Foundations of Math 12

Chapter 3: Set Theory and Logic
Vocabulary and Symbols

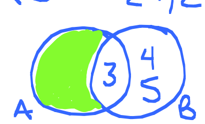
Key

3.1 Types of Sets and Set Notation

Term	**Definition**	**Example**
Set	A collection of distinguishable objects. Sets are defined using brackets.	The set of whole numbers is: W = $\{0, 1, 2, 3, \ldots\}$
Element	An object in a set	2 is an element of W, the set of whole numbers
Universal Set	A set of all the elements under consideration for a particular context. (Also called sample space)	The universal set (or sample space) of digits is: $D = \{0,1,2,3,4,5,6,7,8,9\}$
Subset	A set whose elements all belong to another set. To show A is a subset of B, we write $A \subset B$ "is a subset of"	The set of odd digits, $O = \{1,3,5,7,9\}$ is a subset of D, the set of digits. In set notation, this is written $O \subset D$
Complement	All the elements of a universal set that do not belong to a subset of it. The complement is denoted with a prime sign A' or a horizontal bar above, $\overline{A}$.	$O' = \{0,2,4,6,8\}$ Is the complement of $O = \{1,3,5,7\}$, a subset of the universal set of digit, D.
Empty Set	A set with no elements. The empty set is denoted by { } or $\emptyset$.	Q, the set of odd numbers divisible by 2 is the empty set. In set notation, this is written: $Q = \{\ \}$ or $Q = \emptyset$

Term	**Definition**	**Example**
Disjoint	Two or more sets having no elements in common.	The set of even numbers and the set of odd numbers are disjoint.
Finite set	A set with a countable number of elements	The set of even numbers less than 10 $E = \{2,4,6,8\}$
Infinite set	A set with an infinite number of elements.	The set of natural numbers, $N = \{1,2,3,\ldots\}$
n(X)	The number of elements of the set *X*.	If the set *X* is defined as the set of numbers from 1 to 5, $X = \{1,2,3,4,5\}$ $n(X) = 5$
Mutually Exclusive	Two or more events that cannot occur at the same time.	The sun rising + the sun setting are mutually exclusive

3.3 Intersection and Union of Two Sets

Term	**Definition**	**Example**
Intersection	The set of elements that are common to two or more sets. In set notation, the intersection of sets *A* and *B* is: $A \cap B$	If $A=\{1,2,3\}$ and $B=\{3,4,5\}$, then $A \cap B = \{3\}$
Union	The set of all the elements in two or more sets. In set notation, the union of sets and *B* is: $A \cup B$	If $A=\{1,2,3\}$ and $B=\{3,4,5\}$, then $A \cup B = \{1,2,3,4,5\}$
$A \setminus B$	Elements in set A but not in set B	$A \setminus B = \{1,2\}$ 

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3.5 Conditional Statements and Their Converse

Term	Definition	Example
Conditional Statement	An "if – then" statement	If it is Monday Then it is a school day
Hypothesis	An assumption	From above "It is Monday" is the hypothesis
Conclusion	The result of a hypothesis	From above "It is a school day" is the conclusion
Counterexample	An example that disproves a statement.	From above Thanksgiving Monday is a counterexample (no school)
Converse	A conditional statement in which the hypothesis and the conclusion are switched.	From above "If it is a school day then it is Monday"
Biconditional	A conditional statement whose converse is also true. In logic notation, a biconditional statement is written as "*p* if and only if *q*"	The statement: "If a number is even then it is divisible by 2" is true. The converse "If a number is divisible by 2, then it is even" is also true. The biconditional statement is: "A number is even if and only if it is divisible by 2"
$p \Rightarrow q$	Notation for "If p, then q" Is read as "p implies q"	
$p \Leftrightarrow q$	Notation for "p if and only if q" means both the conditional statement and its converse are true.	

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3.6 The Inverse and the Contrapositive of Conditional Statements

Term	Definition	Example
Inverse	A statement that is formed by negating both the hypothesis and the conclusion of a conditional statement.	"If a number is even, then it is divisible by 2." The inverse is: "If a number is not even, then it is not divisible by 2"
Contrapositive	A statement that is formed by negating both the hypothesis and the conclusion of the converse of a conditional statement.	"If a number is even, then it is divisible by 2." The contrapositive is: "If a number is not divisible by 2, then it is not even"
$\neg p$	"not" p	