

# MATH1081 notes

Nira (z5417727)

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## **1    1.1: Introduction**

1. addition, multiplication, division and subtraction
2. Mainly dealing with finite sets

## 2 1.2: Sets and subsets

A set is a well defined collection of distinct objects

Example:  $S = \{1, a, 3\}$ ,  $A = \{\Pi, 1\}$ .

1.  $e \notin A$ ; it is not in A
2. For example, if A is a set of all integers;  $\{\text{all even integers}\} = \{n \in \mathbb{R} | n \text{ is even}\}$ .
3. We can remove superfluous items (elements that occur more than one).  
 $A = \{1, 2, 3, 3\}$  where 3 can be removed.

Example:

$A = \{1, 2, 3\}$ ,  $B = \{2, 3, 1\}$ ,  $C = \{1, 2, 3, 3\}$ ,  $D = \{1, 3\}$ .

Here, D is a proper subset of A, B, C; A, B, C are supersets of D.

$\subseteq$ : Subset (proper subset),  $\supseteq$ : Superset.

1. To prove if a set is a proper subset; do the following:

For example, if  $D \in A$ , then check if  $e \in D$

If  $e \in D$ , then  $e \in A$ . Thus, it would be a proper subset (here, e is just an element).

2. To prove that two sets are equal;

For example, if  $A = B$ , prove:

- i)  $A \subseteq B$ ; if an element is in A, then the element is in B.
- ii)  $B \subseteq A$ ; if an element is in B, then the element is in A.

### 3 1.3: Power Sets and Stability

Subsets of  $A = \{1, 2, 3\}$ :

1. Could throw everything out to get empty set  $\Phi$ ,
2. One element each:  $\{1\}, \{2\}, \{3\}$ ,
3. Two elements:  $\{1, 2\}, \{2, 3\}, \{1, 3\}$ ,
4. Set itself:  $A$ .

The set containing 1, 2, 3, 4 is called the powerset of A.

Given  $A = \{1, 2, 3\}, B = \{1, 2, 3, 3\}, C = \{1, 3\}, D = \{1, 3\}$ , where  $A = B, C \subseteq A, B$  and  $D \not\subseteq A, B, C$ .

1. size of A = 3, B = 3, C = 2, D = 2.

[Exercise with A = 0, 1, 0, 1, B done in word].

### 3.1 1.4: Set Operations

1. Complement Operation:

Let there be a set  $A$  in  $U$  ( $A$ : all of the people in the video,  $U$ : universal set of everyone in the world,  $A^c$  = complement of  $A$ ).

$$A^c = \{x \in U | x \notin A\}.$$

If there is  $A, B$ , intersecting,