



NCERT Solutions for 11th Class Maths: Chapter 1-Sets



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NCERT Solutions for 11th Class Maths: Chapter 1-Sets

Class 11: Maths Chapter 1 solutions. Complete Class 11 Maths Chapter 1 Notes.

NCERT Solutions for 11th Class Maths: Chapter 1-Sets

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Exercise 1.1

Q.1: Which of the following are sets. Explain your answer.

(a). The collection of all day in a week which have the first letter S.

- (b). The collection of ten most famous singers of India.**
- (c). A group of best football strikers of the world.**
- (d). The collection of all girls in your school.**
- (e). The collection of all odd numbers below 50.**
- (f). A collection of poems written by the poet Shakespeare.**
- (g). The collection of all prime numbers.**
- (h). The collection of questions in science book.**
- (i). A collection of most dangerous reptiles in India.**

Solution:

(i) The collection of all months of a year beginning with the letter J is a well-defined collection of objects because one can definitely identify a month that belongs to this collection. Hence, this collection is a set.

(ii) The collection of ten most talented writer of India is not a well-defined collection because the criteria for determining a writer's talent vary from person to person. Hence, this collection is not a set.

(iii) A team of eleven best cricket batsmen of the world is not a well-defined collection because the criteria for determining a batsman's talent may vary from person to person. Hence, this collection is not a set.

(iv) The collection of all boys in your class is a well-defined collection because you can definitely identify a boy who belongs to this collection. Hence, this collection is a set.

(v) The collection of all natural numbers less than 100 is a well-defined collection because one can definitely identify a number that belongs to this collection. Hence, this collection is a set.

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(vi) A collection of novels written by the writer Munshi Prem Chand is a well-defined collection because one can definitely identify a book that belongs to this collection. Hence, this collection is a set.

(vii) The collection of all even integers is a well-defined collection because one can definitely identify an even integer that belongs to this collection.

Hence, this collection is a set.

(viii) The collection of questions in this chapter is a well-defined collection because one can definitely identify a question that belongs to this chapter. Hence, this collection is a set.

(ix) The collection of most dangerous animals of the world is not a well-defined collection because the criteria for determining the dangerousness of an animal can vary from person to person. Hence, this collection is not a set.

Q.2: Let $P = \{2, 3, 4, 5, 6, 7\}$. Insert the correct symbol inside the given blank spaces below:

(a). $2 \dots\dots\dots P$

(b). $9 \dots\dots\dots P$

(c). $11 \dots\dots\dots P$

(d). $4 \dots\dots\dots P$

(e). $0 \dots\dots\dots P$

(f). $7 \dots\dots\dots P$

Solution:

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(i) $5 \in A$

(ii) $8 \notin A$

(iii) $0 \notin A$

(iv) $4 \in A$

(v) $2 \in A$

(vi) $10 \notin A$

Q.3: Write the given sets in roster form:

(a). $P = \{y: y \text{ is an integer and } -4 < y < 6\}$.

(b). $Q = \{y: y \text{ is a natural number which is } < 8\}$

(c). $R = \{y: y \text{ is a 2 digit natural number in which the sum of its digits is } 9\}$

(d). $S = \{y: y \text{ is a prime number which is a divisor of } 70\}$

(e). $T = \text{The set of all letters in the word ELEPHANT}$

(f). $U = \text{The set of all letters in the word DIVISION}$

Solution:

(i) $A = \{x: x \text{ is an integer and } 3 < x < 7\}$

The elements of this set are $\{2, 1, 0, 1, 2, 3, 4, 5, \text{ and } 6\}$ only.

Therefore, the given set can be written in roster form as

$$A = \{2, 1, 0, 1, 2, 3, 4, 5, 6\}$$

(ii) $B = \{x: x \text{ is a natural number less than } 6\}$

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The elements of this set are 1, 2, 3, 4, and 5 only.

Therefore, the given set can be written in roster form as

$$B = \{1, 2, 3, 4, 5\}$$

(iii) $C = \{x: x \text{ is a two-digit natural number such that the sum of its digits is } 8\}$

The elements of this set are 17, 26, 35, 44, 53, 62, 71, and 80 only.

Therefore, this set can be written in roster form as

$$C = \{17, 26, 35, 44, 53, 62, 71, 80\}$$

(iv) $D = \{x: x \text{ is a prime number which is a divisor of } 60\}$

$$\begin{array}{l} 6 \\ 2 \end{array} \begin{array}{l} \\ 0 \end{array}$$

$$\begin{array}{l} 2 \ 3 \\ 0 \end{array}$$

$$\begin{array}{l} 3 \ 1 \\ 5 \end{array}$$

$$5$$

$$\therefore 60 = 2 \times 2 \times 3 \times 5$$

The elements of this set are 2, 3, and 5 only.

Therefore, this set can be written in roster form as $D = \{2, 3, 5\}$.

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Q.4: Write the given sets in set-builder form:

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(a). $\{4, 8, 12, 16, 20\}$

(b). $\{3, 9, 27, 81\}$

(c). $\{4, 16, 64, 256, 1024\}$

(d). $\{1, 3, 5, 7, \dots\}$

(e). $\{1, 8, 27, 64, \dots, 1000\}$

Solution:

(i) $\{3, 6, 9, 12\} = \{x: x = 3n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 4\}$

(ii) $\{2, 4, 8, 16, 32\}$

It can be seen that $2 = 2^1, 4 = 2^2, 8 = 2^3, 16 = 2^4$, and $32 = 2^5$.

$\therefore \{2, 4, 8, 16, 32\} = \{x: x = 2^n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 5\}$

(iii) $\{5, 25, 125, 625\}$

It can be seen that $5 = 5^1, 25 = 5^2, 125 = 5^3$, and $625 = 5^4$.

