Logic & Set Theory
3.AB PreIB Maths – Mock Exam

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

Logic – propositions and conjunctions.

a) Supposing a proposition p is false and another proposition q is also false, is the proposition   [15 %]

$$(p \Rightarrow q) \lor q$$

true or false? **Explain**.

b) Fill the propositions p and q (you may not need both) in the blanks so that the proposition   [10 %]

$$(\neg p \Rightarrow \boxed{}) \Leftrightarrow (\boxed{} \lor q)$$

is **always** true independently of whether p and q are themselves true or false.

Basic set operations.

a) Given sets $A = \{2, 3, 5\}$, $B = \{3, 4, 5\}$ and $C = \{1, 2, 3, 4\}$, determine the set   [15 %]

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

You **don't** have to provide any **explanation**.

b) Show that   [10 %]

$$(A \cup B) \cup C = A \cup (B \cup C)$$

for any sets A, B, C. **Explain**.
Hint: Use Venn diagrams.

Cartesian product and relations.

a) Mark each of the following sets **if it's a relation** from A to B, where   [15 %]

$$A = \{1, 2\} \text{ and } B = \{a, b, c\}.$$

☐ $R = \{(1, a), (1, b), (2, c)\}$
☐ $R = \{(a, 2), (b, 1)\}$
☐ $R = \{(1, 2), (1, b), (2, 2)\}$
☐ $R = \{(2, a), (2, b)\}$
☐ $R = \{(a, b), (a, c)\}$

b)   [10 %]