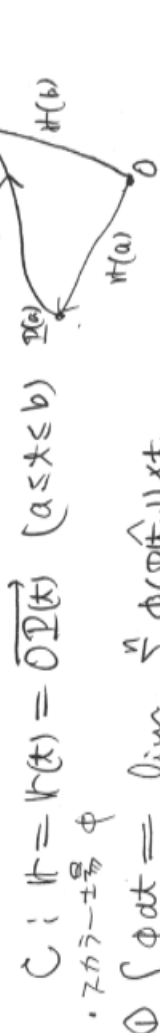


② 線積分のリーマン和による定義



$C: h = h(x) = \overline{P(x)} \quad (a \leq x \leq b)$
 スカラー場 ϕ

$$\int_C \phi dx = \lim_{n \rightarrow \infty} \sum_{k=1}^n \phi(P(x_k)) \Delta x_k$$

 定義

$$= \int_a^b \phi(x) dx$$

①
$$\int_C \phi ds = \lim_{n \rightarrow \infty} \sum_{k=1}^n \phi(P(x_k)) \Delta s_k$$

 定義

$$\Delta s_k = S(x_k) - S(x_{k-1})$$

$$= \int_a^b \phi(x) \frac{ds}{dx} dx$$

 ②
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 定義

$$= \int_a^b \phi(x) dx$$

③
$$\int_C \phi dx = \int_a^b \phi(x) dx$$

 ④
$$\int_C \phi dy = \int_a^b \phi(x) h'(x) dx$$

$$= \int_a^b \phi(x) \frac{dy}{dx} dx$$

 ⑤
$$\int_C \phi dz = \int_a^b \phi(x) h'(x) \sqrt{1 + h'(x)^2} dx$$

$$= \int_a^b \phi(x) \sqrt{1 + h'(x)^2} dx$$

①は1107x-1に依存, ②-⑤は定義よりホに無関係でCとAに決定
 1107x-1で表せる
 ① $\int_C \phi dx = \int_a^b \phi dx$
 ② $\int_C \phi ds = \int_a^b \phi \frac{ds}{dx} dx = \int_a^b \phi |h'(x)| dx$
 ③ $\int_C \phi dx = \int_a^b \phi dx$
 ④ $\int_C \phi dy = \int_a^b \phi \frac{dy}{dx} dx = \int_a^b \phi \frac{dz}{dx} dx$

$$= \int_a^b \phi \left(\frac{dx}{dx}, \frac{dy}{dx}, \frac{dz}{dx} \right) dx = \int_a^b \phi \frac{dV}{dx} dx$$

 ⑤ $\int_C A \cdot dV = \int_a^b A_x \frac{dx}{dx} dx + \int_a^b A_y \frac{dy}{dx} dx + \int_a^b A_z \frac{dz}{dx} dx = \int_a^b A \cdot \frac{dV}{dx} dx$
 ⑥ $\int_C A \times dV = \int_a^b (A_y \frac{dz}{dx} - A_z \frac{dy}{dx}, \dots) dx = \int_a^b A \times \frac{dV}{dx} dx$

7)
$$\begin{aligned} ds &= \frac{ds}{dx} dx = |h'(x)| dx \\ dx &= \frac{dx}{dx} dx = 1 \cdot dx \\ dV &= \frac{dV}{dx} dx = h'(x) dx \end{aligned}$$

$$= \int_C A_x dx + \int_C A_y dy + \int_C A_z dz$$

$$= \int_C (A_x dx + A_y dy + A_z dz)$$

⑥
$$\int_C A \cdot dV = \lim_{n \rightarrow \infty} \sum_{k=1}^n A(P(x_k)) \times \Delta V_k$$

 定義

$$(A_y \Delta z_k - A_z \Delta y_k, \dots)$$

$$= \int_C (A_y dz - A_z dy, A_x dz - A_x dy, A_x dy - A_y dx)$$

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