$\{X \in B\}$

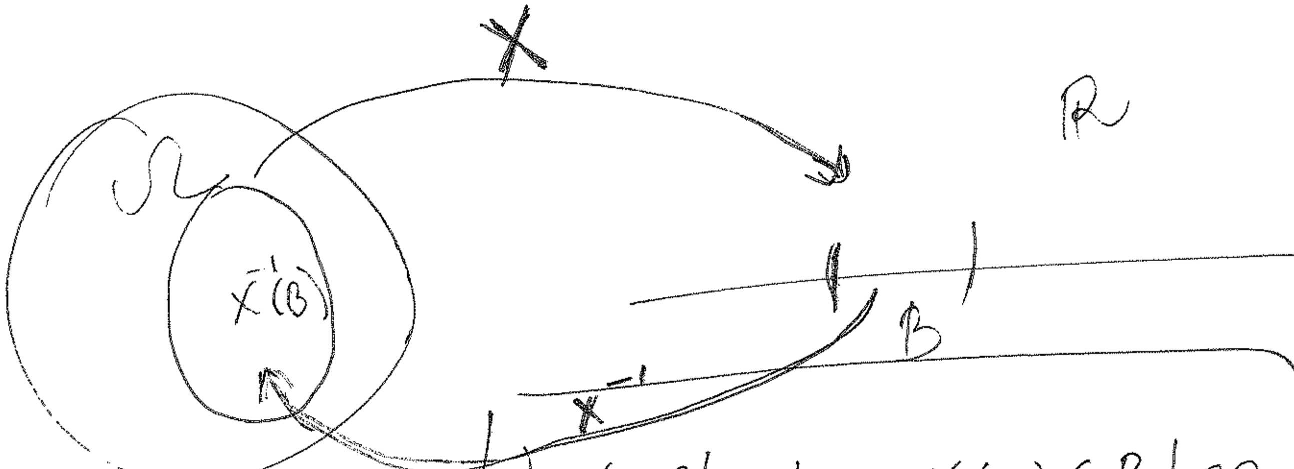
$f : A \to B$

$\{f \in (1,2)\}$

$= \{x,\ f(x) \in (1,2)\}$

$= f^{-1}((1,2))$

$X : \Omega \longrightarrow \mathbb{R}$



$$\boxed{\begin{aligned}\{X \in B\} &= \{\omega,\ X(\omega) \in B\} \subset \Omega \\ &= X^{-1}(B)\end{aligned}}$$

$$\boxed{P(X \in B)}$$

$\{X = x\} = \{\omega \mid X(\omega) = x\}$

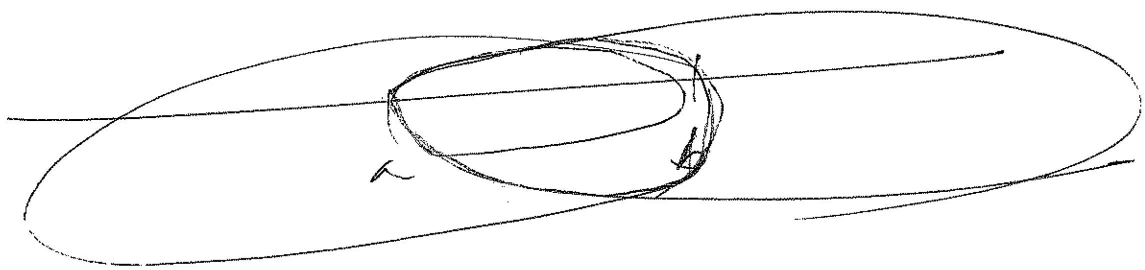
$\{X \leq x\} = \{\omega \mid X(\omega) \leq x\}$

$= X^{-1}((-\infty, x])$

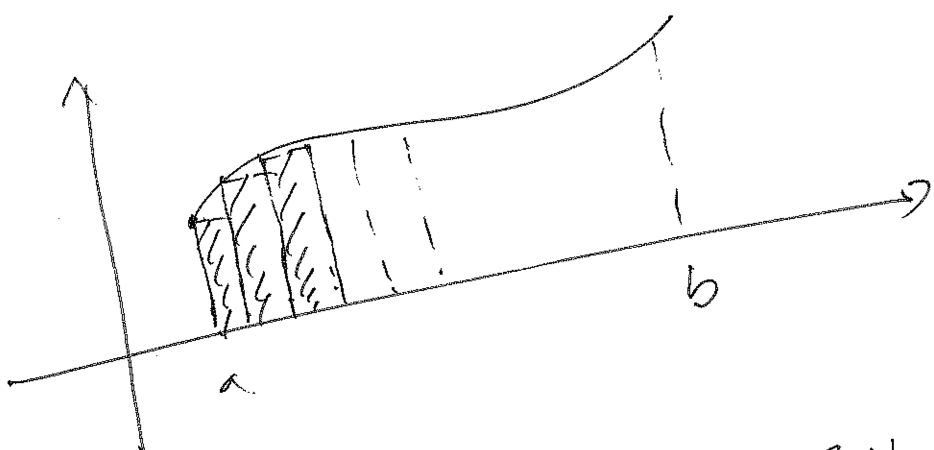
1) $P(X > x) = 1 - F_X(x)$

$$P(X > x) = P\left((X \le x)^c\right)$$
$$= 1 - P(X \le x) = 1 - F_X(x)$$

2) $P(a < X \le b) = P\left((X \le b) \cap (X \le a)^c\right)$



$$= P(X \le b) - P(X \le a)$$
$$= F_X(b) - F_X(a)$$



$$P(a \le X \le a+h) = \int_a^{a+h} f_X(u)\,du \approx f(a)h.$$

$$P(a \le X \le b) = \int_a^b f_X(u)\,du$$

$$\shortparallel$$

$$P(X \in (a,b]) = \int_a^b f_X(u)\,du$$

$$\shortparallel$$

$$\int_{(a,b]} f_X(u)\,du$$

$$\boxed{P(X \in A) = \int_A f_X(u)\,du}$$

A - ~~[illegible]~~ Borel set.

(A is any interval, union of intervals...)

$X_1 : \Omega \longrightarrow \mathbb{R}$

$X_2 : \Omega \longrightarrow \mathbb{R}$

$\vdots$

$X_n : \Omega \longrightarrow \mathbb{R}$

$(X_1, X_2, \ldots, X_n) : \Omega \longrightarrow \mathbb{R}^n$

$B \subset \mathbb{R}^n$

$$P_{X_1, X_2, \ldots X_n}(B) = P((X_1, X_2, \ldots X_n) \in B)$$

$$P_{X_1, X_2}((1,2) \times (3,4)) = P((X_1, X_2) \in (1,2) \times (3,4))$$

$$= P\Big(X_1 \in (1,2),\ X_2 \in (3,4) \Big)$$