NCERT Solutions Class 11 Maths
Chapter 2: Relations and Functions
EXERCISE 2.2

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 2 Exercise 2.2, students learn to work with relations, their representation methods, and key properties. This exercise covers Cartesian products, domain and range identification, and expressing relations in both roster and set-builder forms, which are fundamental concepts for CBSE Class 11 exams and form the foundation for advanced function theory.

Key Takeaways:

- Cartesian Product: For sets A and B, A × B = \(a, b) : a \in A, b \in B\
- Domain of relation R is the set of all first elements, Range is the set of all second elements
- Relations can be expressed in roster form \(x, y) : ...\ or set-builder form with conditions
- Understanding relation types and their graphical representation is crucial for Class 11 board exams

Complete Solutions

Question 1

QUESTION

Let A = \1, 2, 3, ..., 14\. Define a relation R from A to A by R = \(x, y) : 3x - y = 0,\; x, y \in A\. Write down its domain, codomain and range.

SOLUTION

This question tests our understanding of relations, domain, range, and codomain. We need to find the elements of the relation based on the given condition and then identify its domain, range, and codomain.

Step 1: Define the relation

The relation is defined as , where . This means we need to find all pairs such that and both and are elements of set .

Step 2: Find the ordered pairs

We can rewrite the condition as . Now, we'll find the pairs by substituting values of from set and checking if the resulting is also in set .

- If , then . Since , we have the pair .
- If , then . Since , we have the pair .
- If , then . Since , we have the pair .
- If , then . Since , we have the pair .
- If , then . Since , we stop here.

Therefore, .

Step 3: Determine the domain of

The domain of is the set of all first elements (x-coordinates) of the ordered pairs in . So, the domain of is .

Step 4: Determine the range of

The range of is the set of all second elements (y-coordinates) of the ordered pairs in . So, the range of is .

Step 5: Determine the codomain of

The codomain of is the set to which the second element of the ordered pairs belongs. In this case, the codomain is .

Final Answer:

Domain of

Range of

Codomain of

ANSWER

R = \(1, 3), (2, 6), (3, 9), (4, 12)\

Domain of R = \1, 2, 3, 4\

Range of R = \3, 6, 9, 12\

Codomain of R = A = \1, 2, ..., 14\

Question 2

QUESTION

Define a relation R on the set \mathbbN of natural numbers by R = \(x, y) : y = x + 5,\; x is a natural number less than 4;\; x, y \in \mathbbN\. Depict this relation in roster form. Write down the domain and the range.

SOLUTION

This question tests our understanding of relations, roster form, domain, and range. We need to express the given relation in roster form and then identify its domain and range.

Step 1: Understand the given relation

The relation is defined on the set of natural numbers as follows:

is a natural number less than

This means that consists of ordered pairs where is obtained by adding 5 to , and is a natural number less than 4.

Step 2: Determine the possible values of

Since is a natural number less than 4, the possible values for are 1, 2, and 3.

Step 3: Calculate the corresponding values of

For each value of , we can find the corresponding value of using the equation :

- If , then
- If , then
- If , then

Step 4: Express the relation in roster form

The relation in roster form is the set of ordered pairs we found:

Step 5: Determine the domain of

The domain of is the set of all first elements (x-coordinates) of the ordered pairs in :

Domain of

Step 6: Determine the range of

The range of is the set of all second elements (y-coordinates) of the ordered pairs in :

Range of

Final Answer:

Domain of

Range of

ANSWER

R = \(1, 6), (2, 7), (3, 8)\

Domain of R = \1, 2, 3\

Range of R = \6, 7, 8\

Question 3

QUESTION

Let A = \1, 2, 3, 5\ and B = \4, 6, 9\. Define a relation R from A to B by R = \(x, y) : the difference between x and y is odd, x \in A, y \in B\. Write R in roster form.

SOLUTION

This question tests the understanding of relations and how to represent them in roster form. We need to find all pairs where is from set , is from set , and the difference between and is odd.

Step 1: Understand the condition for the relation

The relation is defined by the condition that the difference between and must be odd. This means must be an odd number.

Step 2: Examine each element of set and find corresponding elements in set

We will iterate through each element in and check which elements in satisfy the condition.

Step 3: Check for

If , then:

- which is odd, so
- which is odd, so
- which is even, so

Step 4: Check for

If , then:

- which is even, so
- which is even, so
- which is odd, so

Step 5: Check for

If , then:

- which is odd, so
- which is odd, so
- which is even, so

Step 6: Check for

If , then:

- which is odd, so
- which is odd, so
- which is even, so

Step 7: Write the relation in roster form

Collecting all the pairs that satisfy the condition, we get:

ANSWER

R = \(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\

Question 4

QUESTION

The figure (Fig. 2.7) shows a relationship between the sets P and Q. Write this relation

(i) in set-builder form (ii) in roster form. What is its domain and range?

