

MATH 130A Review: Algebra of Sets

Facts to Know

- Sets

Defn A set is a collection of objects

Ex 1 The empty set $\emptyset$

Ex 2 The universal set U

- Unions

$A \cup B =$ the set of objects x such that x is an element of A or x is an element of B

↑ "cup"



- Intersections

$A \cap B =$ the set of objects x such that x is an element of A and x is an element of B

↑ "cap"



- Complements

$A^c =$ the set of objects x such that x is not an element of A .



- Associative laws

$$\begin{aligned} \circ A \cup (B \cap C) &= (A \cup B) \cap (A \cup C) \\ \circ A \cap (B \cup C) &= (A \cap B) \cup (A \cap C) \end{aligned}$$

- Commutative laws

$$\begin{aligned} \circ A \cup B &= B \cup A \\ \circ A \cap B &= B \cap A \end{aligned}$$

- Distributive laws

$$\begin{aligned} \circ \underline{A \cup (B \cap C)} &= (A \cup B) \cap (A \cup C) \\ \circ \underline{A \cap (B \cup C)} &= (A \cap B) \cup (A \cap C) \end{aligned}$$

- Miscellaneous facts

$$\begin{aligned} \circ A \cap B = \emptyset \text{ and } A \cup B = U &\implies B = A^c \\ \circ \emptyset^c &= U \\ \circ U^c &= \emptyset \\ \circ A^{cc} &= A \\ \circ (A \cup B)^c &= A^c \cap B^c \\ \circ (A \cap B)^c &= A^c \cup B^c \end{aligned}$$

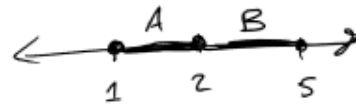
} De Morgan laws

Examples

- If the universal set is given by $U = \{1, 2, 3, 4, 5, 6\}$, and $A = \{1, 2\}$, $B = \{2, 4, 5\}$ are two subsets, find the following sets:

- $A \cup B = \{1, 2, 4, 5\}$
- $A \cap B = \{2\}$
- $A^c = \{3, 4, 5, 6\}$
- $B^c = \{1, 3, 6\}$

- If the universal set is given by $U = (-\infty, +\infty) = \mathbb{R}$, and $A = [1, 2]$, $B = [2, 5]$ are two subsets, find the following sets:



- $A \cup B$
- $A \cap B$
- A^c
- B^c

$$A \cup B = [1, 5]$$

$$A \cap B = \{2\}$$

$$A^c = (-\infty, 1) \cup (2, +\infty)$$

$$B^c = (-\infty, 2) \cup (5, +\infty)$$