NCERT Solutions Class 11 Maths
Chapter 2: Relations and Functions
EXERCISE 2.1

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 2 Exercise 2.1, students learn the fundamental concepts of Cartesian Product of Sets and Relations through step-by-step solved problems. This exercise covers ordered pairs, set operations, and basic relation types which are essential building blocks for advanced topics in CBSE Class 11 and 12 mathematics, particularly in probability and coordinate geometry.

Key Takeaways:

- Cartesian Product formula: For sets A and B, A × B = \(a,b) : a \in A, b \in B\
- Number of elements in Cartesian product: n(A × B) = n(A) × n(B)
- Understanding that A × B ≠ B × A unless A = B (non-commutative property)
- Mastery of ordered pairs notation and finding unknown values in relation problems for CBSE exams

Complete Solutions

Question 1

QUESTION

If \left((x)/(3) + 1,\; y - (2)/(3)\right) = \left((5)/(3),\; (1)/(3)\right), find the values of x and y.

SOLUTION

We are given an equation involving ordered pairs and asked to find the values of and .

Step 1: Understand Ordered Pair Equality

Two ordered pairs are equal if and only if their corresponding components are equal. That is, if , then and .

Step 2: Apply the Equality Condition

Given , we can equate the corresponding components:

and

Step 3: Solve for

From the first equation, we have:

Subtract 1 from both sides:

Multiply both sides by 3:

Step 4: Solve for

From the second equation, we have:

Add to both sides:

Final Answer:

and .

ANSWER

x = 2 and y = 1.

Question 2

QUESTION

If the set A has 3 elements and the set B = \3, 4, 5\, then find the number of elements in A × B.

SOLUTION

We are given that set has 3 elements and set . We need to find the number of elements in the Cartesian product .

Step 1: Understand the Cartesian Product

The Cartesian product is the set of all ordered pairs where and . The number of elements in is the product of the number of elements in and the number of elements in .

Step 2: Determine the number of elements in set

We are given that the set has 3 elements. We can write this as , where denotes the number of elements in set .

Step 3: Determine the number of elements in set

The set is given as . By counting the elements, we see that has 3 elements. Thus, .

Step 4: Calculate the number of elements in

The number of elements in is given by the formula:

Substituting the values we found in Steps 2 and 3:

Final Answer: The number of elements in is .

ANSWER

The number of elements in A × B is 9.

Question 3

QUESTION

If G = \7, 8\ and H = \5, 4, 2\, find G × H and H × G.

SOLUTION

This question tests our understanding of the Cartesian product of two sets. We are given two sets, and , and we need to find and .

Step 1: Define the Cartesian Product

The Cartesian product of two sets and , denoted by , is the set of all ordered pairs where and . In simpler terms, we take each element from the first set and pair it with every element from the second set.

Step 2: Find

We have and . To find , we pair each element of with each element of .

First, we take the element 7 from and pair it with each element of :

Next, we take the element 8 from and pair it with each element of :

Combining these, we get:

Step 3: Find

Now, we need to find . This time, we pair each element of with each element of .

First, we take the element 5 from and pair it with each element of :

Next, we take the element 4 from and pair it with each element of :

Finally, we take the element 2 from and pair it with each element of :

Combining these, we get:

Final Answer:

ANSWER

G × H = \(7, 5), (7, 4), (7, 2), (8, 5), (8, 4), (8, 2)\

H × G = \(5, 7), (5, 8), (4, 7), (4, 8), (2, 7), (2, 8)\

Question 4

QUESTION

State whether each of the following statements is true or false. If the statement is false, rewrite it correctly.

(i) If P = \m, n\ and Q = \n, m\, then P × Q = \(m, n), (n, m)\.

(ii) If A and B are non-empty sets, then A × B is a non-empty set of ordered pairs (x, y) such that x \in A and y \in B.

(iii) If A = \1, 2\, B = \3, 4\, then A × (B \cap \varnothing) = \varnothing.

SOLUTION

This question tests our understanding of Cartesian products of sets. We need to determine if the given statements about Cartesian products are true or false, and correct the false statements.

(i) If and , then .

Step 1: Understand the Cartesian Product

The Cartesian product is the set of all ordered pairs where and .

Step 2: Calculate

Given and , we form all possible ordered pairs:

Step 3: Compare with the given statement

The given statement says , which is missing the elements and .

Step 4: Conclusion

The statement is **false**. The correct Cartesian product is .

(ii) If and are non-empty sets, then is a non-empty set of ordered pairs such that and .

Step 1: Understand the definition

This statement is the definition of the Cartesian product of two non-empty sets and .

Step 2: Verify the conditions

Since and are non-empty, there exists at least one element in and at least one element in . Therefore, the ordered pair can be formed, and is non-empty.

Step 3: Conclusion

The statement is **true**.

(iii) If , , then .

