

Chapter 1: Sets Exercise 1.5

NCERT · Class 11 · Maths

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

Ans: Given that,

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

To find,

$$A'$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$A' = U - A$$

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

$$= \{5, 6, 7, 8, 9\}$$

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

Ans: Given that,

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

To find,

$$B'$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$B' = U - B$$

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

$$= \{1, 3, 5, 7, 9\}$$

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

Ans: Given that,

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

To find,

$$(A \cup C)'$$

The complement of set A is the set of all elements of U which are not the elements of A.

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

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

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

$$= \{7, 8, 9\}$$

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

Ans: Given that,

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

To find,

$$(A \cup B)'$$

The complement of set A is the set of all elements of U which are not the elements of A.

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

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

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

$$\{5, 6, 8\} \cap \{7, 9\}$$

$$= \{5, 7, 9\}$$

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

Ans: Given that,

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

To find,

$$(A')'$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$(A')' = A$$

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

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

Ans: Given that,

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

To find,

$$(B - C)'$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$B - C = \{2, 8\}$$

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

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

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

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

Question 2

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

Ans: Given that,

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

$$A = \{a, b, c\}$$

To find the complement of A

The complement of set A is the set of all elements of U which are not the elements of A.

$$A' = U - A$$

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

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

∴ The complement of A is $A' = \{d, e, f, g, h\}$

Ans: Given that,

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

$$B = \{d, e, f, g\}$$

To find the complement of B

The complement of set A is the set of all elements of U which are not the elements of A.

$$B' = U - B$$

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

$$= \{a, b, c, h\}$$

∴ The complement of B is $B' = \{a, b, c, h\}$

Ans: Given that,

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

$$C = \{a, c, e, g\}$$

To find the complement of A

The complement of set A is the set of all elements of U which are not the elements of A.

$$C' = U - C$$

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

$$= \{b, d, f, h\}$$

∴ The complement of C is $C' = \{b, d, f, h\}$

Ans: Given that,

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

$$A = \{f, g, h, a\}$$

To find the complement of A

The complement of set A is the set of all elements of U which are not the elements of A.

$$D' = U - D$$

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

$$= \{b, c, d, e\}$$

∴ The complement of D is $D' = \{b, c, d, e\}$

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. $\{x : x \text{ is a natural number divisible by 3 and 5}\}$
- 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

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of even natural number

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is an even natural number}\}' = \{x : x \text{ is an odd natural number}\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of odd natural number

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is an odd natural number}\}' = \{x : x \text{ is an even natural number}\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of positive multiples of 3

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is a positive multiple of } 3\}' = \{x : x \in N \text{ and } x \text{ is not a positive multiple of } 3\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of prime number

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is a prime number}\}' = \{x : x \text{ is a positive composite number and } x \neq 1\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of natural number divisible by 3 and 5

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is a number divisible by 3 and 5}\}' =$$

$$\{x : x \text{ is a natural number that is not divisible by 3 or 5}\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of perfect squares.

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is a perfect squares}\}' = \{x : x \in N \text{ and } x \text{ is not a perfect square}\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the set of perfect cube

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \text{ is a perfect cube}\}' = \{x : x \in N \text{ and } x \text{ is not a perfect cube}\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of $\{x : x + 5 = 8\}$

$$x + 5 = 8$$

$$x = 3$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x + 5 = 8\}' = \{x : x \in N \text{ and } x \neq 3\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the

$$\{x : 2x + 5 = 9\}$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$2x + 5 = 9$$

$$2x = 4$$

$$x = 2$$

$$\therefore \{x : 2x + 5 = 9\}' = \{x : x \in N \text{ and } x \neq 2\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of

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

The complement of set A is the set of all elements of U which are not the elements of A.

$$\therefore \{x : x \geq 7\}' = \{x : x \in N \text{ and } x < 7\}$$

Ans: Given that,

The set of natural number is the universal set

To find the complement of the

$$\{x : x \in N \text{ and } 2x+1 > 10\}$$

The complement of set A is the set of all elements of U which are not the elements of A.

$$2x + 1 > 10$$

$$2x > 9$$

$$x > \frac{9}{2}$$

$$\therefore \{x : x \in N \text{ and } 2x+1 > 10\}' = \left\{x : x \in N \text{ and } x \leq \frac{9}{2}\right\}$$

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

Ans: Given that.

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

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

$$B = \{2, 3, 5, 7\}$$

To prove that $(A \cup B)' = A' \cap B'$

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

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

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

$$= \{1, 9\}$$

$$A' = U - A$$

$$= \{1, 3, 5, 7, 9\}$$

$$B' = U - B$$

$$= \{1, 4, 6, 8, 9\}$$

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

$$= \{1, 9\}$$

Hence it has been proved that $(A \cup B)' = A' \cap B'$

Ans: Given that.

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

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

$$B = \{2, 3, 5, 7\}$$

To prove that $(A \cap B)' = A' \cup B'$

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

$$= \{2\}$$

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

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

$$A' = U - A$$

$$= \{1, 3, 5, 7, 9\}$$

$$B' = U - B$$

$$= \{1, 4, 6, 8, 9\}$$

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

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

Hence it has been proved that $(A \cap B)' = A' \cup B'$

Question 5

Draw appropriate Venn diagrams for each of the following:

i. $(A \cup B)'$

ii. $A' \cap B'$

iii. $(A \cap B)'$

iv. $A' \cup B'$

Solution

Ans: To draw the Venn diagram for $(A \cup B)'$

(Image Will Be Updated Soon)

Ans: To draw the Venn diagram for $A' \cap B'$

(Image Will Be Updated Soon)

Ans: To draw the Venn diagram for $(A \cap B)'$

(Image Will Be Updated Soon)

Ans: To draw the Venn diagram for $A' \cup B'$

(Image Will Be Updated Soon)

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

Ans: Given that,

U is the set of all triangles in the plane

A = Set of triangles different from 60°

To find A'

The complement of set A is the set of all elements of U which are not the elements of A .

$$A' = U - A$$

= Set of all equilateral triangles

$\therefore A'$ 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. $\emptyset' \cap A = \dots$

iii. $A \cap A' = \dots$

iv. $U' \cap A = \dots$

Solution

Ans: To fill the blanks given in the statement

The union of the set and its complement is the universal set

$$\therefore A \cup A' = U$$

Ans: To fill the blanks given in the statement

We know that,

$$\emptyset' \cap A = U \cap A = A$$

$$\therefore \emptyset' \cap A = A$$

Ans: To fill the blanks given in the statement

The intersection of the set and its complement is an empty set.

$$\therefore A \cap A' = \emptyset$$

Ans: To fill the blanks given in the statement

We know that,

$$\emptyset \cap A = U' \cap A = \emptyset$$

$$\therefore U' \cap A = \emptyset$$
