

## 1.1. Sets and Functions

(Knowledge of this material is assumed.)

NOTATION.

$\mathbb{N} = \{1, 2, 3, \dots\}$ , the natural numbers.

$\mathbb{Z} = \{0, 1, -1, 2, -2, \dots\}$ , the integers.

$\mathbb{Q} = \left\{ \frac{m}{n} : m, n \in \mathbb{Z}, n \neq 0 \right\}$ , the rational numbers.

$\mathbb{R}$ , the real numbers.

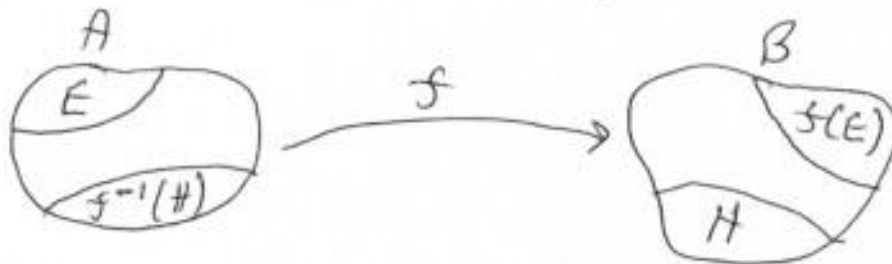
$A \setminus B$  — the complement of  $B$  relative to  $A$  (other books may use  $A - B$  or  $B'$  if  $A$  is understood)

$D(f)$  — domain of  $f$

$R(f)$  — range of  $f$

Let  $f : A \rightarrow B$  be a function with domain  $A$  and  $R(f) \subseteq B$ :

- 1) If  $E \subseteq A$ ,  $f(E) = \{f(x) : x \in E\}$  is the direct image of  $E$  under  $f$ .
- 2) If  $H \subseteq B$ ,  $f^{-1}(H) = \{x \in A : f(x) \in H\}$  is the preimage of  $H$  under  $f$ .



For two sets  $A$  and  $B$ ,

$$A = B \iff A \subseteq B \text{ and } B \subseteq A.$$

NOTATION.

$p \implies q$  means statement  $p$  implies statement  $q$  (if  $p$ , then  $q$ ).

$p \iff q$  means  $p \implies q$  and  $q \implies p$  ( $p$  and  $q$  are equivalent statements).