$\therefore \{5, 25, 125, 625\} = \{x: x = 5^n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 4\}$

(iv) $\{2, 4, 6, \dots\}$

It is a set of all even natural numbers.

$\therefore \{2, 4, 6, \dots\} = \{x: x \text{ is an even natural number}\}$

(v) $\{1, 4, 9, \dots, 100\}$

It can be seen that $1 = 1^2, 4 = 2^2, 9 = 3^2, \dots, 100 = 10^2$.

$\therefore \{1, 4, 9, \dots, 100\} = \{x: x = n^2, n \in \mathbb{N} \text{ and } 1 \leq n \leq 10\}$

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Exercise 1.2

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Q.1: Which of the following given below is null set?

- (i). Set of odd natural numbers which is divisible by 2.**
- (ii). Set of even numbers which are prime**
- (iii). $\{x: x \text{ is a natural number, } x < 5 \text{ and } x > 7\}$**
- (iv). $\{y: y \text{ is a point common to any two parallel lines}\}$**

Solution:

- (i)** A set of odd natural numbers divisible by 2 is a null set because no odd number is divisible by 2.
- (ii)** A set of even prime numbers is not a null set because 2 is an even prime number.
- (iii)** $\{x: x \text{ is a natural number, } x < 5 \text{ and } x > 7\}$ is a null set because a number cannot be simultaneously less than 5 and greater than 7.
- (iv)** $\{y: y \text{ is a point common to any two parallel lines}\}$ is a null set because parallel lines do not intersect. Hence, they have no common point.

Q.2: State whether the following sets are infinite or finite:

- (i). A set of months of a year.**
- (ii). $\{1, 2, 3 \dots\}$**
- (iii). $\{1, 2, 3 \dots 99, 100\}$**
- (iv). The set of positive integers which are greater than 100.**
- (v). The set of prime numbers which are less than 99**

Solution:

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- (i) The set of months of a year is a finite set because it has 12 elements.
- (ii) $\{1, 2, 3 \dots\}$ is an infinite set as it has infinite number of natural numbers.
- (iii) $\{1, 2, 3 \dots 99, 100\}$ is a finite set because the numbers from 1 to 100 are finite in number.
- (iv) The set of positive integers greater than 100 is an infinite set because positive integers greater than 100 are infinite in number.
- (v) The set of prime numbers less than 99 is a finite set because prime numbers less than 99 are finite in number.

Q.3: State whether the following sets are infinite or finite:

- (i). The set of lines parallel to the $x -$ axis.
- (ii). The set of letters in the vowels.
- (iii). The set of numbers multiple of 10.
- (iv). The set of humans living on Earth.
- (v). The set of circles passing through the origin $(0, 0)$.

Solution:

- (i) The set of lines which are parallel to the x -axis is an infinite set because lines parallel to the x -axis are infinite in number.
- (ii) The set of letters in the English alphabet is a finite set because it has 26 elements.
- (iii) The set of numbers which are multiple of 5 is an infinite set because multiples of 5 are infinite in number.
- (iv) The set of animals living on the earth is a finite set because the number of animals living on the earth is finite (although it is quite a big number).
- (v) The set of circles passing through the origin $(0, 0)$ is an infinite set because infinite number of circles can pass through the origin.

Q.4: In the following set given below, state whether $A = B$ or not:

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(i). $A = \{w, x, y, z\}$

$B = \{z, y, x, w\}$

(ii). $A = \{5, 9, 13, 17\}$

$B = \{9, 5, 17, 19\}$

(iii). $A = \{4, 2, 6, 10, 8\}$

$B = \{x: x \text{ is positive even integer and } x \leq 10\}$

(iv). $A = \{x: x \text{ is a multiple of } 10\}$

$B = \{10, 15, 20, 25, 30 \dots\}$

Solution:

i) $A = \{a, b, c, d\}; B = \{d, c, b, a\}$

The order in which the elements of a set are listed is not significant.

$\therefore A = B$

(ii) $A = \{4, 8, 12, 16\}; B = \{8, 4, 16, 18\}$

It can be seen that $12 \in A$ but $12 \notin B$.

$\therefore A \neq B$

(iii) $A = \{2, 4, 6, 8, 10\}$

$B = \{x: x \text{ is a positive even integer and } x \leq 10\}$

$= \{2, 4, 6, 8, 10\}$

$\therefore A = B$

(iv) $A = \{x: x \text{ is a multiple of } 10\}$

$B = \{10, 15, 20, 25, 30 \dots\}$

It can be seen that $15 \in B$ but $15 \notin A$.

$\therefore A \neq B$

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Q.5 In the following set given below, is the pair of sets equal?

(i). $A = \{3, 4\}$

$B = \{y: y \text{ is solution of } y^2 + 5y + 6 = 0\}$

(ii). $A = \{a: a \text{ is a letter in the word FOLLOW}\}$

$B = \{b: b \text{ is a letter in the word WOLF}\}$

Solution:

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$$A = \{2, 4, 8, 12\}; B = \{1, 2, 3, 4\}; C = \{4, 8, 12, 14\}$$

$$D = \{3, 1, 4, 2\}; E = \{-1, 1\}; F = \{0, a\}$$

$$G = \{1, -1\}; A = \{0, 1\}$$

It can be seen that

$$8 \in A, 8 \notin B, 8 \notin D, 8 \notin E, 8 \notin F, 8 \notin G, 8 \notin H$$

$$\Rightarrow A \neq B, A \neq D, A \neq E, A \neq F, A \neq G, A \neq H$$

$$\text{Also, } 2 \in A, 2 \notin C$$

$$\therefore A \neq C$$

$$3 \in B, 3 \notin C, 3 \notin E, 3 \notin F, 3 \notin G, 3 \notin H$$

$$\therefore B \neq C, B \neq E, B \neq F, B \neq G, B \neq H$$

$$12 \in C, 12 \notin D, 12 \notin E, 12 \notin F, 12 \notin G, 12 \notin H$$

$$\therefore C \neq D, C \neq E, C \neq F, C \neq G, C \neq H$$

$$4 \in D, 4 \notin E, 4 \notin F, 4 \notin G, 4 \notin H$$

Q.6: From the following sets, select equal sets:

$$A = \{2, 4, 8, 12\}$$

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

$$C = \{4, 8, 12, 14\}$$

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

$$E = \{-1, 1\}$$

$$F = \{0, a\}$$

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$$G = \{1, -1\}$$

$$H = \{0, 1\}$$

Solution:

$$(i) A = \{2, 3\}; B = \{x: x \text{ is a solution of } x^2 + 5x + 6 = 0\}$$

The equation $x^2 + 5x + 6 = 0$ can be solved as:

$$x(x + 3) + 2(x + 3) = 0$$

$$(x + 2)(x + 3) = 0$$

$$x = -2 \text{ or } x = -3$$

$$\therefore A = \{2, 3\}; B = \{-2, -3\}$$

$$\therefore A \neq B$$

$$(ii) A = \{x: x \text{ is a letter in the word FOLLOW}\} = \{F, O, L, W\}$$

$$B = \{y: y \text{ is a letter in the word WOLF}\} = \{W, O, L, F\}$$

The order in which the elements of a set are listed is not significant.

$$\therefore A = B$$

$$\therefore D \neq E, D \neq F, D \neq G, D \neq H$$

Similarly, $E \neq F, E \neq G, E \neq H$

$$F \neq G, F \neq H, G \neq H$$

The order in which the elements of a set are listed is not significant.

$$\therefore B = D \text{ and } E = G$$

Hence, among the given sets, $B = D$ and $E = G$.

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Exercise 1.3

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Q.1: Fill in the blanks properly using \subset and $\not\subset$.

(i). $\{3, 4, 5\}$ _____ $\{2, 3, 4, 5, 6\}$

(ii). $\{a, b, c\}$ _____ $\{d, c, d\}$

(iii). $\{y: y \text{ is a pupil of Class 11 of the school}\}$ _____ $\{y: y \text{ is students of the school}\}$

(iv). $\{y: y \text{ is a circle in the plane}\}$ _____ $\{y: y \text{ is a circle in the same plane with radius 2 unit}\}$

(v). $\{y: y \text{ is an equilateral triangle in a plane}\}$ _____ $\{y: y \text{ is a rectangle in the same plane}\}$

(vi). $\{y: y \text{ is an equilateral triangle in a plane}\}$ _____ $\{y: y \text{ is a triangle in the plane}\}$

(vii). $\{y: y \text{ is an odd natural number}\}$ _____ $\{x: x \text{ is an integers}\}$

Solution:

(i) $\{2, 3, 4\} \subset \{1, 2, 3, 4, 5\}$

(ii) $\{a, b, c\} \not\subset \{b, c, d\}$

(iii) $\{x: x \text{ is a student of class XI of your school}\} \subset \{x: x \text{ is student of your school}\}$

(iv) $\{x: x \text{ is a circle in the plane}\} \not\subset \{x: x \text{ is a circle in the same plane with radius 1 unit}\}$

(v) $\{x: x \text{ is a triangle in a plane}\} \not\subset \{x: x \text{ is a rectangle in the plane}\}$

(vi) $\{x: x \text{ is an equilateral triangle in a plane}\} \subset \{x: x \text{ in a triangle in the same plane}\}$

(vii) $\{x: x \text{ is an even natural number}\} \subset \{x: x \text{ is an integer}\}$

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Q.2: State whether the given statements are true or false:

(i). $\{b, c\} \not\subset \{c, d, e\}$

(ii). $\{a, e, i\} \subset \{x: x \text{ is a vowel in the English alphabets}\}$

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(iii). $\{1, 2, 3\} \subset \{1, 2, 4, 5\}$

(iv). $\{c\} \subset \{b, c, d\}$

(v). $\{b\} \in \{a, b, c, d\}$

(vi). $\{y: y \text{ is an even natural no. less than } 6\} \subset \{y: y \text{ is a natural no. which can divide } 36\}$

Solution:

(i) False. Each element of $\{a, b\}$ is also an element of $\{b, c, a\}$.

(ii) True. a, e are two vowels of the English alphabet.

(iii) False. $2 \in \{1, 2, 3\}$; however, $2 \notin \{1, 3, 5\}$

(iv) True. Each element of $\{a\}$ is also an element of $\{a, b, c\}$.

(v) False. The elements of $\{a, b, c\}$ are a, b, c . Therefore, $\{a\} \subset \{a, b, c\}$

(vi) True. $\{x: x \text{ is an even natural number less than } 6\} = \{2, 4\}$

$\{x: x \text{ is a natural number which divides } 36\} = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

Q.3: Let $X = \{11, 12, \{13, 14\}, 15\}$. According to the given set which of the given statements are false? Explain why.

(i). $\{13, 14\} \subset X$

(ii). $\{13, 14\} \in X$

(iii). $\{\{13, 14\}\} \subset X$

(iv). $11 \in X$

(v). $11 \subset X$

(vi). $\{11, 12, 15\} \subset X$

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(vii). $\{11, 12, 15\} \in X$

(viii). $\{11, 12, 13\} \subset X$

(ix). $\emptyset \in X$

(x). $\emptyset \subset X$

(xi). $\{\emptyset\} \subset X$

Solution:

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

(i) The statement $\{3, 4\} \subset A$ is incorrect because $3 \in \{3, 4\}$; however, $3 \notin A$.

