NCERT Solutions Class 11 Maths
Chapter 1: Sets
EXERCISE 1.5

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 1 Exercise 1.5, students learn about the complement of a set and fundamental set operations through detailed step-by-step solutions. This exercise covers De Morgan's Laws, algebra of sets, and Venn diagram representations which are essential topics frequently tested in CBSE Class 11 exams and competitive examinations.

Key Takeaways:

- Master De Morgan's Laws: (A \cup B)' = A' \cap B' and (A \cap B)' = A' \cup B'
- Understand complement notation where A' represents all elements in universal set U that are not in set A
- Learn to solve complex set operations involving union, intersection, and complement systematically
- Practice Venn diagram construction to visualize set relationships and verify algebraic solutions

Complete Solutions

Question 1

QUESTION

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

This question tests our understanding of set operations, specifically the complement, union, and difference of sets. We are given the universal set and three sets , , and , and we need to find the complements of various sets.

(i) Find

The complement of , denoted by , is the set of all elements in the universal set that are not in .

Given and , we find the elements in that are not in :

(ii) Find

Similarly, the complement of , denoted by , is the set of all elements in that are not in .

Given and , we find the elements in that are not in :

(iii) Find

First, find the union of and , denoted by , which is the set of all elements that are in or or both.

Now, find the complement of , denoted by , which is the set of all elements in that are not in .

(iv) Find

First, find the union of and , denoted by .

Now, find the complement of , denoted by .

(v) Find

We already found . Now we need to find the complement of , denoted by . This is the set of all elements in that are not in .

Note that .

(vi) Find

First, find the difference , which is the set of all elements in that are not in .

Now, find the complement of , denoted by .

ANSWER

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

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

(iii) (A \cup C)' = \7, 8, 9\

(iv) (A \cup B)' = \5, 7, 9\

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

(vi) (B - C)' = \1, 3, 4, 5, 6, 7, 9\

Question 2

QUESTION

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

This question tests the understanding of the concept of the complement of a set. Given a universal set and a set , the complement of (denoted as) contains all elements of that are *not* in .

(i) Finding where

Step 1: Identify the universal set and the set .

We have and .

Step 2: List all elements in that are *not* in .

The elements are in but not in .

Step 3: Form the complement set .

(ii) Finding where

Step 1: Identify the universal set and the set .

We have and .

Step 2: List all elements in that are *not* in .

The elements are in but not in .

Step 3: Form the complement set .

(iii) Finding where

Step 1: Identify the universal set and the set .

We have and .

Step 2: List all elements in that are *not* in .

The elements are in but not in .

Step 3: Form the complement set .

(iv) Finding where

Step 1: Identify the universal set and the set .

We have and .

Step 2: List all elements in that are *not* in .

The elements are in but not in .

Step 3: Form the complement set .

ANSWER

(i) A' = \d, e, f, g, h\

(ii) B' = \a, b, c, h\

(iii) C' = \b, d, f, h\

(iv) D' = \b, c, d, e\

Question 3

QUESTION

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) $\{x : x \ge 7\}$

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

SOLUTION

This question tests our understanding of sets and complements, specifically within the universal set of natural numbers. We need to find the complement of each given set, meaning all natural numbers NOT in the given set.

(i)

The complement of the set of even natural numbers is the set of all natural numbers that are not even. This is the set of odd natural numbers.

Answer:

(ii)

The complement of the set of odd natural numbers is the set of all natural numbers that are not odd. This is the set of even natural numbers.

Answer:

(iii)

The complement of the set of multiples of 3 is the set of all natural numbers that are not multiples of 3.

Answer:

(iv)

The complement of the set of prime numbers (within the natural numbers) includes all composite numbers and the number 1 (since 1 is neither prime nor composite).

Answer:

(v)

This set contains numbers divisible by both 3 and 5, meaning they are divisible by 15. The complement is the set of natural numbers that are NOT divisible by 3 OR NOT divisible by 5.

