Course Overview

Finite Math is a collection of real-world applications that build on Math 11. Here are the main topics, with an example application for each topic.

Chapters 3-5 Sets, Counting and Probability
Is an event likely or unlikely to happen?

Chapters 1-2 Linear Programming
How to maximize profit with a fixed amount of capital and raw materials?

Chapters 6-7 Matrices and Markov Chains
Predict a company's marketshare two years from now.

Chapter 8 Financial Math
What will your monthly payment be when taking out a loan?

Chapter 9 Logic
Helpful when reading legal documents like employment contracts or tenancy agreements.

3.1 Sets

Definition: A **set** is a collection of objects. The objects are called **elements**.

Here is a set with three elements:

$A = \{x, y, z\}$

Here is a set with four elements:

$B = \{3, 5, 7, 9\}$

Example: Write down the following sets:

a) $A = \{$all the letters before f in the English alphabet$\}$

$A = \{a, b, c, d, e\}$

b) $B = \{$all the even numbers between 5 and 9$\}$

$B = \{6, 8\}$

c) $C = \{$all the even numbers between 5 and 7$\}$

$C = \{6\}$

Definition: The **union** of sets A and B is the set of elements that are in A or B or both. It is written $A \cup B$.

OR

Definition: The **intersection** of sets A and B is the set of elements that are in both A and B. It is written $A \cap B$.

AND

Example: Let $A = \{-3, -1, 3\}$ and $B = \{-2, -1, 3\}$. Find:

a) $A \cup B$

$A \cup B = \{-3, -2, -1, 3\}$ OR

b) $A \cap B$

$A \cap B = \{-1, 3\}$ AND

Example: Let $A = \{1, 2, 3\}$, $B = \{3, 4, 5\}$ and $C = \{0, 1, 5, 6\}$.
Find $(A \cup B) \cap C$.

$A \cup B = \{1, 2, 3, 4, 5\}$

$(A \cup B) \cap C = \{1, 5\}$

Definition: B is a **subset of A**, written $B \subseteq A$, if every element of B is an element of A.

Example: Let's write down some examples of subsets.

$\{1, 3\} \subseteq \{1, 2, 3\}$

$\{1, 3\} \subseteq \{1, 3\}$

$\{1, 3\} \subseteq \{3, 1\}$

$\{3, 4\} \not\subseteq \{1, 2, 3\}$ is not a subset of

Definition: The **empty set** contains no elements. It is written $\varnothing$.

Fact: The empty set is a subset of every set.

Example: Let's write down some examples involving the empty set.

$\{1,3\} \cap \{2,4\} = \phi$

$\phi \subseteq \{1\}$

$\phi \subseteq \{1,3,4\}$

$\phi \subseteq \phi$

Example: List all the subsets of $\{x, y, z\}$.

$\{x,y,z\}$

$\{x,y\}$ $\{x,z\}$ $\{y,z\}$

$\{x\}$ $\{y\}$ $\{z\}$

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Definition: The **complement of A** is the set of elements in the universal set U that are not in A. It is written A'.

Example: Let $U = \{a, b, c, d, f\}$, $A = \{b, c\}$ and $B = \{c, d, f\}$. Find:

a) A'

$A' = \{a, d, f\}$

b) $(A \cup B)'$

$A \cup B = \{b, c, d, f\}$

$(A \cup B)' = \{a\}$

c) $A' \cup B$

$A' = \{a, d, f\}$

$A' \cup B = \{a, c, d, f\}$

Notation: $b \in A$ means: b is an element of set A.

Example: Let's write down some examples to practice notation for elements and subsets.

$-1 \in \{-2, -1\}$

$\{-1\} \subseteq \{-2, -1\}$

$-3 \notin \{4, 5\}$

$\{-3\} \not\subseteq \{4, 5\}$

is not an element of