
 A \otimes (\alpha B) &= \alpha(A \otimes B) \\
 (A + B) \otimes C &= A \otimes C + B \otimes C \\
 A \otimes (B + C) &= A \otimes B + A \otimes C \\
 A \otimes (B \otimes C) &= (A \otimes B) \otimes C \\
 (A \otimes B)' &= A' \otimes B' \\
 (A \otimes B)(C \otimes D) &= AC \otimes BD \\
 (A \otimes B)^{-1} &= A^{-1} \otimes B^{-1} \\
 \text{vec}(AYB) &= (B' \otimes A) \text{vec } Y \\
 |A \otimes B| &= |A|^m |B|^n \text{ when } A \text{ and } B \text{ are of order} \\
 &\quad (n \times n) \text{ and } (m \times m) \text{ respectively} \\
 A \otimes B &= U_1(B \otimes A)U_2, U_1 \text{ and } U_2 \text{ are permutation} \\
 &\quad \text{matrices} \\
 \text{tr}(A \otimes B) &= \text{tr } A \text{ tr } B \\
 A \oplus B &= A \otimes I_m + I_n \otimes B \\
 U &= \sum_r \sum_s E_{rs} \otimes E'_{rs}
 \end{aligned}$$

Table 3

$$\begin{aligned}
 \frac{\partial(Ax)}{\partial x} &= A' \\
 \frac{\partial(x'A)}{\partial x} &= A \\
 \frac{\partial(x'x)}{\partial x} &= 2x \\
 \frac{\partial(x'Ax)}{\partial x} &= Ax + A'x \\
 \frac{\partial z}{\partial x} &= \frac{\partial y}{\partial x} \frac{\partial z}{\partial y}
 \end{aligned}$$

Table 4

$$\begin{aligned}
 \frac{\partial f(X)}{\partial X} &= \sum \sum E_{ij} \frac{\partial f(X)}{\partial x_{ij}} \\
 \frac{\partial |X|}{\partial X} &= |X|(X^{-1}), \text{ when elements of } X \text{ are} \\
 &\quad \text{independent} \\
 &= 2[X_{ii}] - \text{diag } \{X_{ii}\}, \text{ when } X \text{ is symmetric.} \\
 \frac{\partial X}{\partial x_{rs}} &= E_{rs} \\
 \frac{\partial X'}{\partial x_{rs}} &= E'_{rs} \\
 \frac{\partial(AXB)}{\partial x_{rs}} &= AE_{rs}B \\
 \frac{\partial(AX'B)}{\partial x_{rs}} &= AE'_{rs}B \\
 \frac{\partial(X'A'AX)}{\partial x_{rs}} &= E'_{rs}A'AX + X'A'AE_{rs} \\
 \frac{\partial(AX^{-1}B)}{\partial x_{rs}} &= -AX^{-1}E_{rs}X^{-1}B \\
 \frac{\partial(X'AX)}{\partial x_{rs}} &= E'_{rs}AX + X'AE_{rs} \\
 \frac{\partial(X^n)}{\partial x_{rs}} &= \sum_{k=0}^{n-1} X^k E_{rs} X^{n-k-1} \\
 \frac{\partial(X^{-n})}{\partial x_{rs}} &= -X^{-n} \left[\sum_{k=0}^{n-1} X^k E_{rs} X^{n-k-1} X^{-n} \right]
 \end{aligned}$$