Engineering Mathematics

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Common Reasoning

$$\int \frac{1}{x}\,dx = \ln|x| + C$$

> This is valid for $x \neq 0$, and the absolute value ensures the logarithm is defined for both positive and negative values of x.

Total Derivative

$$d\phi = \frac{\partial \phi}{\partial x}dx + \frac{\partial \phi}{\partial y}dy$$

> When partially differentiating with respect to x, treat y as a constant, and vice versa.

Linear Algebra

Transportation

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \Rightarrow A^T = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix} \Rightarrow A^T_{ij} = A_{ji}$$

Speical types of Matrices

Diagonal Matrix

E.g.

$$D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Another example (3×4):

$$D = \begin{bmatrix} 5 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 7 & 0 \end{bmatrix}$$

Identity Matrix (Unit Matrix)

$$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$