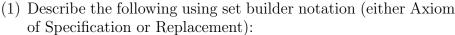
Math 2001 - Assignment 2

Due January 31, 2020



- (a) A =the set of points in \mathbb{R}^2 on the line through (2,3) that is parallel to the y-axis
- (b) $B = \text{the set of points } (x, y) \in \mathbb{R}^2 \text{ on the line through } (1, 2)$ and (3, 4)
- (c) C = the set of points in \mathbb{R}^2 that lie on a circle with center (0,0) and radius 2
- (2) For $U := \{x \in \mathbb{Z} : 1 \le x \le 8\}, A = \{1, 2, 3, 4, 5\}, B = \{x \in U : x \text{ is even } \}, \text{ and } C = \{x \in U : x \ge 4\} \text{ compute:}$
 - (a) $A \cap C_U(B)$
- (b) $A \cup (B \cap C)$
- (c) $(A-B)\cup B$
- (3) Are the following true for all sets A, B in a universe U?
 - (a) A B = B A
 - (b) $A \cup B \subseteq (A \cap \bar{B}) \cup (B \cap \bar{A})$

Consider Venn diagrams first and then either write a proof that the equations hold or give an example where they fail.

(4) Show that for all sets A, B, C

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

without Venn diagrams.

Recall that we already showed that the lefthand side is contained in the the righthand side. So it only remains to write a proof for the converse,

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

(5) Show for all sets A, B in the universe U:

$$\overline{A \cup B} = \overline{A} \cap \overline{B}$$
 (de Morgan's law)

First use Venn diagrams. Then write down a proof.

(6) Simplify the following sets and justify your answers:

(a)
$$\bigcup_{n\in\mathbb{N}}(0,n]$$
 (b) $\bigcap_{n=1}^{3}\{nz:z\in\mathbb{Z}\}$ (c) $\bigcup_{A\in P(\mathbb{N})}A$

In (a) we have $(0, n] = \{x \in \mathbb{R} : 0 < x \le n\}$, the real interval from 0 to n that does not contain 0 but contains n.