(ii) The statement $\{3, 4\} \in A$ is correct because $\{3, 4\}$ is an element of A .

(iii) The statement $\{\{3, 4\}\} \subset A$ is correct because $\{3, 4\} \in \{\{3, 4\}\}$ and $\{3, 4\} \in A$.

(iv) The statement $1 \in A$ is correct because 1 is an element of A .

(v) The statement $1 \subset A$ is incorrect because an element of a set can never be a subset of itself.

(vi) The statement $\{1, 2, 5\} \subset A$ is correct because each element of $\{1, 2, 5\}$ is also an element of A .

(vii) The statement $\{1, 2, 5\} \in A$ is incorrect because $\{1, 2, 5\}$ is not an element of A .

(viii) The statement $\{1, 2, 3\} \subset A$ is incorrect because $3 \in \{1, 2, 3\}$; however, $3 \notin A$.

(ix) The statement $\Phi \in A$ is incorrect because Φ is not an element of A .

(x) The statement $\Phi \subset A$ is correct because Φ is a subset of every set.

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(xi) The statement $\{\emptyset\} \subset A$ is incorrect

\emptyset is a subset of A and it is not an element of A .

$\{\emptyset\} \subset A$ means that elements of the set $\{\emptyset\}$ are the elements of A .

But since $\emptyset \in A$ is incorrect, $\{\emptyset\} \not\subset A$.

Q.4: Write all the subsets of the given sets:

(i). $\{b\}$

(ii). $\{b, c\}$

(iii). $\{2, 3, 4\}$

(iv). \emptyset

Solution:

(i) The subsets of $\{a\}$ are Φ and $\{a\}$.

(ii) The subsets of $\{a, b\}$ are Φ , $\{a\}$, $\{b\}$, and $\{a, b\}$.

(iii) The subsets of $\{1, 2, 3\}$ are Φ , $\{1\}$, $\{2\}$, $\{3\}$, $\{1, 2\}$, $\{2, 3\}$, $\{1, 3\}$, and $\{1, 2, 3\}$

(iv) The only subset of Φ is Φ .

Q.5: How many elements has $P(X)$, if $X = \emptyset$?

Solution:

We know that if A is a set with m elements i.e., $n(A) = m$, then $n[P(A)] = 2^m$.

If $A = \Phi$, then $n(A) = 0$.

$\therefore n[P(A)] = 2^0 = 1$

Hence, $P(A)$ has one element.

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Q.6: Write the given in the form of intervals:

(i). $\{y: y \in \mathbf{R}, -5 < y \leq 7\}$

(ii). $\{y: y \in \mathbf{R}, -13 < y < -11\}$

(iii). $\{y: y \in \mathbf{R}, 1 \leq y < 8\}$

(iv). $\{y: y \in \mathbf{R}, 4 \leq y \leq 5\}$

Solution:

(i) $\{x: x \in \mathbf{R}, -4 < x \leq 6\} = (-4, 6]$

(ii) $\{x: x \in \mathbf{R}, -12 < x < -10\} = (-12, -10)$

(iii) $\{x: x \in \mathbf{R}, 0 \leq x < 7\} = [0, 7)$

(iv) $\{x: x \in \mathbf{R}, 3 \leq x \leq 4\} = [3, 4]$

Q.7: Write the given intervals in the form of set – builder:

(i). $(-4, 1)$

(ii). $[7, 13]$

(iii). $(7, 13]$

(iv). $[-24, 6)$

Solution:

- (i) $(-3, 0) = \{x: x \in \mathbb{R}, -3 < x < 0\}$
- (ii) $[6, 12] = \{x: x \in \mathbb{R}, 6 \leq x \leq 12\}$
- (iii) $(6, 12] = \{x: x \in \mathbb{R}, 6 < x \leq 12\}$
- (iv) $[-23, 5) = \{x: x \in \mathbb{R}, -23 \leq x < 5\}$

Q.8: What universal set/ sets would you propose for the given sets?

- (i). The set of right triangles**
- (ii). The set of isosceles triangles**

Solution:

(i) For the set of right triangles, the universal set can be the set of triangles or the set of polygons.

(ii) For the set of isosceles triangles, the universal set can be the set of triangles or the set of polygons or the set of two-dimensional figures.

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Q.9: $X = \{1, 3, 5\}$, $Y = \{2, 4, 6\}$ and $Z = \{0, 2, 4, 6, 8\}$

Which of the given sets can be considered as the universal set for the given sets X, Y and Z?

- (i). $\{0, 1, 2, 3, 4, 5, 6\}$**
- (ii). \emptyset**
- (iii). $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$**
- (iv). $\{1, 2, 3, 4, 5, 6, 7, 8\}$**

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Solution:

i) It can be seen that $A \subset \{0, 1, 2, 3, 4, 5, 6\}$

$B \subset \{0, 1, 2, 3, 4, 5, 6\}$

However, $C \not\subset \{0, 1, 2, 3, 4, 5, 6\}$

Therefore, the set $\{0, 1, 2, 3, 4, 5, 6\}$ cannot be the universal set for the sets A, B, and C.

(ii) $A \not\subset \Phi$, $B \not\subset \Phi$, $C \not\subset \Phi$

Therefore, Φ cannot be the universal set for the sets A, B, and C.

(iii) $A \subset \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$B \subset \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$C \subset \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

Therefore, the set $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ is the universal set for the sets A, B, and C.