SOLUTION

This question requires us to express a relation depicted in a figure in both set-builder and roster forms, and then determine its domain and range.

(i) Set-builder form:

Step 1: Analyze the relationship between elements of P and Q

From the figure, we observe the following mappings:

5 maps to 3

6 maps to 4

7 maps to 5

Step 2: Identify the pattern

We can see that each element in set is 2 less than its corresponding element in set . This can be expressed as , where belongs to and belongs to .

Step 3: Write the relation in set-builder form

Therefore, the relation in set-builder form is:

(ii) Roster form:

Step 1: List the ordered pairs based on the figure

The relation consists of the following ordered pairs:

(5, 3), (6, 4), (7, 5)

Step 2: Write the relation in roster form

Therefore, the relation in roster form is:

Domain and Range:

Step 1: Define Domain

The domain of a relation is the set of all first elements (x-coordinates) of the ordered pairs in the relation.

Step 2: Identify the Domain

In this case, the domain of is the set of all first elements in the ordered pairs , which is .

Step 3: Define Range

The range of a relation is the set of all second elements (y-coordinates) of the ordered pairs in the relation.

Step 4: Identify the Range

In this case, the range of is the set of all second elements in the ordered pairs , which is .

Final Answer:

(i)

(ii)

Domain of

Range of

ANSWER

(i) R = \(x, y) : y = x - 2 \text for x = 5, 6, 7\

(ii) R = \(5, 3), (6, 4), (7, 5)\

Domain of R = \5, 6, 7\

Range of R = \3, 4, 5\

Question 5

QUESTION

Let A = \1, 2, 3, 4, 6\. Let R be the relation on A defined by R = \(a, b) : a, b \in A, b \text is exactly divisible by a\.

(i) Write R in roster form.

(ii) Find the domain of R.

(iii) Find the range of R.

SOLUTION

This question tests the understanding of relations, roster form, domain, and range. We are given a set and a relation defined on . We need to express in roster form and then find its domain and range.

(i) Write in roster form.

The relation is defined as . This means we need to find all pairs where and are elements of , and is divisible by .

Let's examine all possible pairs:

- If , then can be any element of since every number is divisible by 1. So, we have .
- If , then can be 2, 4, or 6 since these are the only elements in divisible by 2. So, we have .
- If , then can be 3 or 6 since these are the only elements in divisible by 3. So, we have .
- If , then can only be 4 since it's the only element in divisible by 4. So, we have .
- If , then can only be 6 since it's the only element in divisible by 6. So, we have .

Therefore, the roster form of is:

(ii) Find the domain of .

The domain of is the set of all first elements in the ordered pairs of . From the roster form of , we can see that the first elements are 1, 2, 3, 4, and 6. Therefore, the domain of is .

(iii) Find the range of .

The range of is the set of all second elements in the ordered pairs of . From the roster form of , we can see that the second elements are 1, 2, 3, 4, and 6. Therefore, the range of is .

ANSWER

(i) R = \(1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 4), (2, 6), (2, 2), (4, 4), (6, 6), (3, 3), (3, 6)\

(ii) Domain of R = \1, 2, 3, 4, 6\

(iii) Range of R = \1, 2, 3, 4, 6\

Question 6

QUESTION

Determine the domain and range of the relation R defined by R = \(x, x + 5) : x \in \0, 1, 2, 3, 4, 5\\.

SOLUTION

We are asked to find the domain and range of the relation defined as .

Step 1: Understand the definition of the relation

The relation consists of ordered pairs . The first element, , is taken from the set . The second element is obtained by adding 5 to the first element.

Step 2: Determine the domain

The domain of a relation is the set of all first elements in the ordered pairs. In this case, the first element is , and we are given that belongs to the set .

Therefore, the domain of is:

Step 3: Determine the range

The range of a relation is the set of all second elements in the ordered pairs. In this case, the second element is . We need to find the values of for each in the domain.

When ,

When ,

When ,

When ,

When ,

When ,

Therefore, the range of is:

Final Answer:

Domain of

ANSWER

Domain of R = \0, 1, 2, 3, 4, 5\\

Range of \(R = \5, 6, 7, 8, 9, 10\

Question 7

QUESTION

Write the relation R = \(x, x^3) : x is a prime number less than 10\ in roster form.

SOLUTION

This question asks us to express a given relation in roster form, where the relation is defined based on prime numbers less than 10.

Step 1: Identify the prime numbers less than 10

Prime numbers are numbers greater than 1 that have only two factors: 1 and themselves. The prime numbers less than 10 are 2, 3, 5, and 7.

Step 2: Understand the relation

The relation is defined as is a prime number less than . This means that for each prime number less than 10, the ordered pair belongs to the relation .

