

CBSE Class-11 Mathematics
NCERT Solutions
Chapter - 1 Sets
Exercise 1.5

1. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$. Find:

(i) A'

(ii) B'

(iii) $(A \cup C)'$

(iv) $(A \cup B)'$

(v) $(A')'$

(vi) $(B - C)'$

Ans. Given: $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$,

$A = \{1, 2, 3, 4\}$,

$B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$.

(i) $A' = U - A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{1, 2, 3, 4\}$

$$\Rightarrow A' = \{5, 6, 7, 8, 9\}$$

(ii) $B' = U - B = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 4, 6, 8\}$

$$\Rightarrow B' = \{1, 3, 5, 7, 9\}$$

(iii) $(A \cup C)' = U - (A \cup C)$

$$\Rightarrow (A \cup C)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{1, 2, 3, 4\} \cup \{3, 4, 5, 6\})$$

$$\Rightarrow (A \cup C)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{1, 2, 3, 4, 5, 6\}$$

$$\Rightarrow (A \cup C)' = \{7, 8, 9\}$$

$$(iv) (A \cup B)' = U - (A \cup B)$$

$$\Rightarrow (A \cup B)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{1, 2, 3, 4\} \cup \{2, 4, 6, 8\})$$

$$\Rightarrow (A \cup B)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{1, 2, 3, 4, 6, 8\}$$

$$\Rightarrow (A \cup B)' = \{5, 7, 9\}$$

$$(v) (A')' = U - A' = U - (U - A)$$

$$\Rightarrow (A')' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{1, 2, 3, 4\})$$

$$\Rightarrow (A')' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{5, 6, 7, 8, 9\}$$

$$\Rightarrow (A')' = \{1, 2, 3, 4\}$$

$$\Rightarrow (A')' = A$$

$$(vi) (B - C)' = U - (B - C)$$

$$\Rightarrow (B - C)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{2, 4, 6, 8\} - \{3, 4, 5, 6\})$$

$$\Rightarrow (B - C)' = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 8\}$$

$$\Rightarrow (B - C)' = \{1, 3, 4, 5, 6, 7, 9\}$$

2. If $U = \{a, b, c, d, e, f, g, h\}$, find the complement of the following sets:

(i) $A = \{a, b, c\}$

(ii) $B = \{d, e, f, g\}$

(iii) $C = \{a, c, e, g\}$

(iv) $D = \{f, g, h, a\}$

Ans. Given: $U = \{a, b, c, d, e, f, g, h\}$

(i) $A' = U - A$

$$= \{a, b, c, d, e, f, g, h\} - \{a, b, c\} = \{d, e, f, g, h\}$$

(ii) $B' = U - B$

$$= \{a, b, c, d, e, f, g, h\} - \{d, e, f, g\} = \{a, b, c, h\}$$

(iii) $C' = U - C$

$$= \{a, b, c, d, e, f, g, h\} - \{a, c, e, g\} = \{b, d, f, h\}$$

(iv) $D' = U - D$

$$= \{a, b, c, d, e, f, g, h\} - \{f, g, h, a\} = \{b, c, d, e\}$$

3. Taking the set of natural numbers as the universal set, write down the complement of the following set:

(i) $\{x: x \text{ is an even natural number}\}$

(ii) $\{x: x \text{ is an odd natural number}\}$

(iii) $\{x: x \text{ is a positive multiple of 3}\}$

(iv) $\{x: x \text{ is a prime number}\}$

(v) $\{x: x \text{ is a natural number divisible by 3 and 5}\}$

(vi) $\{x: x \text{ is a perfect square}\}$

(vii) $\{x: x \text{ is a perfect cube}\}$

(viii) $\{x: x + 5 = 8\}$

(ix) $\{x: 2x + 5 = 9\}$

(x) $\{x: x \geq 7\}$

(xi) $\{x: x \in \mathbb{N} \text{ and } 2a + 1 > 10\}$

Ans. Given: $U = \{x: x \in \mathbb{N}\}$

(i) Let $A = \{x: x \text{ is an even natural number}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is an even natural number}\} \\ &= \{x: x \text{ is an odd natural number}\}\end{aligned}$$

(ii) Let $A = \{x: x \text{ is an odd natural number}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is an odd natural number}\} \\ &= \{x: x \text{ is an even natural number}\}\end{aligned}$$

(iii) Let $A = \{x: x \text{ is a positive multiple of 3}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is a positive multiple of 3}\} \\ &= \{x: x \in \mathbb{N}, x: x \text{ is not a positive multiple of 3}\}\end{aligned}$$

(iv) Let $A = \{x: x \text{ is a prime number}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is a prime number}\} \\ &= \{x: x \in \mathbb{N}, x: x \text{ is a positive composite number and } x \neq 1\}\end{aligned}$$

(v) Let $A = \{x: x \text{ is a natural number divisible by 3 and 5}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is a natural number divisible by 15}\} \\ &= \{x: x \in \mathbb{N}, x: x \text{ is not divisible by 15}\}\end{aligned}$$

(vi) Let $A = \{x: x \text{ is a perfect square}\}$

$$\begin{aligned}\therefore A' &= U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is a perfect square}\} \\ &= \{x: x \in \mathbb{N}, x: x \text{ is not a perfect square}\}\end{aligned}$$