(iv) $A \subset \{1, 2, 3, 4, 5, 6, 7, 8\}$

$B \subset \{1, 2, 3, 4, 5, 6, 7, 8\}$

However, $C \not\subset \{1, 2, 3, 4, 5, 6, 7, 8\}$

Therefore, the set $\{1, 2, 3, 4, 5, 6, 7, 8\}$ cannot be the universal set for the sets A, B, and C.

Exercise 1.4

Q.1: Find the union of each of the following pairs of sets:

(i). $P = \{1, 4, 6\}$ and $Q = \{1, 3, 4\}$

(ii). $X = \{a, e, i, o, u\}$ and $Y = \{x, y, z\}$

(iii). $X = \{x: x \text{ is a natural number and multiple of } 3\}$ and $Y = \{x: x \text{ is a natural number less than } 6\}$

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(iv). $X = \{x: x \text{ is a natural number and } 1 < x \leq 5\}$ and $Y = \{x: x \text{ is a natural number and } 5 < x < 10\}$

(v). $X = \{4, 5, 6\}$ and $Y = \Phi$

Solution:

i) $X = \{1, 3, 5\}$ $Y = \{1, 2, 3\}$

$$X \cup Y = \{1, 2, 3, 5\}$$

(ii) $A = \{a, e, i, o, u\}$ $B = \{a, b, c\}$

$$A \cup B = \{a, b, c, e, i, o, u\}$$

(iii) $A = \{x: x \text{ is a natural number and multiple of } 3\} = \{3, 6, 9 \dots\}$

As $B = \{x: x \text{ is a natural number less than } 6\} = \{1, 2, 3, 4, 5\}$

$$A \cup B = \{1, 2, 3, 4, 5, 6, 9, 12 \dots\}$$

$$\therefore A \cup B = \{x: x = 1, 2, 4, 5 \text{ or a multiple of } 3\}$$

(iv) $A = \{x: x \text{ is a natural number and } 1 < x \leq 6\} = \{2, 3, 4, 5, 6\}$

$B = \{x: x \text{ is a natural number and } 6 < x < 10\} = \{7, 8, 9\}$

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

$$\therefore A \cup B = \{x: x \in \mathbb{N} \text{ and } 1 < x < 10\}$$

(v) $A = \{1, 2, 3\}$, $B = \Phi$

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

Q.2: Let $A = \{x, y\}$ and $B = \{x, y, z\}$

Is $A \subset B$? What is $A \cup B$?

Solution:

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Here, $A = \{a, b\}$ and $B = \{a, b, c\}$

Yes, $A \subset B$.

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

Q.3: If X and Y are two sets such that $X \subset Y$, then what is $X \cup Y$?

Solution:

If A and B are two sets such that $A \subset B$, then $A \cup B = B$.

Q.4: If $P = \{1, 2, 3, 4\}$, $Q = \{3, 4, 5, 6\}$, $R = \{5, 6, 7, 8\}$ and $S = \{7, 8, 9, 10\}$

Find the following:

(i). $P \cup Q$

(ii). $P \cup R$

(iii). $Q \cup R$

(iv). $Q \cup S$

(v). $P \cup Q \cup R$

(vi). $P \cup Q \cup S$

(vii). $Q \cup R \cup S$

Solution:

$A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{5, 6, 7, 8\}$ and $D = \{7, 8, 9, 10\}$

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

(ii) $A \cup C = \{1, 2, 3, 4, 5, 6, 7, 8\}$

(iii) $B \cup C = \{3, 4, 5, 6, 7, 8\}$

(iv) $B \cup D = \{3, 4, 5, 6, 7, 8, 9, 10\}$

(v) $A \cup B \cup C = \{1, 2, 3, 4, 5, 6, 7, 8\}$

(vi) $A \cup B \cup D = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

(vii) $B \cup C \cup D = \{3, 4, 5, 6, 7, 8, 9, 10\}$

Q.5: Find the intersection of each of the following pairs of sets:

(i). $P = \{1, 4, 6\}$ and $Q = \{1, 3, 4\}$

(ii). $X = \{a, e, i, o, u\}$ and $Y = \{x, y, z\}$

(iii). $X = \{x: x \text{ is a natural number and multiple of } 3\}$ and $Y = \{x: x \text{ is a natural number less than } 6\}$

(iv). $X = \{x: x \text{ is a natural number and } 1 < x \leq 5\}$ and $Y = \{x: x \text{ is a natural number and } 5 < x < 10\}$

(v). $X = \{4, 5, 6\}$ and $Y = \Phi$

Solution 5:

i) $X = \{1, 3, 5\}$, $Y = \{1, 2, 3\}$

$$X \cap Y = \{1, 3\}$$

(ii) $A = \{a, e, i, o, u\}$, $B = \{a, b, c\}$

$$A \cap B = \{a\}$$

(iii) $A = \{x: x \text{ is a natural number and multiple of } 3\} = \{3, 6, 9, \dots\}$

$$B = \{x: x \text{ is a natural number less than } 6\} = \{1, 2, 3, 4, 5\}$$

$$\therefore A \cap B = \{3\}$$

(iv) $A = \{x: x \text{ is a natural number and } 1 < x \leq 6\} = \{2, 3, 4, 5, 6\}$

$$B = \{x: x \text{ is a natural number and } 6 < x < 10\} = \{7, 8, 9\}$$

$$A \cap B = \emptyset$$

(v) $A = \{1, 2, 3\}$, $B = \emptyset$

$$A \cap B = \emptyset$$

Q.6: If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$, $C = \{11, 13, 15\}$ and $D = \{15, 17\}$

Find the following:

(i). $A \cap B$

(ii). $B \cap C$

(iii). $A \cap C \cap D$

(iv). $A \cap C$

(v). $B \cap D$

(vi). $A \cap (B \cup C)$

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(vii). $A \cap D$

(viii). $A \cap (B \cup D)$

(ix). $(A \cap B) \cap (B \cup C)$

(x). $(A \cup D) \cap (B \cup C)$

Solution:

