Math 116 Summer 2004
Set Theory Definitions and Examples

element A set is a collection of *elements*. If $A = \{1, 2, 3, 4\}$ then 1,2,3,4 are the *elements* of the set A. The symbol "$\in$" means "is an element of". So we can write $1 \in A$ or $3 \in A$ or $5 \notin A$.

empty set The empty set is a set that contains no elements. We denote it by $\{\}$ or (more often) by $\emptyset$.

subset A set A is a *subset* of a set B if all the elements of A are also elements of B.

1. Let $A = \{1, 4, 9, 16\}, B = \{1, 2, 3, 4, 9, 10, 12, 16\}$. Then A is a subset of B, denoted $A \subset B$.
2. Let $C = \{a, b, c, d, e\}, D = \{b, c, d, e, f\}$. Then C is not a subset of D, nor is D a subset of C: $C \not\subset D, D \not\subset C$.

universal set When dealing with a particular set theory problem or collection of sets, we often speak of a *universal set*, which is a set that contains all the elements of the universe for the particular problem.

union Taking the *union* of two (or more) sets produces a set whose elements are those elements that belong to either (any) of the original two (or more) sets.

1. Let $A = \{1, 2, 3, 4, 5\}, B = \{1, 3, 5, 7, 9, 11\}$. Then their union is $A \cup B = \{1, 2, 3, 4, 5, 7, 9, 11\}$
2. Let $C = \{a, c, e, f\}, D = \{b, c, d, e, z\}$. Then $C \cup D = \{a, b, c, d, e, f, z\}$.

intersection Taking the *intersection* of two (or more) sets produces a set whose elements are those elements that belong to both (all) of the original two (or more) sets.

1. Let $A = \{1, 2, 3, 4, 5\}, B = \{1, 3, 5, 7, 9, 11\}$. Then their intersection is $A \cap B = \{1, 3, 5\}$
2. Let $C = \{a, c, e, f\}, D = \{b, c, d, e, z\}$. Then $C \cap D = \{c, e\}$.
3. $A \cap C = \emptyset$.

complement When a universal set U is defined, the *complement* of a set A is the set A^c or $c(A)$ that contains all elements of the universal set U that are not in A.

Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}, A = \{2, 4, 6, 8\}, B\{1, 2, 3, 4, 5\}$.

1. $A^c = c(A) = \{1, 3, 5, 7, 9, 10\}$ and
2. $B^c = c(B) = \{6, 7, 8, 9, 10\}$.