



Exercise 1.5

Question 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) $(B - C)'$

Solution 1:

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

$$C = \{3, 4, 5, 6\}$$

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

$$B = \{2, 4, 6, 8\}$$

$$(i) A' = \{5, 6, 7, 8, 9\}$$

$$(ii) B' = \{1, 3, 5, 7, 9\}$$

$$(iii) A \cup C = \{1, 2, 3, 4, 5, 6\}$$

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

$$(iv) A \cup B = \{1, 2, 3, 4, 6, 8\}$$

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

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

$$(vi) B - C = \{2, 8\}$$

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

Question 2:

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

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

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

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

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

Solution 2:

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

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

$$A' = \{d, e, f, g, h\}$$

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

$$\therefore B' = \{a, b, c, h\}$$

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

$$\therefore C' = \{b, d, f, h\}$$

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

$$\therefore D' = \{b, c, d, e\}$$

Question 3:

Taking the set of natural numbers as the universal set, write down the complements of the following sets:

- (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) $\{x : x \text{ is a natural number divisible by } 3 \text{ and } 5\}$
- (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) $\{x : x \in N \text{ and } 2x + 1 > 10\}$

Solution 3:

$U = N$ set of natural numbers

- (i) $\{x : x \text{ is an even natural number}\}' = \{x : x \text{ is an odd natural number}\}$
- (ii) $\{x : x \text{ is an odd natural number}\}' = \{x : x \text{ is an even natural number}\}$
- (iii) $\{x : x \text{ is a positive multiple of } 3\}' = \{x : x \in N \text{ and } x \text{ is not a multiple of } 3\}$
- (iv) $\{x : x \text{ is a prime number}\}' = \{x : x \text{ is a positive composite number and } x = 1\}$

- (v) $\{x: x \text{ is a natural number divisible by 3 and 5}\}' = \{x: x \text{ is a natural number that is not divisible by 3 or 5}\}$
- (vi) $\{x: x \text{ is a perfect square}\}' = \{x: x \in N \text{ and } x \text{ is not a perfect square}\}$
- (vii) $\{x: x \text{ is a perfect cube}\}' = \{x: x \in N \text{ and } x \text{ is not a perfect cube}\}$
- (viii) $\{x: x+5=8\}' = \{x: x \in N \text{ and } x \neq 3\}$
- (ix) $\{x: 2x+5=9\}' = \{x: x \in N \text{ and } x \neq 2\}$
- (x) $\{x: x \geq 7\}' = \{x: x \in N \text{ and } x < 7\}$
- (xi) $\{x: x \in N \text{ and } 2x+1 > 10\}' = \{x: x \in N \text{ and } x \leq 9/2\}$
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Question 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) $(A \cap B)' = A' \cup B'$

Solution 4:

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

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

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

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

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

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

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

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

Question 5:

Draw appropriate Venn diagram for each of the following:

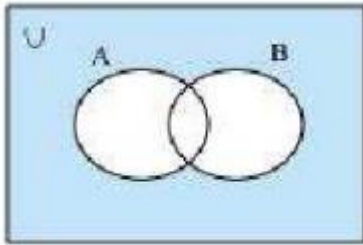
- (i)
- (ii) $A' \cap B'$
- (iii) $(A \cap B)'$

$$(A \cup B)'$$

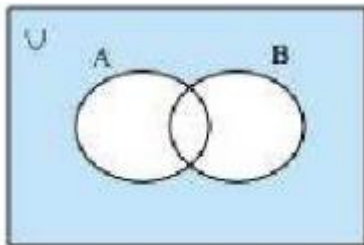
(iv) $A' \cup B'$

Solution 5:

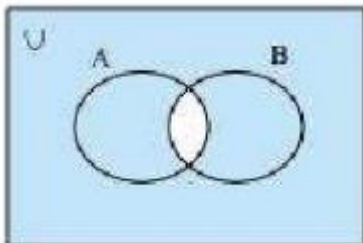
(i)



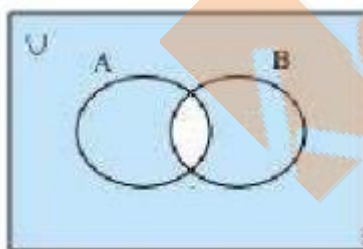
(ii) $A' \cap B'$



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



(iv) $A' \cup B'$



Question 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' ?

Solution 6:

is the set of all equilateral triangles.

Question 7:

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

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

(ii) $\emptyset \cap A$

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

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

Solution 7:

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

(ii) $\emptyset \cap A = U \cap A = A$

$\therefore \emptyset \cap A = A$

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

(iv) $U \cap A = \emptyset \cap A = \emptyset$

$\therefore U \cap A = \emptyset$