(vii) Let $A = \{x: x \text{ is a perfect cube}\}$

$$\therefore A' = U - A = \{x: x \in \mathbb{N}\} - \{x: x \text{ is a perfect cube}\}$$

$$= \{x: x \in \mathbb{N}, x \text{ is not a perfect cube}\}$$

(viii) Let $A = \{x: x + 5 = 8\} = \{3\}$

$$\therefore A' = U - A = \{x: x \in \mathbb{N}\} - \{3\}$$

$$= \{x: x \in \mathbb{N}, x \neq 3\}$$

(ix) Let $A = \{x: 2x + 5 = 9\} = \{2\}$

$$\therefore A' = U - A = \{x: x \in \mathbb{N}\} - \{2\}$$

$$= \{x: x \in \mathbb{N}, x \neq 2\}$$

(x) Let $A = \{x: x \geq 7\} = \{7, 8, 9, 10, \dots\}$

$$\therefore A' = U - A = \{x: x \in \mathbb{N}\} - \{7, 8, 9, 10, \dots\}$$

$$= \{1, 2, 3, 4, 5, 6\} = \{x: x \in \mathbb{N}, x < 7\}$$

(xi) Let $A = \{x: x \in \mathbb{N} \text{ and } 2x + 1 > 10\} = \{5, 6, 7, 8, \dots\}$

$$\therefore A' = U - A = \{x: x \in \mathbb{N}\} - \{5, 6, 7, 8, \dots\}$$

$$= \{1, 2, 3, 4\}$$

4. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$, verify that:

(i) $(A \cup B)' = A' \cap B'$

(ii) $(A \cap B)' = A' \cup B'$

Ans. Given: $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$,

$A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$

$$(i) \text{ L.H.S.} = (A \cup B)' = U - (A \cup B)$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{2, 4, 6, 8\} \cup \{2, 3, 5, 7\})$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 3, 4, 5, 6, 7, 8\} = \{1, 9\}$$

$$\text{R.H.S.} = A' \cap B' = (U - A) \cap (U - B)$$

$$= (\{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 4, 6, 8\}) \cap (\{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 3, 5, 7\})$$

$$= \{1, 3, 5, 7, 9\} \cap \{1, 4, 6, 8, 9\} = \{1, 9\}$$

$$\text{L.H.S.} = \text{R. H. S.}$$

$$\Rightarrow (A \cup B)' = A' \cap B'$$

$$(ii) \text{ L.H.S.} = (A \cap B)'$$

$$= U - (A \cap B)$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - (\{2, 4, 6, 8\} \cap \{2, 3, 5, 7\})$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2\}$$

$$= \{1, 3, 4, 5, 6, 7, 8, 9\}$$

$$\text{R.H.S.} = A' \cup B' = (U - A) \cup (U - B)$$

$$= (\{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 4, 6, 8\}) \cup (\{1, 2, 3, 4, 5, 6, 7, 8, 9\} - \{2, 3, 5, 7\})$$

$$= \{1, 3, 5, 7, 9\} \cup \{1, 4, 6, 8, 9\}$$

$$= \{1, 3, 4, 5, 6, 7, 8, 9\}$$

$$\text{L.H.S.} = \text{R. H. S.}$$

$$\Rightarrow (A \cap B)' = A' \cup B'$$

5. Draw appropriate Venn diagrams for each of the following:

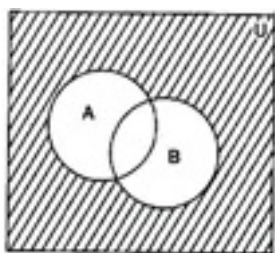
(i) $(A \cup B)'$

(ii) $A' \cap B'$

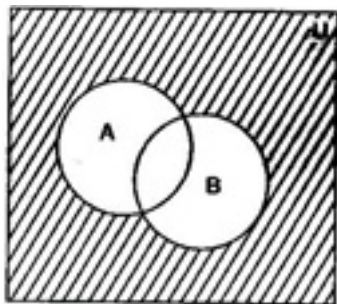
(iii) $(A \cap B)'$

(iv) $A' \cup B'$

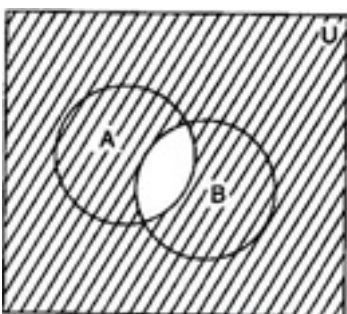
Ans. (i) In the diagrams, shaded portion represents $(A \cup B)'$



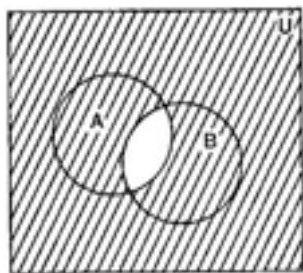
(ii) In the diagrams, shaded portion represents $A' \cap B'$



(iii) In the diagrams, shaded portion represents $(A \cap B)'$



(iv) In the diagrams, shaded portion represents $A' \cup B'$



6. Let U be the set of all triangles in a plane. If A is the set of all triangles with at least one angle different from 60° , what is A' ?

Ans. Given: $U = \{x : x \text{ is a triangle}\}$

$A = \{x : x \text{ is a triangle and has at least one angle different from } 60^\circ\}$

$\therefore A' = U - A = \{x : x \text{ is a triangle and has all angles equal to } 60^\circ\}$

= Set of all equilateral triangles

7. Fill in the blanks to make each of the following a true statement:

(i) $A \cup A' = \dots\dots\dots$

(ii) $\phi' \cap A = \dots\dots\dots$

(iii) $A \cap A' = \dots\dots\dots$

(iv) $U' \cap A = \dots\dots\dots$

Ans. (i) $A \cup A' = U$

(ii) $\phi' \cap A = U \cap A = A$

(iii) $A \cap A' = \phi$

(iv) $U' \cap A = \phi' \cap A = \phi$