(i) $A \cap B = \{7, 9, 11\}$

(ii) $B \cap C = \{11, 13\}$

(iii) $A \cap C \cap D = \{A \cap C\} \cap D = \{11\} \cap \{15, 17\} = \Phi$

(iv) $A \cap C = \{11\}$

(v) $B \cap D = \Phi$

(vi) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$= \{7, 9, 11\} \cup \{11\} = \{7, 9, 11\}$

(vii) $A \cap D = \Phi$

(viii) $A \cap (B \cup D) = (A \cap B) \cup (A \cap D)$

$= \{7, 9, 11\} \cup \Phi = \{7, 9, 11\}$

(ix) $(A \cap B) \cap (B \cup C) = \{7, 9, 11\} \cap \{7, 9, 11, 13, 15\} = \{7, 9, 11\}$

(x) $(A \cup D) \cap (B \cup C) = \{3, 5, 7, 9, 11, 15, 17\} \cap \{7, 9, 11, 13, 15\}$

$= \{7, 9, 11, 15\}$

Q.7: If $A = \{y: y \text{ is a natural number}\}$, $B = \{y: y \text{ is an even natural number}\}$, $C = \{y: y \text{ is an odd natural number}\}$ and $D = \{y: y \text{ is a prime number}\}$

Find the following:

<https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-1-sets/>

(i). $A \cap B$

(ii). $A \cap C$

(iii). $A \cap D$

(iv). $B \cap C$

(v). $B \cap D$

(vi). $C \cap D$

Solution :

$$A = \{x: x \text{ is a natural number}\} = \{1, 2, 3, 4, 5 \dots\}$$

$$B = \{x: x \text{ is an even natural number}\} = \{2, 4, 6, 8 \dots\}$$

$$C = \{x: x \text{ is an odd natural number}\} = \{1, 3, 5, 7, 9 \dots\}$$

$$D = \{x: x \text{ is a prime number}\} = \{2, 3, 5, 7 \dots\}$$

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

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

$$(iii) A \cap D = \{x: x \text{ is a prime number}\} = D$$

$$(iv) B \cap C = \Phi$$

$$(v) B \cap D = \{2\}$$

$$(vi) C \cap D = \{x: x \text{ is odd prime number}\}$$

Q.8: Which of the given pairs of sets are disjoint?

(i). $A = \{1, 2, 3, 4\}$ and $B = \{x: x \text{ is a natural number and } 4 \leq x \leq 6\}$

(ii). $A = \{a, e, i, o, u\}$ and $B = \{c, d, e, f\}$

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(iii). $A = \{x: x \text{ is an even integer}\}$ and $B = \{x: x \text{ is an odd integer}\}$

Solution:

(i) $\{1, 2, 3, 4\}$

$$\{x: x \text{ is a natural number and } 4 \leq x \leq 6\} = \{4, 5, 6\}$$

$$\text{Now, } \{1, 2, 3, 4\} \cap \{4, 5, 6\} = \{4\}$$

Therefore, this pair of sets is not disjoint.

(ii) $\{a, e, i, o, u\} \cap \{c, d, e, f\} = \{e\}$

Therefore, $\{a, e, i, o, u\}$ and $\{c, d, e, f\}$ are not disjoint.

(iii) $\{x: x \text{ is an even integer}\} \cap \{x: x \text{ is an odd integer}\} = \Phi$

Therefore, this pair of sets is disjoint.

Q.9: If $A = \{3, 6, 9, 12, 15, 18, 21\}$, $B = \{4, 8, 12, 16, 20\}$, $C = \{2, 4, 6, 8, 10, 12, 14, 16\}$ and $D = \{5, 10, 15, 20\}$

Find the following:

(i). $A - B$

(ii). $A - C$

(iii). $A - D$

(iv). $B - A$

(v). $C - A$

(vi). $D - A$

(vii). $B - C$

(viii). $B - D$

(ix). $C - B$

(x). $D - B$

(xi). $C - D$

(xii). $D - C$

Solution :

(i) $A - B = \{3, 6, 9, 15, 18, 21\}$

(ii) $A - C = \{3, 9, 15, 18, 21\}$

(iii) $A - D = \{3, 6, 9, 12, 18, 21\}$

(iv) $B - A = \{4, 8, 16, 20\}$

(v) $C - A = \{2, 4, 8, 10, 14, 16\}$

(vi) $D - A = \{5, 10, 20\}$

(vii) $B - C = \{20\}$

(viii) $B - D = \{4, 8, 12, 16\}$

(ix) $C - B = \{2, 6, 10, 14\}$

(x) $D - B = \{5, 10, 15\}$

(xi) $C - D = \{2, 4, 6, 8, 12, 14, 16\}$

(xii) $D - C = \{5, 15, 20\}$

Q.10: If $X = \{a, b, c, d\}$ and $Y = \{f, b, d, g\}$

Find the following:

(i). $X - Y$

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(ii). $Y - X$

(iii). $X \cap Y$

Solution:

i) $X - Y = \{a, c\}$

(ii) $Y - X = \{f, g\}$

(iii) $X \cap Y = \{b, d\}$

Q.11: What is $R - Q$, if R is the set of real numbers and Q is the set of rational?

Solution:

R : set of real numbers

Q : set of rational numbers

Therefore, $R - Q$ is a set of irrational numbers

Q.12: State whether the following statements are true or false. Give reason.

(i). $A = \{2, 3, 4, 5\}$ and $B = \{3, 6\}$ are disjoint sets.

(ii). $A = \{a, e, i, o, u\}$ and $B = \{a, b, c, d\}$ are disjoint sets.

