

# Exercises 2: Set Operations

## Exercises

1. Using an appropriate Venn Diagram in each case indicate the following sets.

(a)  $(A \cap B) \cup B^c$

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

(b)  $A \setminus (A \setminus B)$

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

(c)  $A \cap (B \setminus A)$

(g)  $A^c \cup B^c \cup C^c$

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

(h)  $A^c \cap (B \setminus C^c)$

2. Let  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{3, 4, 5, 6, 7\}$ , and  $C = \{1, 2, 6, 7\}$ , with the universal set being  $U = \{1, 2, 3, \dots, 10\}$ . Write down the following sets by listing their elements:

(a)  $(A \cap B) \cup B^c$

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

(b)  $A \setminus (A \setminus B)$

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

(c)  $A \cap (B \setminus A)$

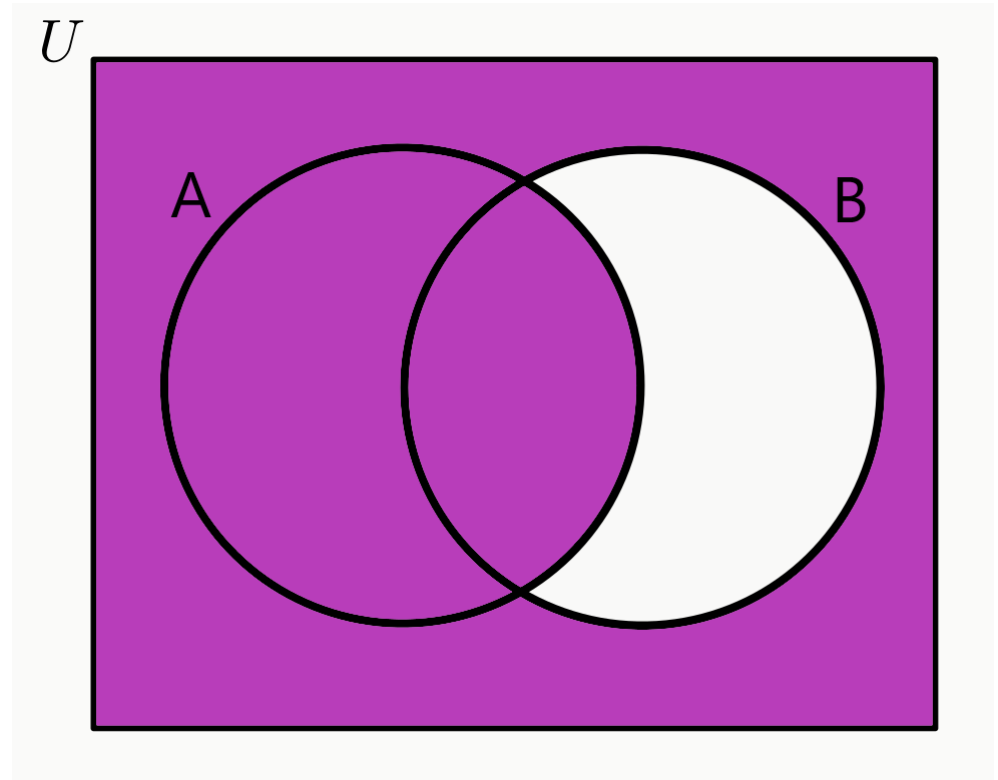
(g)  $A^c \cup B^c \cup C^c$

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

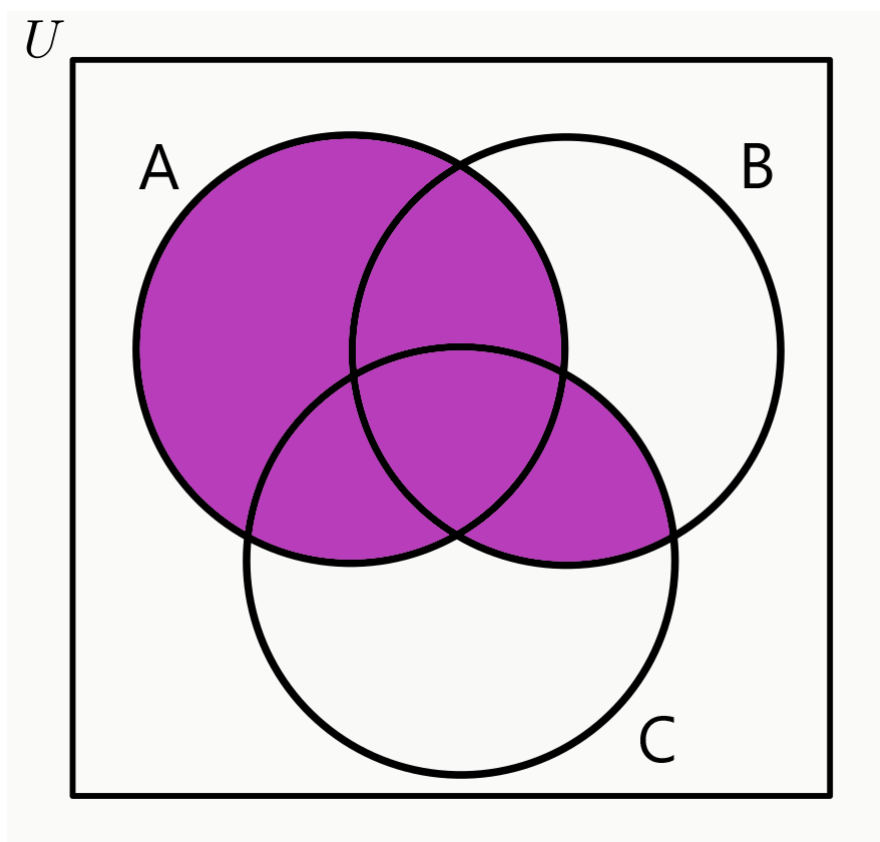
(h)  $A^c \cap (B \setminus C^c)$

3. Give an example of three sets  $A$ ,  $B$  and  $C$  such that  $A \cap B \cap C = \emptyset$ , but  $A \cap B$ ,  $B \cap C$  and  $C \cap A$  are all non-empty.

## Solutions







(d)



(e)



(f)



(g)



(h)

2. Let  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{3, 4, 5, 6, 7\}$ , and  $C = \{1, 2, 6, 7\}$ , with the universal set being  $U = \{1, 2, 3, \dots, 10\}$ . Write down the following sets by listing their elements:

- (a)  $(A \cap B) \cup B^c = \{1, 2, 3, 4, 5, 8, 9, 10\}$
- (b)  $A \setminus (A \setminus B) = \{3, 4, 5\}$
- (c)  $A \cap (B \setminus A) = \emptyset$
- (d)  $A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6, 7\}$
- (e)  $(A \cup B) \cap C = \{1, 2, 6, 7\}$
- (f)  $(A \cup B) \cap (A \cup C) = \{1, 2, 3, 4, 5, 6, 7\}$
- (g)  $A^c \cup B^c \cup C^c = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
- (h)  $A^c \cap (B \setminus C^c) = \{6, 7\}$

3.  $A = \{1, 2\}$ ,  $B = \{1, 3\}$ ,  $C = \{2, 3\}$  is but one example.