1. Definitions/Key Idea

1.1. A **statement** is a declarative sentence that is either true or false but not both; thus, a statement has exactly one **truth value**: true (T) or false (F). We often represent a statement by a letter (such as P), called a **statement variable**, similar to the way we represent a number by a variable (such as x). §1.1 p1

1.2. A **logical operator** (or **connective**), on mathematical statements, is a word (e.g.: implies, and, or) or combinations of words (e.g.: if-then), that combines one or more mathematical statements to make a new mathematical statement. §2.1 p33

1.3. An **atomic statement** (or **atom**) is a statement satisfying that no part of it is itself a statement. (e.g., P) ∄

1.4. A **compound statement** is a statement that contains one or more logical operators. ∄
To form a compound statement, we connect two statements by a logical operator. (e.g., $P \Rightarrow Q$)
A compound statement can be decomposed into atomic statements (i.e., it's atoms).

1.5. A **truth table** of a statement exhibits the truth values (TorF) of the statement for each possible combination of truth values for its components. §1.1 p6

1.6. A **tautology** is a compound statement that is true for each assignment of truth values to its components. §2.1 p40

1.7. A **contradiction** is a compound statement that is false for each assignment of truth values to its components. §2.1 p40

1.8. Two statements $\widetilde{P}$ and $\widetilde{Q}$ are **logically equivalent** provided they have the same truth value for all possible combinations of truth values for all variables (i.e. all atoms) appearing in $\widetilde{P}$ and $\widetilde{Q}$. In this case, we write $\widetilde{P} \equiv \widetilde{Q}$ and say that $\widetilde{P}$ and $\widetilde{Q}$ are logically equivalent. §2.2 p43

2. Logical Connective Symbols and Truth Tables

2.1.

	negation
P	∼ P
T	F
F	T

		conjunction (and)	disjunction (or)	conditional (implication/if-then)	biconditional (if and only if)
P	Q	P∧ Q	P∨Q	P⇒Q	P⇔Q
T	T	**T**	T	T	T
T	F	F	T	**F**	F
F	T	F	T	T	F
F	F	F	**F**	T	T

2.2. The truth table of a compound proposition form consisting of n simple proposition forms linked with connectives has 2^n lines. This exhausts all possible truth values of the simple propositions.
On written work, follow the book's (as done above) pattern of the last listed atomic statement column has alternating T's and F's.

2.3. As in algebra, we give the connectives a priority ordering that resolves ambiguities when parentheses are omitted. The **priority/precedence of the connectives**, from highest to lowest, is: ∄
$\sim\ , \wedge\ , \vee\ , \Rightarrow\ , \Leftrightarrow$.

2.4. Use $P \Rightarrow Q$ to translate: (Good check if you have grasp of 2.4 is the book's ER 2.1.13 p. 42).) §2.1 p37

(1) If P, then Q
(2) P implies Q
(3) P is sufficient for Q
(4) P only if Q
(5) P only when Q
(6) Q is necessary for P
(7) Q if P
(8) Q when P (also Q whenever P)

Rmk on (4). What sounds correct to your ear?
- $x > 0$ only if $x > 17$.
- $x > 17$ only if $x > 0$.

2.5. Use $P \Leftrightarrow Q$ to translate: §2.1 p39

(1) P is equivalent to Q
(2) P if and only if Q (See above $P \Rightarrow Q$'s (4) and (7))
(3) P if but only if Q
(4) P precisely when Q
(5) P is necessary and sufficient for Q (See above $P \Rightarrow Q$'s, (3) and (6))