(iii). $A = \{2, 6, 10, 14\}$ and $B = \{3, 7, 11, 15\}$ are disjoint sets.

(iv). $A = \{2, 6, 10\}$ and $B = \{3, 7, 11\}$ are disjoint sets.

Solution:

<https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-1-sets/>

(i) False

As $3 \in \{2, 3, 4, 5\}, 3 \in \{3, 6\}$

$$\Rightarrow \{2, 3, 4, 5\} \cap \{3, 6\} = \{3\}$$

(ii) False

As $a \in \{a, e, i, o, u\}, a \in \{a, b, c, d\}$

$$\Rightarrow \{a, e, i, o, u\} \cap \{a, b, c, d\} = \{a\}$$

(iii) True

As $\{2, 6, 10, 14\} \cap \{3, 7, 11, 15\} = \Phi$

(iv) True

As $\{2, 6, 10\} \cap \{3, 7, 11\} = \Phi$

Exercise 1.5

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

$X = \{1, 2, 3, 4, 5\}$

$Y = \{2, 4, 6\}$ and

$Z = \{2, 4, 5, 6\}$.

Find the following sets:

(i). X'

(ii). Y'

(iii). $(X \cup Y)'$

(iv). $(X \cup Z)'$

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(v). $(X)'$

(vi). $(Y-Z)'$

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Solution:

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

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

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

Q.3: Take natural numbers as the universal set. Write the complements of the given sets:

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

(ii). $B = \{y: y \text{ is an odd natural number}\}$

(iii). $C = \{y: y \text{ is a positive multiple of 3}\}$

(iv). $D = \{y: y \text{ is a prime number}\}$

(v). $E = \{y: y \text{ is a natural number divisible by 3 and 5}\}$

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(vi). $F = \{y: y \text{ is a perfect square}\}$

(vii). $G = \{y: y \text{ is perfect cube}\}$

(viii). $H = \{y: y + 5 = 8\}$

(ix). $I = \{y: 2y + 5 = 9\}$

(x). $J = \{y: y \geq 7\}$

(xi). $K = \{y: y \in \mathbf{N} \text{ and } 2y + 1 > 10\}$

Solution:

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

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

(v) $\{x: x \text{ is a natural number divisible by } 3 \text{ and } 5\}' = \{x: x \text{ is a natural number that is not divisible by } 3 \text{ or } 5\}$

(vi) $\{x: x \text{ is a perfect square}\}' = \{x: x \in \mathbf{N} \text{ and } x \text{ is not a perfect square}\}$

(vii) $\{x: x \text{ is a perfect cube}\}' = \{x: x \in \mathbf{N} \text{ and } x \text{ is not a perfect cube}\}$

(viii) $\{x: x + 5 = 8\}' = \{x: x \in \mathbf{N} \text{ and } x \neq 3\}$

(ix) $\{x: 2x + 5 = 9\}' = \{x: x \in \mathbf{N} \text{ and } x \neq 2\}$

(x) $\{x: x \geq 7\}' = \{x: x \in \mathbf{N} \text{ and } x < 7\}$

(xi) $\{x: x \in \mathbf{N} \text{ and } 2x + 1 > 10\}' = \{x: x \in \mathbf{N} \text{ and } x \leq 9/2\}$

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

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

Verify that:

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

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

Solution:

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

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

(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)

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

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

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

Q.5: Draw the Venn diagrams for the following:

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

(ii). $A' \cap B'$

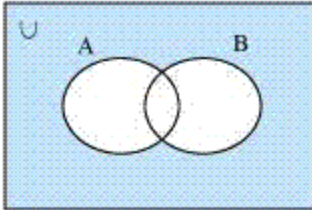
(iii). $(A \cap B)'$

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

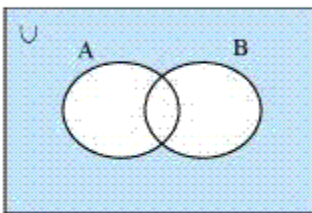
<https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-1-sets/>

Solution:

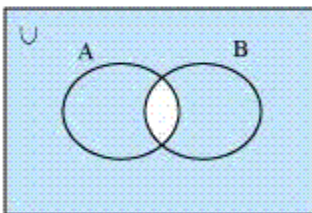
i) $(A \cup B)'$



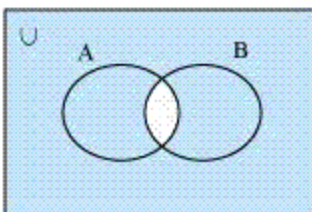
(ii) $A' \cap B'$



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



(iv) $A' \cup B'$



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

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Solution:

A' is the set of all equilateral triangles

Q.7: Complete the given statements using proper symbols:

(i). $A \cup A'$

(ii). $\emptyset \cap A$

(iii). $A \cap A'$

(iv). $U' \cap A$

Solution:

i) $A \cup A' = U$

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

$\therefore \Phi' \cap A = A$

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

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

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

Exercise 1.6

Q.1: If A and B are two sets such that $n(A) = 16$, $n(B) = 24$ and $n(A \cup B) = 39$. Find $n(A \cap B)$.

Solution:

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It is given that:

$$n(X) = 17, n(Y) = 23, n(X \cup Y) = 38$$

$$n(X \cap Y) = ?$$

We know that:

$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$

$$\therefore 38 = 17 + 23 - n(X \cap Y)$$

$$\Rightarrow n(X \cap Y) = 40 - 38 = 2$$

$$\therefore n(X \cap Y) = 2$$

Q.2: If A and B are two sets such that $A \cup B$ has 17 elements, A has 9 elements and B has 14 elements. How many elements does $A \cap B$ have?

