

Logic & Set Theory

2.AB Prel Maths – Exam D

Unless specified otherwise, you are to **always** (at least briefly) explain your reasoning. Even in closed questions.

Logic – propositions and operators

Is the proposition

[25 %]

$$(p \wedge q) \vee (\neg p \wedge \neg q)$$

a **tautology**? Meaning, is it **always true** regardless of p and q being true or false?
Explain.

Bonus Problem

[10 %]

Consider a new logical operator \odot given by the following truth table:

p	q	$p \odot q$
T	T	T
T	F	T
F	T	F
F	F	T

Write the proposition $p \odot q$ using only the standard logical operators \neg , \wedge , \vee , \Rightarrow and \Leftrightarrow .

Basic set operations

Given sets $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 5\}$ and $C = \{1, 4, 5\}$, determine the sets [35 %]

$$A \setminus (B \cup C) \text{ and } (A \cup B) \cap C$$

You **don't** have to **explain** your method.

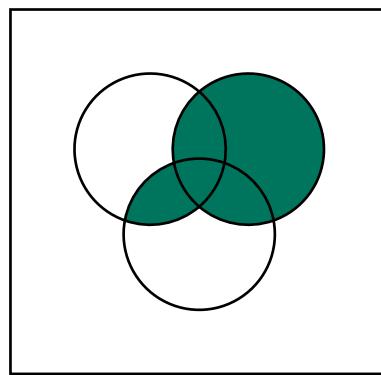
Bonus Problem

[10 %]

Consider the logical operator \odot from the previous bonus problem. Determine the set $\{x \mid x \in A \odot x \in B\}$ where A and B are defined above. Give some **comments** on the method you used to obtain the set.

Venn diagrams

- a) Given the Venn diagram below, determine the set which it represents. You **don't** have to provide an **explanation**. [20 %]



- b) Draw a Venn diagram for the following expression: [20 %]

$$(B \cup C) \setminus (A \cap C)$$

You **don't** have to **explain** anything.

Bonus Problem

[10 %]

The **complement** of a set X inside a set Y is defined as $Y \setminus X$. Draw a Venn diagram of the **complement** of the set $(A \cap B) \cup C$ inside $A \cup B \cup C$.