Step 3: Calculate for each prime number

We need to calculate the cube of each prime number identified in Step 1:

- For ,
- For ,
- For ,
- For ,

Step 4: Write the relation in roster form

Now, we write the relation in roster form by listing all the ordered pairs we found in Step 3:

Final Answer:

ANSWER

R = \(2, 8), (3, 27), (5, 125), (7, 343)\

Question 8

QUESTION

Let A = \x, y, z\ and B = \1, 2\. Find the number of relations from A to B.

SOLUTION

This question tests our understanding of relations between sets and how to count the number of possible relations.

Step 1: Define a relation

A relation from set to set is a subset of the Cartesian product . In simpler terms, it's a collection of ordered pairs where the first element comes from and the second element comes from .

Step 2: Find the Cartesian product

Given and , the Cartesian product is the set of all possible ordered pairs where and . So,

Step 3: Determine the number of elements in

The number of elements in , denoted as , is the product of the number of elements in and the number of elements in . In this case,

and , so .

Step 4: Relate the number of relations to the power set

Each relation from to is a subset of . The total number of possible subsets of any set is given by , where is the number of elements in the set. This is also the number of elements in the power set of .

Step 5: Calculate the number of relations

Since , the number of relations from to is .

Final Answer: The number of relations from into is .

ANSWER

Number of relations from A into B is 2^6.

Question 9

QUESTION

Let R be the relation on \mathbbZ defined by R = \(a, b) : a, b \in \mathbbZ, a - b \text is an integer\. Find the domain and range of R.

SOLUTION

We are given a relation on the set of integers , defined as . We need to find the domain and range of this relation.

Step 1: Understand the definition of the relation

The relation consists of ordered pairs where and are integers, and the difference is also an integer.

Step 2: Determine the domain of

The domain of is the set of all first elements (i.e.,) in the ordered pairs that belong to . Since can be any integer, and for any integer , we can find an integer such that is an integer (for example, , then , which is an integer), the domain of is the set of all integers.

Therefore, Domain of .

Step 3: Determine the range of

The range of is the set of all second elements (i.e.,) in the ordered pairs that belong to . Since can be any integer, and for any integer , we can find an integer such that is an integer (for example, , then , which is an integer), the range of is the set of all integers.

Therefore, Range of .

Final Answer:

Domain of

Range of

ANSWER

Domain of R = \mathbbZ

Range of R = \mathbbZ

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Key Formulas

Important Formulas for Exercise 2.2

Formula / Concept	Description
Cartesian Product	The Cartesian product of two non-empty sets A and B, denoted by 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, b \in B\
Number of Elements in Cartesian Product	If set A has p elements and set B has q elements, then the number of elements in their Cartesian product is given by: n(A × B) = p × q
Relation	A relation R from a non-empty set A to a non-empty set B is a subset of the Cartesian product A × B. The subset is derived by describing a relationship between the first element and the second element of the ordered pairs in A × B. R \subseteq A × B
Domain of a Relation	The set of all first elements of the ordered pairs in a relation R from a set A to a set B is called the domain of the relation R. \textDomain(R) = \a | (a, b) \in R\
Range of a Relation	The set of all second elements (images) in a relation R from a set A to a set B is called the range of the relation R. \textRange(R) = \b | (a, b) \in R\
Codomain of a Relation	If R is a relation from a set A to a set B, the entire set B is called the codomain of the relation R. The range of R is always a subset of the codomain of R.
Total Number of Relations	If a set A has p elements and a set B has q elements, then the total number of possible relations from set A to set B is 2^pq.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.2?

Exercise 2.2 of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions contains exactly 9 questions. These questions cover important concepts like Cartesian product of sets and various types of relations which are crucial 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 2.2?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.2 from the official NCERT website or various educational portals. These step by step solutions are updated according to the CBSE syllabus 2025-26 and include detailed explanations for all 9 questions.

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

Relations and Functions (Chapter 2) carries 8 marks in CBSE Class 11 board exam 2025-26 as part of Unit I - Sets and Functions. This weightage is shared across the entire unit, making NCERT Solutions for Class 11 Maths Chapter 2 Exercise 2.2 essential for exam preparation.

Q4. Which is the most difficult question in Exercise 2.2 of NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions?

Questions 8 and 9 in Exercise 2.2 of Class 11 Maths Chapter 2 Relations and Functions are generally considered the most challenging as they involve complex Cartesian product applications. However, with step by step solutions and proper practice, students can master these questions for CBSE board exam 2025-26.

Q5. What is Cartesian Product explained in NCERT Solutions Class 11 Maths Chapter 2 Exercise 2.2?

Cartesian Product in NCERT Class 11 Maths Chapter 2 Exercise 2.2 is the set of all ordered pairs formed by taking one element from each of two sets. If A and B are two sets, their Cartesian product $A \times B = \{(a, b) : a \in A \text{ and } b \in B\}$, which is fundamental for understanding relations and functions in CBSE syllabus 2025-26.

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