

## Sets in MPL

An MPL set is a finite collection of expressions that is surrounded by the braces  $\{$  and  $\}$ . For example, the expression  $\{x + y = 1, x - y = 2\}$  represents a set with two members, the equations  $x + y = 1$  and  $x - y = 2$ .

Following mathematical convention, MPL sets satisfy the two properties:

1. *The contents of a set does not depend on the order of the elements in the set.* This means that  $\{u, v\}$  and  $\{v, u\}$  are the same set.
2. *The elements of a set are distinct.* In other words, a set cannot contain duplicate elements.

**Algebraic Operations On Sets** Let  $A$  and  $B$  represent sets and let  $x$  represent an arbitrary expression. The following operations are defined for sets:

- *Union of Sets,  $A \cup B$ .* The *union* of sets  $A$  and  $B$  is a new set that contains all the elements in  $A$  or in  $B$  or in both sets. For example,

$$\{a, b, c\} \cup \{b, c, d\} \rightarrow \{a, b, c, d\}$$

where the expression to the right of the arrow is the evaluated form of the expression.

- *Intersection of Sets,  $A \cap B$ .* The *intersection* of sets  $A$  and  $B$  is a new set that contains all the elements that are in both  $A$  and  $B$ . For example,

$$\{a, b, c\} \cap \{b, c, d\} \rightarrow \{b, c\}.$$

- *Difference of Sets,  $A \sim B$ .* The *difference* of sets  $A$  and  $B$  is a new set that contains all the elements that are in  $A$  but not in  $B$ . For example,

$$\{a, b, c\} \sim \{b, c, d\} \rightarrow \{a\}.$$

- *Set membership,  $x \in A$ .* The expression  $x \in A$  evaluates to **true** if  $x$  is in  $A$ , and otherwise evaluates to **false**. For example,

$$a \in \{a, b, c\} \rightarrow \mathbf{true}, \quad d \in \{a, b, c\} \rightarrow \mathbf{false}.$$

Following mathematical convention, we represent the empty set with the reserved symbol  $\emptyset$ .

Most computer algebra systems provide sets along with the algebraic operations described above (see Fig. 1).

MPL	Maple	Mathematica	MuPAD
set notation			
$\{a, b, c\}$	$\{a, b, c\}$	$\{a, b, c\}$	$\{a, b, c\}$
$\emptyset$	$\{\}$	$\{\}$	$\{\}$
$A \cup B$	A union B	Union[A,B]	A union B
$A \cap B$	A intersect B	Intersection[A,B]	A intersect B
$A \sim B$	A minus B	Complement[A,B]	A minus B
$x \in A$	member(x, A)	MemberQ[x,A]	contains(A,x)

**Figure 1.** MPL Set operations in Maple, Mathematica, and MuPAD. (Implementation: [Maple](#) (mws), [Mathematica](#) (nb), [MuPAD](#) (mnb).)

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