Answer:

(vi)

The complement of the set of perfect squares is the set of all natural numbers that are not perfect squares.

Answer:

(vii)

The complement of the set of perfect cubes is the set of all natural numbers that are not perfect cubes.

Answer:

(viii)

First, solve the equation: . The set is . The complement is all natural numbers except 3.

Answer:

(ix)

Solve the equation: . The set is . The complement is all natural numbers except 2.

Answer:

(x)

The complement of the set of natural numbers greater than or equal to 7 is the set of natural numbers less than 7. This includes 1, 2, 3, 4, 5, and 6.

Answer:

(xi)

Solve the inequality: . Since must be a natural number, the set contains all natural numbers greater than 4.5, i.e., . The complement is the set of natural numbers less than or equal to 4.5, i.e., .

Answer:

ANSWER

(i) \x : x \text is an odd natural number\

(ii) \x : x \text is an even natural number\

(iii) \x : x \in \mathbbN \text and x \text is not a multiple of 3\

(iv) \x : x \text is a positive composite number or x = 1\

(v) \x : x \text is a positive integer which is not divisible by 3 \text or not divisible by 5\

(vi) \x : x \in \mathbbN \text and x \text is not a perfect square\

(vii) \x : x \in \mathbbN \text and x \text is not a perfect cube\

(viii) \x : x \in \mathbbN \text and x \ne 3\

(ix) \x : x \in \mathbbN \text and x \ne 2\

(x) \x : x \in \mathbbN \text and x < 7\

(xi) \x : x \in \mathbbN \text and x \le \tfrac(9)/(2)\

Question 4

QUESTION

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

This question requires us to verify De Morgan's laws for sets, using a given universal set and two sets and .

(i) Verify

Step 1: Find

is the set of all elements in or or both. Given and , we have:

Step 2: Find

is the complement of with respect to the universal set . This means we take all elements in that are *not* in . Since , we get:

Step 3: Find and

is the complement of with respect to :

is the complement of with respect to :

Step 4: Find

is the intersection of and , meaning the elements that are in *both* and :

Step 5: Compare and

We found and . Therefore, is verified.

(ii) Verify

Step 1: Find

is the set of all elements in *both* and . Given and , we have:

Step 2: Find

is the complement of with respect to the universal set . Since , we get:

Step 3: We already have and from part (i)

Step 4: Find

is the union of and , meaning all elements that are in or or both:

Step 5: Compare and

We found and . Therefore, is verified.

Question 5

QUESTION

Draw appropriate Venn diagram for each of the following:

(i) (A \cup B)'

(ii) A' \cap B'

(iii) (A \cap B)'

(iv) A' \cup B'

SOLUTION

This question asks us to represent the given set operations using Venn diagrams. We will draw a Venn diagram for each expression, shading the region that represents the result of the set operation.

(i)

Step 1: Draw the universal set as a rectangle and sets and as overlapping circles inside .

Step 2: Identify . This is the region that includes all elements in , all elements in , or both. Shade this region lightly.

Step 3: is the complement of . This means it includes all elements in the universal set that are *not* in . Shade the region outside both circles and within the rectangle . This shaded region represents .

(ii)

Step 1: Draw the universal set as a rectangle and sets and as overlapping circles inside .

Step 2: Identify . This is the complement of , meaning all elements in that are not in . Shade the region outside circle lightly.

Step 3: Identify . This is the complement of , meaning all elements in that are not in . Shade the region outside circle lightly using a different pattern or color.

Step 4: is the intersection of and . This means we want the region that is shaded in *both* and . This is the region outside both circles and within the rectangle . Shade this region more distinctly. This represents .

(iii)

Step 1: Draw the universal set as a rectangle and sets and as overlapping circles inside .

Step 2: Identify . This is the region where and overlap, containing elements that are in both and . Shade this region lightly.

Step 3: is the complement of . This means it includes all elements in the universal set that are *not* in . Shade the region outside the overlapping area of circles and within the rectangle . This shaded region represents .