Solution:

It is given that:

$$n(X \cup Y) = 18, n(X) = 8, n(Y) = 15$$

$$n(X \cap Y) = ?$$

We know that:

$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$

$$\therefore 18 = 8 + 15 - n(X \cap Y)$$

$$\Rightarrow n(X \cap Y) = 23 - 18 = 5$$

$$\therefore n(X \cap Y) = 5$$

Q.3: In a group there are 450 people, 200 speaks Hindi and 270 can speak English. How many people can speak both English and Hindi?

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Solution:

Let H be the set of people who speak Hindi, and

E be the set of people who speak English

$$\therefore n(H \cup E) = 400, n(H) = 250, n(E) = 200$$

$$n(H \cap E) = ?$$

We know that:

$$n(H \cup E) = n(H) + n(E) - n(H \cap E)$$

$$\therefore 400 = 250 + 200 - n(H \cap E)$$

$$\Rightarrow 400 = 450 - n(H \cap E)$$

$$\Rightarrow n(H \cap E) = 450 - 400$$

$$\therefore n(H \cap E) = 50$$

Thus, 50 people can speak both Hindi and English.

Q.4: If X and Y are two sets such that X has 22 elements, Y has 34 elements, and $n(X \cap Y)$ has 10 elements, how many elements does $n(X \cup Y)$ have?

Solution:

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It is given that:

$$n(S) = 21, n(T) = 32, n(S \cap T) = 11$$

We know that:

$$n(S \cup T) = n(S) + n(T) - n(S \cap T)$$

$$\therefore n(S \cup T) = 21 + 32 - 11 = 42$$

Thus, the set $(S \cup T)$ has 42 elements

Q.5: If A and B are two sets such that A has 45 elements, $n(A \cap B)$ has 15 elements and $n(A \cup B)$ has 70 elements, how many elements does B have?

Solution:

It is given that:

$$n(X) = 40, n(X \cup Y) = 60, n(X \cap Y) = 10$$

We know that:

$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$

$$\therefore 60 = 40 + n(Y) - 10$$

$$\therefore n(Y) = 60 - (40 - 10) = 30$$

Thus, the set Y has 30 elements.

Q.6: There are 70 people, out of which 35 like tea, 55 like coffee, and each person likes at least one of the two beverages. How many people like both tea and coffee?

Solution:

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Let C denote the set of people who like coffee, and

T denote the set of people who like tea

$$n(C \cup T) = 70, n(C) = 37, n(T) = 52$$

We know that:

$$n(C \cup T) = n(C) + n(T) - n(C \cap T)$$

$$\therefore 70 = 37 + 52 - n(C \cap T)$$

$$\Rightarrow 70 = 89 - n(C \cap T)$$

$$\Rightarrow n(C \cap T) = 89 - 70 = 19$$

Thus, 19 people like both coffee and tea.

Q.7: There are 70 students in a group, 35 like cricket, 15 like both tennis and cricket. How many like tennis only and not cricket? How many like tennis?

Solution:

Let C denote the set of people who like cricket, and

T denote the set of people who like tennis

$$\therefore n(C \cup T) = 65, n(C) = 40, n(C \cap T) = 10$$

We know that:

$$n(C \cup T) = n(C) + n(T) - n(C \cap T)$$

$$\therefore 65 = 40 + n(T) - 10$$

$$\Rightarrow 65 = 30 + n(T)$$

$$\Rightarrow n(T) = 65 - 30 = 35$$

Therefore, 35 people like tennis.

Now,

$$(T - C) \cup (T \cap C) = T$$

Also,

$$(T - C) \cap (T \cap C) = \Phi$$

$$\therefore n(T) = n(T - C) + n(T \cap C)$$

$$\Rightarrow 35 = n(T - C) + 10$$

$$\Rightarrow n(T - C) = 35 - 10 = 25$$

Thus, 25 people like only tennis.

Q.8: In a committee, 60 people speak French, 30 speak Spanish and 20 speak both Spanish and French. How many speak at least one of these two languages?

Solution:

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Let F be the set of people in the committee who speak French, and

S be the set of people in the committee who speak Spanish

$$\therefore n(F) = 50, n(S) = 20, n(S \cap F) = 10$$

We know that:

$$n(S \cup F) = n(S) + n(F) - n(S \cap F)$$

$$= 20 + 50 - 10$$

$$= 70 - 10 = 60$$

Thus, 60 people in the committee speak at least one of the two languages.



Chapterwise NCERT Solutions for Class 11 Maths :

- Chapter 1-Sets
- Chapter 2-Relations and Functions
- Chapter 3-Trigonometric Functions
- Chapter 4-Principle of Mathematical Induction
- Chapter 5-Complex Numbers and Quadratic Equations
- Chapter 6-Linear Inequalities
- Chapter 7-Permutation and Combinations
- Chapter 8-Binomial Theorem
- Chapter 9-Sequences and Series
- Chapter 10-Straight Lines
- Chapter 11-Conic Sections
- Chapter 12-Introduction to three Dimensional Geometry
- Chapter 13-Limits and Derivatives
- Chapter 14-Mathematical Reasoning
- Chapter 15-Statistics
- Chapter 16-Probability

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Organise pre-service and in-service training of teachers; develop and disseminate innovative educational techniques and practices; collaborate and network with state educational departments, universities, NGOs and other educational institutions; act as a clearing house for ideas and information in matters related to school education; and act as a nodal agency for achieving the goals of Universalisation of Elementary Education. In addition to research, development, training, extension, publication and dissemination activities, NCERT is an implementation agency for bilateral cultural exchange programmes with other countries in the field of school education. Its headquarters are located at Sri Aurobindo Marg in New Delhi. [Visit the Official NCERT website](#) to learn more.

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