Step 1: Evaluate the intersection

The intersection of any set with the empty set is the empty set:

Step 2: Evaluate the Cartesian product

The Cartesian product of any set with the empty set is the empty set:

Step 3: Conclusion

The statement is **true**.

ANSWER

(i) False. P × Q = \(m, n), (m, m), (n, n), (n, m)\.

(ii) True.

(iii) True.

Question 5

QUESTION

If A = \-1, 1\, find A × A and A × A × A.

SOLUTION

This question tests the understanding of Cartesian products of sets. We need to find and given the set .

Step 1: Find

The Cartesian product is the set of all ordered pairs where and . Since , we need to form all possible pairs using these elements.

The possible pairs are:

- (-1, -1)
- (-1, 1)
- (1, -1)
- (1, 1)

Therefore, .

Step 2: Find

The Cartesian product is the set of all ordered triples where , , and . Since , we need to form all possible triples using these elements.

We can think of this as taking each element of and combining it with each element of .

The possible triples are:

- (-1, -1, -1)
- (-1, -1, 1)
- (-1, 1, -1)
- (-1, 1, 1)
- (1, -1, -1)
- (1, -1, 1)
- (1, 1, -1)
- (1, 1, 1)

Therefore, .

Final Answer:

ANSWER

A × A = \(-1, -1), (-1, 1), (1, -1), (1, 1)\

A × A × A = \(-1, -1, -1), (-1, -1, 1), (-1, 1, -1), (-1, 1, 1), (1, -1, -1), (1, -1, 1), (1, 1, -1), (1, 1, 1)\

Question 6

QUESTION

If A × B = \(a, x), (a, y), (b, x), (b, y)\, find the sets A and B.

SOLUTION

The question asks us to find the sets and given their Cartesian product . The Cartesian product is the set of all ordered pairs where the first element comes from and the second element comes from .

Step 1: Understand the definition of Cartesian Product

The Cartesian product is defined as:

Step 2: Identify the elements of set A

The set consists of all the first elements in the ordered pairs of . In the given , the first elements are and . Therefore, .

Step 3: Identify the elements of set B

The set consists of all the second elements in the ordered pairs of . In the given , the second elements are and . Therefore, .

Step 4: State the final answer

Thus, the sets and are:

, .

ANSWER

A = \a, b\, B = \x, y\.

Question 7

QUESTION

Let A = \1, 2\, B = \1, 2, 3, 4\, C = \5, 6\ and D = \5, 6, 7, 8\. Verify that

(i) A × (B \cap C) = (A × B) \cap (A × C)

(ii) A × C is a subset of B × D.

SOLUTION

This question tests our understanding of Cartesian products of sets and set operations like intersection and subset.

(i) Verify

Step 1: Find

is the intersection of sets and , which means the set of elements common to both and .

and . There are no common elements.

Therefore, (the empty set).

Step 2: Find

. The Cartesian product of any set with the empty set is the empty set.

Step 3: Find

Step 4: Find

Step 5: Find

is the intersection of the two Cartesian products, meaning the set of ordered pairs common to both.

Comparing the elements of and , we see that there are no common ordered pairs.

Therefore, .

Step 6: Conclusion for (i)

Since and , we have verified that .

(ii) Verify is a subset of

Step 1: Recall

From part (i), we know .

Step 2: Find

Step 3: Check if is a subset of

A set is a subset of if every element of is also an element of .

The elements of are . All these ordered pairs are also elements of .

Step 4: Conclusion for (ii)

Therefore, is a subset of .

Question 8

QUESTION

Let A = \1, 2\ and B = \3, 4\. Write A × B. How many subsets will A × B have? List them.

SOLUTION

This question tests our understanding of Cartesian products of sets and the concept of subsets. We are given two sets and , and we need to find their Cartesian product , determine the number of subsets of , and list all the subsets.

Step 1: Find the Cartesian product

The Cartesian product is the set of all ordered pairs where and . Given and , we have:

Step 2: Determine the number of subsets of

If a set has elements, then the number of its subsets is . This is because each element can either be in a subset or not, giving 2 choices for each element. Since has 4 elements, the number of subsets of is .

Step 3: List all the subsets of

The subsets of are:

{} (the empty set)

(the set itself)

Final Answer: will have subsets.

ANSWER

A × B = \(1, 3), (1, 4), (2, 3), (2, 4)\.

A × B will have 2^4 = 16 subsets.

Question 9

QUESTION

Let A and B be two sets such that n(A) = 3 and n(B) = 2. If (x, 1), (y, 2), (z, 1) are in A × B, find A and B, where x, y and z are distinct elements.

SOLUTION

We are given the number of elements in sets and , and some elements of their Cartesian product . We need to find the sets and .

Step 1: Understand the Cartesian Product

The Cartesian product is the set of all ordered pairs where and . The given elements belong to , which means and .