(iv)

Step 1: Draw the universal set as a rectangle and sets and as overlapping circles inside .

Step 2: Identify . This is the complement of , meaning all elements in that are not in . Shade the region outside circle lightly.

Step 3: Identify . This is the complement of , meaning all elements in that are not in . Shade the region outside circle lightly using a different pattern or color.

Step 4: is the union of and . This means we want the region that is shaded in *either* or or *both*. This includes everything outside circle , everything outside circle , and the region outside both circles. Shade this entire region. This represents .

Question 6

QUESTION

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^\circ, what is A'?

SOLUTION

This question involves understanding sets and complements, specifically in the context of geometry. We need to determine the complement of a set of triangles that have at least one angle different from 60 degrees, within the universal set of all triangles.

Step 1: Define the Universal Set

The universal set is the set of all possible triangles in a plane. This includes equilateral, isosceles, scalene, right-angled, and obtuse-angled triangles.

Step 2: Understand Set A

The set consists of all triangles with at least one angle not equal to . This means includes all triangles that are *not* equilateral. Equilateral triangles have all angles equal to .

Step 3: Determine the Complement

The complement of a set , denoted by , contains all elements in the universal set that are *not* in . In other words, .

Step 4: Apply to the Problem

Since contains all triangles that are not equilateral, must contain all triangles that *are* equilateral. An equilateral triangle is a triangle where all three angles are and all three sides are equal.

Step 5: State the Answer

Therefore, is the set of all equilateral triangles.

ANSWER

A' is the set of all equilateral triangles.

Question 7

QUESTION

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

(i) A \cup A' = ...

(ii) \varphi' \cap A = ...

(iii) A \cap A' = ...

(iv) U' \cap A = ...

SOLUTION

This question tests our understanding of basic set operations like union, intersection, and complement.

(i)

Step 1: Understand the terms

is a set, and is the complement of . The complement of contains all elements in the universal set that are *not* in .

Step 2: Apply the union operation

The union of two sets, , combines all elements from both sets into a single set. Since contains everything that doesn't within the universal set, their union will include all elements in the universal set.

Step 3: Conclusion

Therefore, , where is the universal set.

(ii)

Step 1: Understand the terms

represents the empty set (a set with no elements). is the complement of the empty set.

Step 2: Find the complement of the empty set

The complement of the empty set, , contains all elements in the universal set that are *not* in the empty set. Since the empty set contains no elements, its complement is the entire universal set: .

Step 3: Apply the intersection operation

Now we need to find . The intersection of two sets contains only the elements that are common to both sets. Since is a subset of , all elements in are also in .

Step 4: Conclusion

Therefore, .

(iii)

Step 1: Understand the terms

As before, is a set, and is its complement. The intersection contains elements that are in *both* and .

Step 2: Reason about the intersection

By definition, contains all elements that are *not* in . Therefore, there can be no element that is simultaneously in both and .

Step 3: Conclusion

Therefore, , the empty set.

(iv)

Step 1: Understand the terms

is the universal set. is the complement of the universal set.

Step 2: Find the complement of the universal set

The complement of the universal set, , contains all elements in the universal set that are *not* in the universal set. This means contains no elements.

Step 3: Simplify

Therefore, , the empty set.

Step 4: Apply the intersection operation

Now we need to find . The intersection of the empty set and any set is always the empty set, because there are no elements in common.

Step 5: Conclusion

Therefore, .

