Math 150

Section 3.1 Statements and Quantifiers

A statement is defined as a declarative sentence that is either true or false, but not both simultaneously.

Example 1 Which of the following are statements?

3+1=4

3+1=5

"Dr. Abernathy ate bacon for breakfast this morning."

"What time is it?"

"The weather is beautiful."

x+3=5

"This sentence is false."

Logical Connectives

Connective	Symbol	Type of Statement
and	$\wedge$	conjunction
or	$\vee$	disjunction
not	$\sim$	negation

Example 2 Let p represent the statement "6 is a prime number." and q represent the statement "Water is a liquid." Write the following statements and determine their truth value.

$p \vee q$

$p \wedge q$

$\sim p$

$\sim q$

$\sim p \vee q$

$\sim (p \vee q)$

$\sim p \vee \sim q$

$\sim p \wedge \sim q$

Quantifiers

Quantifier	Symbol	Type of Quantifer
all, each, every	$\forall$	universal
some, there exists, at least one	$\exists$	existential

Negating Quantifiers

Statement	Negation
All do.	Some do not.
Some do.	All do not.

Example 3 Negate the statement "Some whole numbers are not rational numbers."

Sets of Numbers

Natural or Counting Numbers: $\{1, 2, 3, 4, \cdots\}$ ($\mathbb{N}$)

Whole Numbers: $\{0, 1, 2, 3, \cdots\}$

Integers: $\{\cdots, -3, -2, -1, 0, 1, 2, 3, \cdots\}$ ($\mathbb{Z}$)

Rational Numbers: $\{\frac{p}{q} | p$ and q are integers $, q \neq 0\}$ ($\mathbb{Q}$)

Real Numbers: $\{x | x$ is a number that can be written as a decimal $\}$ ($\mathbb{R}$)

Irrational Numbers: $\{x | x$ is a real number and not a rational number $\}$