Step 2: Determine the elements of set A

We are given that , which means set has 3 distinct elements. From the given ordered pairs, we know that are elements of . Since , and are distinct, we can conclude that .

Step 3: Determine the elements of set B

We are given that , which means set has 2 distinct elements. From the given ordered pairs, we know that and are elements of . Since we are given two ordered pairs with 1 and 2 as second elements, and , we can conclude that .

Step 4: Verify the solution

We have found and . The Cartesian product would contain elements. The given elements are indeed possible elements of .

Final Answer:

and .

ANSWER

A = \x, y, z\ and B = \1, 2\.

Question 10

QUESTION

The Cartesian product A × A has 9 elements among which are found (-1, 0) and (0, 1). Find the set A and the remaining elements of A × A.

SOLUTION

This question tests our understanding of Cartesian products of sets. We are given some elements of and the total number of elements, and we need to find the set and the remaining elements of .

Step 1: Determine the set A

We know that has 9 elements. If represents the number of elements in set , then . Therefore, , which implies . This means set has 3 elements.

We are given that and are elements of . This tells us that , , and must be elements of set . Since we know has 3 elements, we can conclude that .

Step 2: Find all elements of

The Cartesian product is the set of all ordered pairs where and . Since , we can list all possible ordered pairs:

Step 3: Identify the remaining elements

We were given that and are elements of . The remaining elements are:

Final Answer:

.

The remaining elements of are .

ANSWER

A = \-1, 0, 1\.

The remaining elements of A × A are (-1, -1), (-1, 1), (0, -1), (0, 0), (1, -1), (1, 0), (1, 1).

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Key Formulas

Important Formulas for Exercise 2.1

Formula / Concept	Description
Ordered Pair	An ordered pair consists of two objects or elements in a given fixed order. For elements 'a' and 'b', the ordered pair is denoted by (a, b).
Equality of Ordered Pairs	Two ordered pairs (a, b) and (c, d) are equal if and only if their corresponding elements are equal. That is, (a, b) = (c, d) if and only if a = c and b = d.
Cartesian Product of Two Sets (A × B)	Given two non-empty sets A and B, the Cartesian product A × B is the set of all possible ordered pairs (a, b) where a \in A and b \in B. A × B = \ (a, b) : a \in A \text and b \in B \
Cardinality of Cartesian Product	If A and B are two finite sets, the number of elements in their Cartesian product is the product of the number of elements in each set. n(A × B) = n(A) × n(B) If set A has 'p' elements and set B has 'q' elements, then A × B will have p × q elements.
Cartesian Product with an Empty Set	If either set A or set B is an empty set (null set, \phi), then their Cartesian product will also be an empty set. A × \phi = \phi \phi × B = \phi
Non-Commutative Property	The Cartesian product of sets is generally not commutative. A × B ≠ B × A This holds true unless A = B, or one of the sets is empty.
Ordered Triplet	For three sets A, B, and C, an element of the Cartesian product A × B × C is an ordered triplet (a, b, c), where a \in A, b \in B, and c \in C. A × B × C = \ (a, b, c) : a \in A, b \in B, c \in C \
Infinite Sets	If either set A or set B is an infinite set and the other is non-empty, then their Cartesian product A × B is also an infinite set.

Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1 for CBSE board exam 2025-26?

NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1 contains exactly 10 questions. These questions focus on the Cartesian Product of Sets and foundational concepts of relations, which are crucial for understanding the complete chapter and preparing for CBSE board exam 2025-26.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1 from official NCERT website or various educational platforms offering step by step solutions. These PDFs are updated according to the latest CBSE syllabus 2025-26 and include detailed explanations for all 10 questions on Cartesian Product and Relations.

Q3. How many marks does Relations and Functions Chapter 2 carry in CBSE Class 11 Maths board exam 2025-26 syllabus?

Relations and Functions Chapter 2 is part of Unit I (Sets and Functions) which carries 8 marks in CBSE Class 11 Maths board exam 2025-26. This weightage is shared across all chapters in the unit, making Exercise 2.1 and other exercises from this chapter important for scoring well in the examination.

Q4. Which is the most difficult question in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1 for CBSE students?

Question 9 and Question 10 in NCERT Solutions Class 11 Maths Chapter 2 Exercise 2.1 are considered the most difficult as they involve complex Cartesian Product problems requiring multiple steps. Students preparing for CBSE board exam 2025-26 should practice these questions with step by step solutions to master the concepts thoroughly.

Q5. What is Cartesian Product of Sets in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.1?

Cartesian Product in NCERT Class 11 Maths Chapter 2 Exercise 2.1 is the set of all ordered pairs (a, b) where a belongs to set A and b belongs to set B, denoted as A × B. This fundamental concept forms the basis for understanding relations and functions in Class 11 Maths and is extensively covered through 10 questions in Exercise 2.1 for CBSE syllabus 2025-26.

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