ANSWER

(i) U

(ii) A

(iii) \varphi

(iv) \varphi

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📌 Key Formulas

Important Formulas for Exercise 1.5

Formula / Concept	Description
Complement of a Set	Let U be the universal set and A be a subset of U. The complement of A, denoted by A' or A^c, is the set of all elements of U which are not in A. Symbolically, A' = \x : x \in U \text and x \notin A\.
Properties of Complement Sets	• **Complement Laws:** A \cup A' = U and A \cap A' = \emptyset • **Law of Double Complementation:** (A')' = A • **Law of Empty Set and Universal Set:** \emptyset' = U and U' = \emptyset
De Morgan's Laws	For any two sets A and B: • The complement of the union of two sets is the intersection of their complements: (A \cup B)' = A' \cap B' • The complement of the intersection of two sets is the union of their complements: (A \cap B)' = A' \cup B'
Union of Sets	The union of two sets A and B, denoted by A \cup B, is the set of all elements which are in A or in B or in both. A \cup B = \x : x \in A \text or x \in B\
Intersection of Sets	The intersection of two sets A and B, denoted by A \cap B, is the set of all elements which are common to both A and B. A \cap B = \x : x \in A \text and x \in B\
Difference of Sets	The difference of two sets A and B, denoted by A - B, is the set of elements which are in A but not in B. A - B = A \cap B'
Properties of Union	• A \cup B = B \cup A (Commutative law) • (A \cup B) \cup C = A \cup (B \cup C) (Associative law) • A \cup \emptyset = A (Law of identity element) • A \cup A = A (Idempotent law) • U \cup A = U (Law of U)

Formula / Concept	Description
Properties of Intersection	• A \cap B = B \cap A (Commutative law) • (A \cap B) \cap C = A \cap (B \cap C) (Associative law) • \emptyset \cap A = \emptyset (Law of \emptyset) • U \cap A = A (Law of U) • A \cap A = A (Idempotent law) • A \cap (B \cup C) = (A \cap B) \cup (A \cap C) (Distributive law)

Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 1 Sets Exercise 1.5 for CBSE 2025-26?

Exercise 1.5 of NCERT Solutions for Class 11 Maths Chapter 1 Sets contains exactly 7 questions. These questions focus on the complement of a set and De Morgan's Laws, which are crucial topics for CBSE board exam 2025-26. All 7 questions come with detailed step by step solutions to help students understand the algebra of sets thoroughly.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 1 Sets Exercise 1.5 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 1 Sets Exercise 1.5 from the official NCERT website or trusted educational platforms. These PDFs contain complete step by step solutions for all 7 questions covering complement of sets and De Morgan's Laws. The solutions are updated as per the CBSE syllabus 2025-26 and are available for free download to help students prepare effectively.

Q3. How many marks does Sets Chapter 1 carry in CBSE Class 11 Maths board exam 2025-26 syllabus?

Sets Chapter 1 is part of Unit I (Sets and Functions) which carries 8 marks in the CBSE Class 11 Maths board exam 2025-26. Exercise 1.5 covering complement of sets and De Morgan's Laws is an important section for scoring well. Students must practice all NCERT Solutions for Class 11 Maths Chapter 1 thoroughly to secure maximum marks in this unit.

Q4. Which is the most difficult question in Exercise 1.5 of NCERT Solutions Class 11 Maths Chapter 1 Sets?

Questions 6 and 7 in Exercise 1.5 of NCERT Solutions for Class 11 Maths Chapter 1 Sets are considered the most challenging as they involve proving De Morgan's Laws using multiple sets and Venn diagrams. These questions require strong understanding of complement of sets and algebra of sets concepts. With proper step by step solutions and practice, students can master these problems for CBSE board exam 2025-26.

Q5. What is De Morgan's Laws in NCERT Solutions Class 11 Maths Chapter 1 Sets Exercise 1.5 explained with examples?

De Morgan's Laws in NCERT Solutions for Class 11 Maths Chapter 1 Exercise 1.5 state that (A ∪ B)' = A' ∩ B' and (A ∩ B)' = A' ∪ B', where the complement of union equals intersection of complements and vice versa. These fundamental laws of algebra of sets are extensively covered in Exercise 1.5 with step by step solutions. Understanding De Morgan's Laws is crucial for solving problems in CBSE Class 11 board exam 2025-26 and competitive exams like JEE.

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